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ABSTRACT

In response to a growing need for effective and efficient means for auditing computer-based systems, a number of studies dealing primarily with batch-processing type computer operations have been conducted to explore the impact of computers on auditing activities in the Federal Government. This report first presents some statistical data on computers in the Federal Government, and then summarizes the results of the studies in three sections. The first section covers those studies dealing with internal auditing of computer-based systems and attempts to determine whether effective independent reviews and appraisals are being made. The next section covers system documentation to determine whether current and complete documentation is maintained; the final section examines the use of computer techniques to audit computer-based systems to assist other Government auditing organizations in checking computer-based systems. Extensive appendices provide more detailed information on auditing procedures. (Author/SH)

UNITED STATES GENERAL ACCOUNTING OFFICE



# CASE STUDIES OF AUDITING IN A COMPUTER-BASED SYSTEMS ENVIRONMENT

JUNE 1971

# CASE STUDIES OF AUDITING

# IN A COMPUTER-BASED SYSTEMS ENVIRONMENT



UNITED STATES GENERAL ACCOUNTING OFFICE

1971

## NOTE

The GAO Office of Policy and Special Studies coordinated preparation of this study. As of July 1, 1971, the functions of this office were realigned. Therefore inquiries concerning the study should be addressed to the Division of Financial and General Management Studies.

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-115369

# FOREWORD

In response to the growing need for effective and efficient means for auditing computer-based systems, the General Accounting Office has conducted a number of studies to explore the impact of computers on auditing activities in the Federal Government. These studies have dealt primarily with batch-processing-type computer operations or those systems that require input data to be coded and collected into groups or batches for processing. Particular attention was devoted to:

Internal auditing of computer-based systems--to determine whether effective independent reviews and appraisals are being made.

System documentation--to determine whether current and complete documentation is maintained.

The use of computer techniques to audit computer-based systems--to assist other Government auditing organizations in auditing computer-based systems.

This report summarizes the results of these studies. Because of the importance of internal controls, a previously prepared review guide for evaluating internal controls in automatic data processing systems is included as appendix IX. From an audit standpoint, the auditor must always consider the control framework in which computer processing is carried out.

As additional studies of more sophisticated or real-time computer operations are completed, we plan to publish additional information on this important subject.

Elmer B. Staats
Comptroller General
of the United States

June 1971

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## Contents

## ABBREVIATIONS

| | |
|---|---|
| ADP | Automatic Data Processing |
| FHA | Federal Housing Administration |
| GAO | General Accounting Office |
| VA | Veterans Administration |

## CHAPTER 1

## STATISTICS ON COMPUTERS IN THE FEDERAL GOVERNMENT

The use of computers in the Federal Government has grown rapidly in the past decade. The following charts provide a quick picture of the growth of computer use and the distribution of computers by manufacturer and by agency. For example, over 5,200 computers, exclusive of analog and other computers built or modified to special Government design specifications, were installed in the Federal Government by 1970. Only 10 years prior there were as few as 531.

Billions of dollars have been invested in the development and use of computers and computer-related devices. The annual Federal Government expenditures for the purchase and use of automatic data processing (ADP) equipment is not readily available. In congressional hearings conducted in July 1970,[1] these expenditures were estimated between $4 billion and $6 billion.

Computer uses extend into almost every phase, both administrative and technical, of Government operations. The electronic computer has come to be regarded as a major and vital resource for accomplishing the primary program responsibilities of many Government agencies. Therefore special management and audit attention is warranted to ensure that this resource is used efficiently and effectively.

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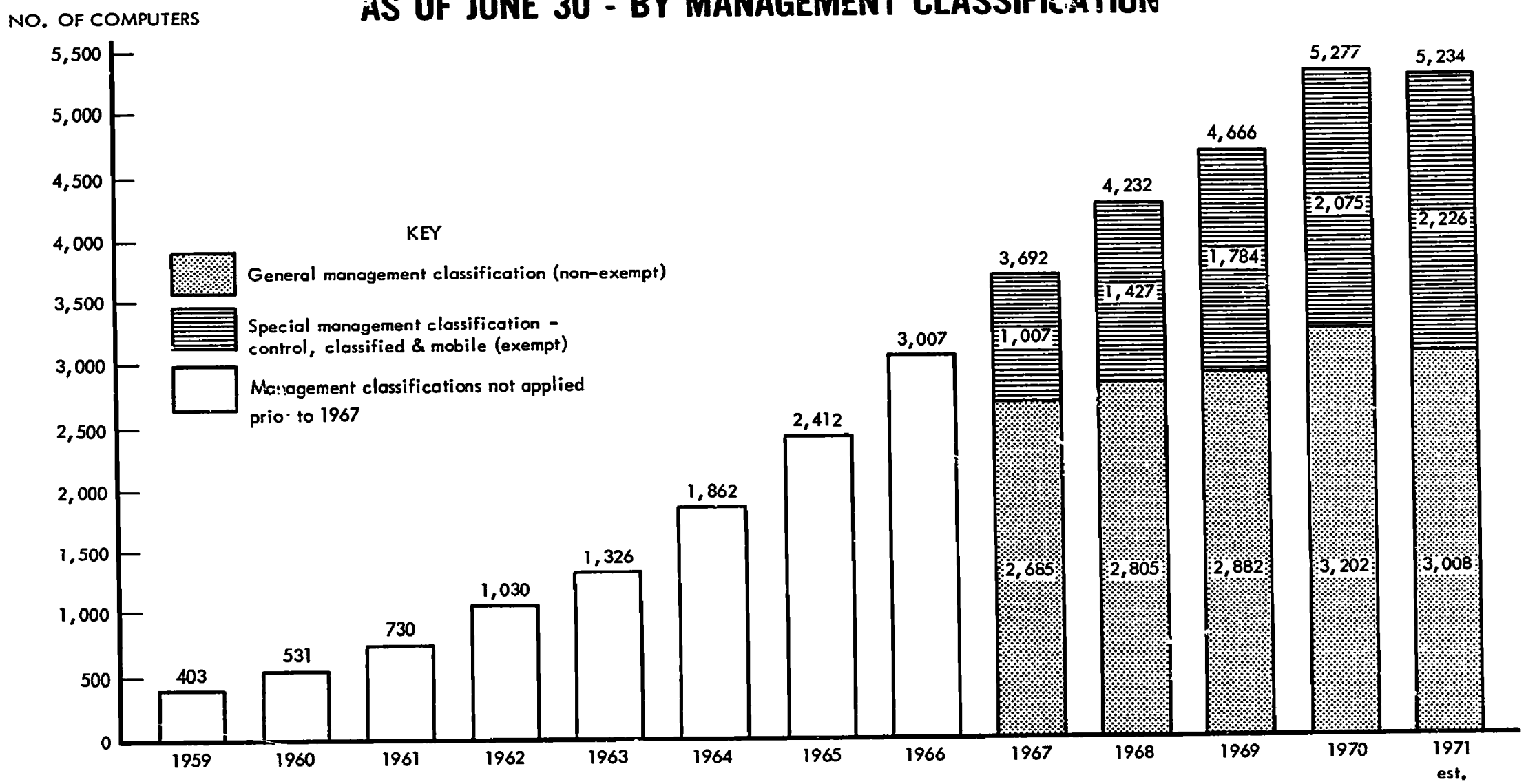
[1] Hearing before the Subcommittee on Economy in Government of the Joint Economic Committee, Ninety-first Congress, second session, dated July 1, 1970, pages 17 and 18.

## CHART 1

# NUMBER OF COMPUTERS IN THE FEDERAL GOVERNMENT AS OF JUNE 30 - BY MANAGEMENT CLASSIFICATION




The rapid growth in the number of computers in recent years is indicative of an increasing awareness on the part of the Federal agencies that mission programs can be accomplished more timely, efficiently, and economically through automation.

For the years prior to 1959 the Office of Management and Budget estimated the number of computers to be: 1950-2; 1951-3; 1952-5; 1953-7; 1954-10; 1955-45; 1956-90; 1957-160; and 1958-250.

SOURCE: GSA Inventory of Automatic Data Processing Equipment in the United States Government, Fiscal Year 1970.

## CHART 2

# DISTRIBUTION OF COMPUTERS BY MANUFACTURER AND AGENCY AS OF JUNE 30, 1970

| AGENCY \ MANUFACTURER | BUR | CDC | DEQ | HON | IBM | NCR | RCA | SDS | UNI | OTHER | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ATOMIC ENERGY COMM. | 2 | 63 | 371 | 27 | 107 | - | - | 38 | 6 | 140 | 754 |
| AGRICULTURE | 1 | 8 | - | - | 26 | - | - | - | 6 | 1 | 42 |
| COMMERCE | - | 7 | 5 | 3 | 24 | - | 2 | 5 | 10 | 17 | 73 |
| TRANSPORTATION | - | 1 | 5 | 10 | 86 | - | - | 2 | 10 | 4 | 118 |
| GEN. SERV. ADMIN. | - | 2 | - | 6 | 4 | - | - | - | 3 | 12 | 27 |
| HEALTH, EDUC., & WELFARE | - | 7 | 9 | 5 | 55 | - | 14 | - | 1 | 5 | 96 |
| INTERIOR | 2 | 7 | 2 | 2 | 26 | - | - | - | 4 | 3 | 46 |
| NAT'L AERO. SPACE ADMIN. | - | 69 | 52 | 62 | 86 | - | 1 | 140 | 162 | 120 | 692 |
| TREASURY | 1 | - | - | 29 | 38 | - | 1 | - | 1 | 7 | 77 |
| VETERANS ADMIN. | - | 1 | - | 1 | 39 | - | - | - | - | - | 41 |
| OTHER CIVIL | 2 | 9 | - | 18 | 61 | 2 | 10 | 2 | 3 | 5 | 112 |
| AIR FORCE | 179 | 76 | 15 | 35 | 249 | 137 | 58 | 11 | 366 | 84 | 1,210 |
| ARMY | 9 | 46 | 10 | 32 | 267 | 172 | 46 | 9 | 266 | 70 | 927 |
| NAVY | 7 | 93 | 30 | 41 | 255 | 10 | 31 | 20 | 156 | 251 | 894 |
| DEF. SUPPLY AGY. | - | 10 | - | 27 | 47 | - | 21 | - | 19 | 1 | 125 |
| OTHER DEPT. OF DEF. | 1 | 5 | - | 1 | 27 | - | - | 2 | 1 | 6 | 43 |
| TOTAL | 204 | 404 | 499 | 299 | 1,397 | 321 | 184 | 229 | 1,014 | 726 | 5,277 |

SOURCE: GSA Inventory of Automatic Data Processing Equipment in the United States Government, Fiscal Year 1970.

## CHART 3

# DISTRIBUTION OF COMPUTERS BY AGENCY AND OPERATOR AS OF JUNE 30

| | | AEC | NASA | DOT | HEW | NSF | LABOR | OEO | OTHER CIVIL | AF | ARMY | NAVY | DSA | OTHER DOD[1] | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1967 | CONTRACTOR OPERATED | 317 | 300 | | 2 | 2 | | 6 | | 74 | 10 | 34 | | 3 | 748 |
| | GOVERNMENT OPERATED | 6 | 316 | 58 | 55 | 1 | 4 | 4 | 300 | 944 | 531 | 609 | 86 | 30 | 2,944 |
| | TOTAL | 323 | 616 | 58 | 57 | 3 | 4 | 10 | 300 | 1,018 | 541 | 643 | 86 | 33 | 3,692 |
| | CONTRACTOR PERCENTAGE OF TOTAL | 98.1 | 48.7 | | 3.5 | 66.7 | | 60.0 | | 7.3 | 1.8 | 5.3 | | 9.1 | 20.3 |
| 1968 | CONTRACTOR OPERATED | 406 | 130 | 1 | 3 | 16 | | 6 | | 69 | 13 | 42 | 4 | 3 | 693 |
| | GOVERNMENT OPERATED | 9 | 509 | 60 | 77 | 1 | 5 | 3 | 325 | 987 | 698 | 721 | 111 | 33 | 3,539 |
| | TOTAL | 415 | 639 | 61 | 80 | 17 | 5 | 9 | 325 | 1,056 | 711 | 763 | 115 | 36 | 4,232 |
| | CONTRACTOR PERCENTAGE OF TOTAL | 97.8 | 20.3 | 1.6 | 3.8 | 94.1 | | 66.7 | | 6.5 | 1.8 | 5.5 | 3.5 | 8.3 | 16.4 |
| 1969 | CONTRACTOR OPERATED | 544 | 138 | 2 | 2 | 16 | | 4 | | 80 | 27 | 62 | | 1 | 876 |
| | GOVERNMENT OPERATED | 12 | 504 | 98 | 82 | 1 | 5 | 4 | 358 | 1,044 | 766 | 761 | 121 | 34 | 3,790 |
| | TOTAL | 556 | 642 | 100 | 84 | 17 | 5 | 8 | 358 | 1,124 | 793 | 823 | 121 | 35 | 4,666 |
| | CONTRACTOR PERCENTAGE OF TOTAL | 97.8 | 21.5 | 2.0 | 2.4 | 94.1 | | 50.0 | | 7.1 | 3.4 | 7.5 | | 2.9 | 18.8 |
| 1970 | CONTRACTOR OPERATED | 734 | 168 | 3 | | 17 | 4 | | | 83 | 56 | 68 | | 2 | 1,135 |
| | GOVERNMENT OPERATED | 20 | 524 | 115 | 96 | 1 | 6 | 3 | 387 | 1,127 | 871 | 826 | 125 | 41 | 4,142 |
| | TOTAL | 754 | 692 | 118 | 96 | 18 | 10 | 3 | 387 | 1,210 | 927 | 894 | 125 | 43 | 5,277 |
| | CONTRACTOR PERCENTAGE OF TOTAL | 97.3 | 24.3 | 2.5 | | 94.4 | 40.0 | | | 6.9 | 6.0 | 7.6 | | 4.7 | 21.5 |

[1] DEPARTMENT OF DEFENSE

SOURCE: GSA Inventory of Automatic Data Processing Equipment in the United States Government, Fiscal Year 1970.

## CHAPTER 2

## SUMMARY OF OBSERVATIONS

### INTERNAL AUDIT OF ADP SYSTEMS

In individual Federal agencies, internal audit coverage of agency computer operations varies from comprehensive system testing to practically no work at all. Although some internal audit groups recently have shown increased interest, in the past, auditors have tended to shy away from comprehensive reviews of computer-based systems. Even though computer systems are becoming increasingly an integral part of agency management and control, independent reviews and appraisals are generally not made to assist managers in establishing effective controls over complex computer systems.

The General Accounting Office (GAO) believes that it is important for an independent group to review and evaluate agency computer operations, especially those systems which affect agency management and control operations, as well as, those systems which involve the disbursement of billions of dollars every year. In the absence of independent evaluations of computer-based systems, the computer operation is vulnerable to undetected error, misuse, and possibly fraud. GAO believes that Federal agency managers should require internal auditors, or a similar group, to devote more attention to computer systems than currently is being done.

### DOCUMENTATION OF ADP SYSTEMS

A related problem centers on the fact that most Federal agencies have not developed or implemented agencywide documentation standards for computer-based systems. In general, documentation being produced is incomplete and inadequate. Documentation may be used by management not only to monitor and control the computer facility resources of an organization but also as a check on performance and compliance with established goals and standards for such resources. Consequently, GAO believes that Government-wide documentation standards should be developed and promulgated by the executive branch to guide all Federal agencies in maintaining an adequate level of system documentation. GAO believes also that the heads of Federal agencies, as an interim measure

pending adoption of Federal standards by the executive branch, should take necessary action to ensure that their computer systems documentation meets the standards listed in this report. (See pp. 18 to 21.)

## COMPUTER-AUDITING TECHNIQUES

New computer-auditing techniques have been developed to assist the auditor in reviewing computer systems and computer-generated records. These techniques permit the auditor to use the computer's speed and accuracy to

--search files and select data for examination,
--make special analyses or summarizations of data,
--perform computations,
--identify unusual transactions, and
--test check processing accuracy.

Several techniques used successfully by GAO include generalized computer audit programs, custom-designed computer audit programs, test decks, and detailed reviews of selected computer programs. Chapter 5 contains a discussion of each technique and a reference to case studies for the reader interested in further study.

## CHAPTER 3

## NEED TO ESTABLISH EFFECTIVE

## INTERNAL AUDIT OF ADP SYSTEMS

Internal audit coverage has not kept pace with the computerization of agency operations. Few of the departments and agencies that we visited during GAO's study indicated that the internal audit staffs review operational ADP systems on a regular basis. Some audit staffs do very little work, or no work at all, on these computerized systems. Reviews of computer systems normally are not made unless the computer operation is an integral part of an accounting, supply, or some other function that is being audited.

Internal audit staffs generally have not reviewed ADP systems to determine whether they meet original objectives or whether they are operating efficiently and effectively. Although there has been an increase in internal audit interest and involvement with computer systems late in 1970 and early in 1971, GAO believes that this effort must be increased and the scope of coverage broadened. It is important for internal audit staffs to understand, review, and evaluate agency ADP operations. In the absence of an independent review and appraisal of such a major part of an agency operation, GAO believes also that the adequacy of internal controls and safeguards over ADP operations are subject to question.

In this study, GAO observed that the degree to which auditors were involved in evaluating computer systems varied from comprehensive system testing, including a check of every computer program change, to almost no work at all. For example, the resident system auditors at the Veterans Administration (VA) Center in Philadelphia use a permanent test file to perform comprehensive testing of the VA insurance program. The test file is used on a continuing basis to establish the validity and accuracy of operating computer programs. Every change is checked and certified before it goes "live." A detailed discussion of the VA's test file is included in appendix VIII.

At the other extreme, we found that internal auditors perform almost no work at all on their agency's ADP operations. At one agency the internal auditors advised us that they make no reviews of the computer systems; instead, they audit around the computer. Management officials relied on testing procedures that simply verified the consistency of processing plus other quality control checks that, in our opinion, constituted neither a complete nor independent review. Furthermore, documentation or written descriptions necessary for understanding how the computer system operated generally were incomplete or not current. Under these conditions, we believe that a system is extremely vulnerable to error or misuse. GAO views the achievement of efficient, economical, and effective operations as a basic agency management responsibility. Because computers are used in achieving these goals, management officials must assure themselves as to the adequacy of the controls over computer operations, especially in view of the multibillion-dollar operations handled through computers.

One of the essential tools of management, complementing all other elements of management control, is the internal audit function. The Congress, through the Budget and Accounting Procedures Act of 1950, requires that the head of each agency establish and maintain systems of internal control designed to provide effective control over and accountability for all funds, property, and other assets for which the agency is responsible, including appropriate internal audit. For many years GAO emphasized the importance of strong internal audit systems.[1] To provide necessary controls over computer operations, we believe that the scope of internal audit coverage should be expanded to include reviews and evaluation of all agency computer systems.

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[1] General Accounting Office Policy and Procedures Manual for Guidance of Federal Agencies, title 3, chapter 11--Internal Auditing.

Internal Auditing in Federal Agencies, United States General Accounting Office, pamphlet dated October 1968.

GAO Views on Internal Auditing in the Federal Agencies, United States General Accounting Office, booklet dated 1970.

## SCOPE OF INTERNAL AUDITING

To be of maximum usefulness, internal auditing should extend to all agency activities and related management controls. Its scope should not be restricted.

In the specific area of data processing, the internal auditor's coverage should include both new systems under development and those in operation. For example, the auditor should be consulted in the development, design, and testing of ADP systems to help ensure that adequate controls are established and adequate audit trails are provided in the system to avoid costly changes after a new system has been installed. For systems already in operation, the auditor should continuously monitor the computer operation and perform necessary appraisals to determine whether an effective and reliable system is functioning.

## CHANGE IN AUDIT APPROACH REQUIRED

To perform an effective review and appraisal of certain sophisticated ADP systems, a change in the audit approach is required.

The advent of the computer has not changed the generally accepted auditing standard that the auditor must study and evaluate the existing internal controls as an integral part of his audit work. In the non-ADP environment, the auditor has historically been able to see and follow the flow of transactions through the system. A visible audit trail has been the key to this approach. In an ADP environment, however, some of the characteristics of today's more sophisticated computer systems make this approach impractical, if not, impossible. The visible audit trail no longer exists in some systems. For example, the computer system may

--rearrange input data and perform calculations internally,

--store data on magnetic tapes, disks, and drums for later use,

--print out summary information which bears no visible relationship to the original input data, and

--use equipment and computer programs that contain control and edit procedures which operate internally.

In sophisticated computer systems where more and more of the controls and decisions are incorporated within the computer, the audit approach must concentrate on ADP controls. The audit must establish whether ADP controls are adequate to ensure that acceptable input results in reliable output. This kind of environment exposes the auditor to types of controls, languages, and conceptual problems which differ from those previously encountered.

To meet these changing needs, ADP audit manuals or guides, internal control questionnaires, and other computer-auditing techniques have been developed to assist in the review of computer systems. Because it is not feasible to prepare a detailed audit program that will be uniformly applicable to all computer systems, review guides can be used. GAO has prepared a review guide for use in evaluating internal controls in ADP systems.[1] It includes background information on ADP controls and a questionnaire for use in reviewing them. Another guide is the recently developed ADP review guide for Federal agency accounting systems,[2] parts of which are equally applicable to any data processing operation.

Along with changes in the audit approach, new tools for auditing computer records also have been developed. They include generalized retrieval programs which permit the user to retrieve, summarize, calculate, sample, and print out

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[1] Review Guide for Evaluating Internal Controls in Automatic Data Processing Systems, United States General Accounting Office, 1968. (See app. IX.)

[2] Review Guide for Federal Agency Accounting Systems, United States General Accounting Office. (See ADP section--app. II.)

computerized information. Other techniques that are not new, such as test decks and custom-designed computer audit programs are used also. All of these computer-auditing tools or techniques have proven to be beneficial under certain circumstances. Chapter 5 includes a more detailed discussion of computer-auditing techniques.

## BENEFITS OF COMPUTER-AUDITING TECHNIQUES

Reviews and evaluations of computer systems using computer-auditing techniques do provide tangible benefits for both auditor and management. Aside from the important control factor provided by an independent review, some of the benefits are

--more confidence in system output,
--more efficient operations, and
--cost savings.

Several examples that illustrate these benefits are discussed below. In each example the computer itself was used to perform much of the actual detailed audit work.

1. GAO conducts an annual audit of the Federal Housing Administration (FHA) financial statements. The audit involves FHA's computerized mortgage insurance program under which lending institutions are insured against loss in financing first mortgages on various types of housing. The computer systems account for over 4-1/2-million mortgages.

   As the procedures and controls were transferred to the computer, it became more difficult for the auditor to use the traditional audit approach, i.e., checking output to input. Summary information printed out by the computer could not readily be traced back to the original input data, the tremendous volume of transactions limited the scope of the manual audit, and the auditor did not understand fully what was going on inside the computer.

   To overcome these problems the audit approach was modified to include a review and evaluation of ADP procedures and controls. A review of computer systems documentation including the related coding of

of selected computer programs and the processing of selected input data through auditor controlled versions of agency computer programs were unique features of the new review approach. The reasoning here is that if the auditor knows exactly how the computer processes input data and that adequate internal controls exist, he can rely on system output. By using this approach the auditor, in effect, tests the computer system that generates the data being audited.

The results of this approach provided the auditor, for the first time, with a detailed understanding of what actually was taking place within the computer. By virtue of this knowledge, the auditor had increased confidence in the information and totals generated by the computer system. Appendix VI contains a more detailed description of the audit approach used in the FHA audit.

2. The Air Force determines its procurement and repair needs for reparable-type stock items through a computerized reparable requirement system. The requirements computations are lengthy and complex--each computation involves about 5,000 mathematical calculations. The auditor had the problem of determining the effect, if any, that different input data had on final computed requirements. GAO first manually tried to recompute the requirements. Each manual recomputation required 1 to 1-1/2 days to complete, and even then, the auditors were not able to duplicate accurately the machine process because of the mathematical complexity and the sheer volume of calculations. The auditors could not be sure that the results of their computations were correct.

   As an alternative the auditors explored the possibility of using Air Force computers to recompute requirements. A plan was worked out with Air Force officials who agreed to write a computer program that would permit the auditor to make changes in the input data. After appropriate changes were made, Air Force officials reran the requirements computations with the same files used to run the original

computations. Because these recomputations were made on Air Force computers with Air Force programs, there was no question that Air Force procedures had been followed. The auditors were able to get accurate requirements computations that were acceptable to the Air Force and from which it was possible to determine the effect of changes in input data.

Use of the computer in this review

--saved 300 man-days that would have been needed to recalculate requirements computations manually and

--provided the auditor with a greater degree of assurance and confidence in results of the work.

The next examples illustrate that an auditor, with minimal computer knowledge and armed with a relatively easy to use computer audit retrieval program, can use the speed of the computer to quickly and efficiently obtain needed information either for audit use or management needs. In each example below, direct cost savings were achieved in terms of time saved to do the work.

1. Agency payroll information was maintained on computer tape. The auditor needed to extract selected information for audit verification at six different field locations. The auditor extracted and printed the information in an easy to use format by using a generalized computer audit retrieval program. These neatly printed listings were then mailed to the appropriate field location for audit verification. The auditor estimated that he had saved 15 man-days that otherwise would have been necessary to manually select and list the necessary information on separate schedules.

2. Agency stock records were maintained on computer tape. As part of an audit, a generalized computer audit retrieval program was used to

--extend the dollar value of 42,000 stock items,

--obtain record counts and dollar amounts of several different types of stock items, and

--select statistical samples of stock items for detailed audit verification.

The auditor estimated that the computer had saved him 30 man-days to perform this work.

3. A large system designed to operate and control containerized freight shipments was maintained on computers. The auditor needed to extract information from a large file to evaluate controls and container-use factors. He used a generalized computer audit retrieval program to extract information on types of shipments necessary for

--review of perishable and nonperishable shipments from selected locations,

--review of container shipments to and from selected locations,

--computation of percentages of cubic feet use of all shipments of containers by various shippers,

--summarization of container shipments by port of discharge, and

--review of distribution of nonperishable shipments by weight and number of pallets for each container.

The auditor estimated that he had saved 50 man-days by using the computer to extract needed information.

## ADDITIONAL TRAINING REQUIRED

To work effectively in a computer environment, the auditor must get additional training in computer technology and develop new computer-auditing skills. For example, if

he is expected to evaluate a highly complex data processing system, he must acquire a detailed understanding of the computer operation, in addition to, a thorough knowledge of agency procedures. The necessary proficiency in evaluating computer operations can be obtained through formal training, individual study of computer technology, and most important of all, actual on-the-job experience.

Management also has a responsibility to extend its understanding of computer operations. To be able to satisfy itself that an ADP system is effective and functioning properly, management ought to have a basic knowledge of the concepts and principles of data processing. Without this knowledge, management will surrender its decisionmaking role involving agency use of computers to technically oriented data processing persons who may be unskilled in managerial methods.

## CONCLUSIONS

The increasing use of computers in Government and the trend toward more sophisticated and complex systems have important implications for auditors. GAO believes that the scope and techniques of auditing in the ADP environment must be expanded. The auditor must become proficient in computer technology to an extent necessary to evaluate computer operations. Prime consideration needs to be given to training and the use of advanced techniques.

GAO believes also that an independent review and evaluation of agency computer systems is a must. To be effective, the review group should be independent of daily computer operations and should report to a high-level management official. It seems logical that the internal audit groups should make these evaluations. An adequate evaluation of any complex ADP system requires both a detailed understanding of computer operations and a thorough knowledge of agency procedures. By "living with" the agency system, internal auditors are in the most favorable position to acquire the necessary know-how and keep it up to date. They are also in a position to monitor the computer's operation continuously.

In general, GAO believes further that internal auditors must develop and extend their activities to include reviews and evaluations of data processing systems. In the absence

of these independent evaluations, the computer operation is more vulnerable to undetected error, misuse, and possibly fraud. To help strengthen controls and safeguards over agency computer operations, GAO believes that Federal agency managers should require internal audit or a similar group to devote more attention to computer systems than currently is being done.

## CHAPTER 4

## NEED FOR COMPREHENSIVE ADP DOCUMENTATION

During fiscal years 1966 through 1969, the Federal Government devoted over 100,000 man-years to the analysis, design, and programming of ADP systems. The investment of Federal resources in these systems continues to expand, and the related costs are becoming increasingly significant. As part of our study, we looked into the practices used by Federal agencies to document computer systems and identified what we consider to be the minimum documentation elements necessary to ensure that all essential information is properly preserved and available for management and operational use.

This study encompassed Federal departments and agencies utilizing about 97 percent of the ADP equipment being operated in Government. Discussions were held with high-level officials at twelve departments and agencies, sixteen bureaus, and thirteen ADP installations. At the thirteen ADP installations we visited, we examined into standards and procedures, along with the documentation created for over 300 scientific and business computer programs.

Briefly, it was found that most Federal agencies have not developed or implemented agencywide documentation standards or guidelines, and that, generally, the documentation produced was incomplete and inadequate. This can result in serious consequences. The cost of poor or outdated information--in terms of inefficient and uncoordinated operations, wasted man-hours, redundant efforts, and disillusioned users--usually is not apparent immediately from a short-range viewpoint. The available evidence bears out that, from an overall long-range standpoint, however, an inefficient operation is often characterized by a lack of good documentation.

## WHAT DOCUMENTATION IS

The term "documentation" generally is used to denote a collection of documents or information on a given subject.[1] As used in this report, however, it refers specifically to the information that is recorded during the design, development, and maintenance of computer applications, to explain all pertinent aspects of a data processing system--including purposes, methods, logic, relationships, capabilities, and limitations.

Documentation should be created as an integral part of the development process. As such, it may b used by management not only to monitor and control an organization's resources, but also as a method of measuring performance and compliance with established goals and standards. Consequently, documentation policies and procedures within the Federal Government need to be stated clearly, systematically communicated, and designed to promote the carrying out of authorized activities efficiently and effectively. At present, adequate documentation is unusual among Federal agencies.

## ADP DOCUMENTATION FOR FEDERAL AGENCIES

On November 25, 1970, the Comptroller General issued a restatement of certain requirements relating to executive agency accounting systems. These requirements[2] include the following types of documentation deemed necessary for GAO approval of proposed mechanized and automated accounting systems.

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[1] American National Standard Vocabulary for Information Processing, American National Standards Institute, Inc., (ANSI), 1970 issue.

[2] General Accounting Office Policy and Procedures Manual, title 2, section 27.5, part 6 as revised by Comptroller General letter B-114365(2) dated November 25, 1970. (See app. I.)

"a. The planned use of ADP and other mechanical equipment including the following:

(1) A statement of objectives pertaining to the use of automation and the degree to which the system will be automated.

(2) An overall narrative description and accompanying flow chart of the general flow of information through the system. This should tie in with the general description of the accounting system.

(3) A description of the equipment configuration and capabilities, and the computer language(s) which will be utilized in programming the processing operations. Where specific equipment has not been selected, the description should include a statement of the general equipment requirements for processing and storage and associated peripheral operations, and a statement of the primary computer language to be used.

"b. The design specifications which describe the logic of the proposed ADP system, including

(1) Flow charts showing the sequence of operations to be performed by each proposed computer run.

(2) For each proposed computer program, a brief description of the functions to be performed, processing frequency, type of input, and the resulting product(s).

(3) Descriptions of the physical characteristics of the data elements to be contained in the transaction records and data files, including the media (punched card, magnetic tape, etc.) to be used.

(4) Descriptions of controls to be provided over data

(a) inputs, including the types and purposes of edit and other purification or validation routines;

(b) processing, including the plan for back-up operations;

(c) storage, including the plans for reconstruction of the data files; and

(d) outputs.

(5) Identification of audit trails in the automated system with special attention given to systems in which conventional audit trails *** will be obscured in the processing operations and alternative procedures will be necessary."

Although this list was promulgated as a requirement prerequisite to GAO approval of automated Federal accounting systems designs, it may also serve as a minimum documentation level during the development phase of any ADP system and will provide a reasonable level of documentation for a general understanding of overall system design. Additional detail, however, is required for operational systems, including:

1. Operator instructions (or run book) showing program loading procedures, processing schedules, peripheral equipment used, tapes needed, and error conditions and procedures.

2. Instructions showing how input data is prepared for processing, scheduled preparation dates, and validity checks.

3. Source listings with appropriate comments and explanations.

4. Data processing center organization information, including organizational components, responsibilities, controls, and emergency operating procedures.

5. Test data and results including documentation of the data used to test system performance, the procedures used, descriptions of test cases, and the results of tests, including samples when appropriate.

Although GAO believes that these documentation elements should be required as a minimum, they do not necessarily represent the full scope of information that should be recorded within a documentation package. Additional data may be necessary for many systems, depending upon such factors as the degree of management control required, system complexity and purpose, and reliability requirements. In every case, documentation is adequate only as (1) it is kept current and complete and (2) it communicates easily and logically all important facts and relationships to those who need them.

## NEED FOR INCREASED MANAGEMENT SURVEILLANCE OF ADP DOCUMENTATION PRACTICES

Where agency management has made the decision to utilize computers, the technologies of information handling, communications, controls, and related developments in information theory are generally applied in ways that have significantly changed methods of operations. These changes call for improvements in the management process also. New managerial techniques must be incorporated that will adequately insure a proper level of control over the use of Government resources.

## CONCLUSIONS

GAO believes that system documentation is a basic prerequesite to improved managerial capacity. Consequently, Government-wide documentation standards should be developed and promulgated by the executive branch to guide all Federal agencies in maintaining an adequate level of system documentation. As an interim measure pending adoption of Federal standards by the executive branch, Federal agencies should critically examine existing documentation practices as a fundamental step toward improving the effectiveness of their computer operations. This effort should include

the development of uniform agency documentation standards and procedures that meet the minimum levels described above and periodic reviews of agency practices.

## CHAPTER 5

## COMPUTER-AUDITING TECHNIQUES

In today's ADP environment, auditors can use computer-auditing techniques to conduct independent reviews and improve responsiveness to management needs by using new tools and techniques that were not previously available. Auditors trained in computer-oriented techniques can use the computer to do detailed clerical-type auditing work. These techniques also can be used to assist in the review and evaluation of computerized systems including the internal controls unique to this new environment.

The computer can perform quickly and accurately many of the detailed and tedious tasks involved in auditing. For example, the computer can

--search files and select data for examination,

--check the accuracy of analyses and summarizations,

--create flow charts for portrayal of systems,

--prepare special analyses or reports for management or audit needs, and

--check the performance of computer programs.

There are undoubtedly many other uses to which the computer can be put. They are limited only by the resourcefulness of the user.

To evaluate computerized systems, an understanding of new types of controls not encountered in manual systems is necessary. These new controls are associated with computer hardware, computer programs, ADP operations, and organizations. For example, hardware controls are available to prevent accidental destruction of data on magnetic tapes, computers are programmed to count records and develop control totals, procedures are established to assure that computer operators mount proper magnetic tapes for each operation, and manuals and written procedures are prepared to ensure adequate communication.

As suggested by the above examples, the auditor is faced with a different situation when working in an ADP environment. Computer-auditing techniques are needed. Several of those used successfully by GAO are:

--Generalized computer audit programs. These consist of a series of prewritten computer programs that can be linked together and used by an auditor. Such names as Audassist, Auditape, CARS, Easytrieve, and STRATA fall under this heading. There are others.

--Custom designed computer audit programs. These generally include computer programs written especially for a specific audit purpose.

--Test decks. These include test decks, test files, or test documents.

--Reviews of selected computer programs. These involve a review of programming documentation and the related coding of the computer program.

It should be remembered that in most cases no single audit technique will suffice. Instead, a combination is required to satisfy the auditors' needs. Professional judgment and the element of risk still govern the extent of testing. A more detailed discussion of computer-assisted-auditing techniques with references to appropriate case studies is included below. Arrangements for use of different computer audit packages can be made with the developer.

## GENERALIZED COMPUTER AUDIT PROGRAMS

A most important development in recent years that has provided auditors with an efficient and effective means of auditing records maintained by computers is the generalized computer audit program. These programs or systems permit the auditor to retrieve a wide variety of information from computerized records and to perform different auditing procedures.

A generalized computer audit program usually consists of a series of prewritten computer programs that easily can be linked together and readily adapted by the auditor to the requirements of a specific audit situation. Some of the uses include:

--Search and retrieve. The auditor can search a large file of records at computer speeds and identify and retrieve items that have audit significance.

--Selection of samples. The computer can be instructed to select samples using any one of several systematic random-sampling techniques, or to calculate and select a sample necessary to satisfy desired statistical confidence levels.

--Mathematical computations. The basic mathematical operations of addition, subtraction, multiplication, and division can be performed at computer speeds.

--File comparison, merges, and sorts. Input files can be merged or sorted in almost any sequence desired. Files can be compared with an option to print out either matched or unmatched records.

--Summarizing and reporting. Large volumes of data in machine-readable form can be easily and quickly summarized to satisfy audit requirements.

--Printing and punching. Desired output can be punched into cards or printed in almost any desired order with descriptive headings over columns of data.

These generalized programs examine and manipulate the output produced by a data processing system. They have not been designed to examine agency programs. Instead, they merely perform on an automated basis the same type of clerical work that has characterized much audit work in the past.

Substantial amounts of audit time can be saved by using a generalized program, especially if it is used on a recurrent basis on the same audit application. Even if first-time savings cannot be achieved, the automated approach may result in benefits such as better audit coverage, better documentation, and a better understanding of the agency computer system. In some cases the generalized programs permit the auditor to retrieve data which, as a practical matter, could not have been obtained manually.

There are a number of generalized computer audit programs. Most of the public accounting firms, as well as some private firms have developed such programs. GAO has not reviewed all the generalized programs, and it is beyond the scope of this report to comment on their differences. A partial listing follows.

| | |
|---|---|
| Audassist | Alexander Grant & Company<br>Certified Public Accountants |
| AUDEX | Arthur Andersen & Co.<br>Certified Public Accountants |
| Auditape | Haskins & Sells<br>Certified Public Accountants |
| Auditpak | Lybrand, Ross Bros., & Montgomery<br>Certified Public Accountants |
| Auditronic 16 | Ernst & Ernst<br>Certified Public Accountants |
| AY Audit/Management System | Arthur Young & Co.<br>Certified Public Accountants |
| CARS | Computer Audit Systems, Inc.<br>725 Park Avenue<br>East Orange, New Jersey |

| | |
|---|---|
| Computer File Analyzer | Price Waterhouse & Co.<br>Certified Public Accountants |
| Easytrieve/300 | Computer Audit Corporation<br>1320 Fenwick Lane<br>Silver Spring, Maryland |
| SCORE | Atlantic Software, Inc.<br>5th and Chestnut Streets<br>Philadelphia, Pennsylvania |
| STRATA | Touche Ross & Co.<br>Certified Public Accountants |
| System 2170 | Peat, Marwick, Mitchell & Co.<br>Certified Public Accountants |

Detailed descriptions and illustrations of the use of Haskins & Sells Auditape System and Alexander Grant & Company's Audassist are included in appendix III and IV. These illustrations demonstrate some of the capabilities of the generalized computer audit program for the reader interested in further study.

The generalized computer audit program has great potential for saving audit time and enhancing the auditors' knowledge of computers. It should be considered a valuable tool to assist the auditor or manager in examining records maintained by computers.

## CUSTOM-DESIGNED COMPUTER AUDIT PROGRAMS

A custom-designed computer audit program is defined here as a computer program especially written either by or for an auditor to accomplish a specific audit objective. In contrast to a generalized computer audit program which can be used on a variety of records or computers, the custom-designed program normally works only on the system or computer for which it was designed.

Oftentimes the need for a custom-designed program develops when the auditor encounters an audit situation for which a generalized program is unsuited. A decision to custom design such a program requires careful consideration of the costs and benefits. In comparison with an already existing generalized program, development of a custom program for a one-shot application is relatively expensive. It takes time and costs money to design, write, test, and debug a computer program.

Other practical considerations also are involved. If programs are prepared by someone other than the auditor, the auditor must establish the validity of the programs for his independent purpose. If programs are prepared by the auditor, he obviously must have a working knowledge of several programming languages. Either case requires a working knowledge of computer hardware and several programming languages which is not now a universal skill of auditors.

Once the decision is made that the value of a custom-designed program justifies the cost of development, it soon becomes apparent that such a program has several unique advantages. For example:

--The program can be tailored to fit the exact needs of the auditor, as opposed to satisfying a need using limited capabilities of a generalized program.

--On a recurring audit, it may be possible to use the same program again with only minor modifications or updating.

--Although not a major consideration for a one-shot application, the custom program probably will run more quickly and efficiently than a generalized program.

To date, development and use of custom-designed computer audit programs in GAO has not been extensive. One rather small computer program designed to compare records on two magnetic tapes and to identify and list either matched or unmatched records is described in appendix VII. More complex and sophisticated examples of custom-designing new programs and customizing existing computer programs are included as part of a case study in appendix VI.

## TEST DECKS

A test deck is a set of dummy transactions created to test the procedures and controls in a computer program. The concept originated with computer programming persons who used test decks in debugging computer programs. Auditors adopted the technique to determine exactly how different types of transactions are handled by the data processing system.

Auditors can use test decks to

--test computer programs to verify the existence and effectiveness of program controls, and

--verify computational operations or program processing.

Test decks can be processed against live current files, in which case special precautions must be taken to safeguard agency records, or test decks can be processed against duplicate or simulated files. A comparison of the results of processing test data with predetermined results will indicate whether the program is functioning as described. These results merely verify that the system is, or is not, functioning properly at a point in time--file accuracy cannot be validated with test decks. If test decking does indicate a program error or the possibility that files are inaccurate, additional audit work is required to determine the cause and impact.

A clear understanding of the data processing system and its relationship to the audit objectives is necessary to develop an effective test deck. The types of transactions to be included in the test requires careful consideration if the auditor is to test the programs fully. He must consider all of the significant data variations.

The auditor can select the types of test transactions by reviewing and analyzing test decks used by programmers in debugging the program or by analyzing system documentation. A combination of the two methods is usually best.

The test deck should include transactions to test processing or handling of

--valid conditions,
--erroneous data,
--missing transactions,
--illogical conditions, and
--validation checks.

In many cases it is impractical to develop a test deck to test every possible combination of conditions. Judgment and the element of risk govern the extent of testing.

Advantages

1. Versatility--test decks can be designed for any program, system, or equipment.

2. Positive results--results are irrefutable if the test is made with a production program.

3. Ease in understanding results--either the test processes correctly or incorrectly.

Disadvantages

1. Design difficulty--the auditor must understand the functioning of the system to develop an adequate test deck.

2. Inflexibility--a test deck is valid for a single application or program for which it was designed.

3. Maintenance required--the test deck must be updated to incorporate program or system changes.

4. Error identification--test deck processing points out errors, not the cause or impact.

5. Error detection--there is only a limited chance of detecting an invalid condition if a program has been altered to manipulate a specific account or amount.

Under certain conditions, test decks can be a highly effective audit tool. For example, GAO uses test decks in the audit of the Federal Crop Insurance Corporation. A detailed discussion is included in appendix V.

An important use of the test-decking procedure is being made at the Veterans Administration (VA) Center in Philadelphia, Pennsylvania. The resident systems auditors have used test decking for a number of years to perform comprehensive testing of VA insurance programs. This application is important because

--the permanent test file designed for and used on a continuing basis enables the auditors to meet their responsibility for certifying to the validity and accuracy of the computer programs and

--a group, independent of daily computer operations, provides management with an independent review and appraisal of the computer system operation.

A discussion of the VA's test-decking procedures is included in appendix VIII.

## REVIEW AND ANALYSIS OF SELECTED COMPUTER PROGRAMS

In sophisticated computer systems, the computer performs a significant amount of internal processing. For example, input data may be highly summarized making it impossible, or at best impractical, to trace transactions through the system or to associate input with output. In this environment the audit approach must concentrate on ADP procedures and controls since it is no longer practical to trace transactions through the system.

If an auditor is to evaluate a computerized operation or to rely on its output, he must understand and test the computer system. New types of controls, different terminology, and different conceptual problems are involved in this environment. In some cases, the auditor may not feel qualified to perform the required analysis. He may wish to consult with a computer-auditing specialist or other technically qualified persons.

One approach to auditing these sophisticated computer systems is described below. A combined team effort between auditors and computer specialists is required. A unique if not controversial procedure is included. It is the review and analysis of selected computer programs encompassing not only the analysis of programming documentation but the related coding of the program. The methodology for performing such a review includes the following steps.

--Analyze the computer application or system on the basis of a review of documentation and interviews with agency employees. How does the system work?

--Review internal controls surrounding the computer-based system and also the related internal controls over actual processing. Are internal controls adequate?

--Analyze selected computer programs including related coding of the program. Is the system functioning in conformity with representations contained in system documentation? Will it produce accurate and acceptable output?

--Evaluate results of the above systems review. How and to what extent should the system be tested?

--Modify existing agency computer programs or prepare new programs that will produce output needed by the auditor to test the system.

--Test the system. Establish the consistency of processing and verify source data entering the system. One method of establishing the consistency of processing is to reprocess selected input data through auditor controlled versions of agency computer programs and compare the auditors' results with the agency's results. Other routines can be incorporated in the auditor-controlled programs that will concurrently accumulate totals or select and print records for verifying source data.

A review such as that described above could not be performed by an auditor unskilled in the computer arts. A combined team effort between auditors and computer specialists is necessary. Obviously this approach should not be employed as a routine one without adequate technical support and guidance. S. D. Leidesdorf & Co., Certified Public Accountants, is one firm that has developed computer audit routines and incorporated computer program reviews in their audits. The approach is to review the computer programs used in processing data and to combine the audit routines within such programs. If the reviewed program is satisfactory and is used in processing, the auditor can be assured of the accuracy of processing.

GAO with the assistance of S. D. Leidesdorf & Co., included a detailed review of selected computer programs as part of the annual audit of FHA. A team consisting of GAO auditors, and S. D. Leidesdorf & Co., computer systems analysts and computer-trained auditors, did the work. A case study on this audit approach is included in appendix VI.

## CONCLUSIONS

Computer-auditing techniques are invaluable as audit tools whether they be generalized computer audit programs, custom-designed programs, test decks, or computer program

reviews. In most cases no one audit technique will satisfy the auditors' needs. Each technique has its advantages and disadvantages. The auditor ought to be familiar with different techniques to select the combination that best meets the specific need.

# APPENDIXES

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-114365 (2)

November 25, 1970

HEADS OF FEDERAL DEPARTMENTS AND AGENCIES

Subject: Restatement of certain principles and standards relating to executive agency accounting systems

We are amending our instructions regarding the development and improvement of agency accounting systems to effectuate the changes in General Accounting Office review and approval policies announced in my letter to you dated October 16, 1969, subject "General Accounting Office operations with respect to executive agency accounting systems."

The changes being made are designed to provide more complete guidance in the development and approval of Federal agency accounting principles and standards and accounting systems designs. An advance copy of the revised pertinent parts of section 27, entitled "Improvement of Accounting Systems," of Title 2--Accounting--of the General Accounting Office Policy and Procedures Manual for Guidance of Federal agencies is enclosed.

Elmer B. Staats
Comptroller General
of the United States

Enclosure [See GAO note.]

GAO note: Parts of the enclosure have been deleted.

APPENDIX I

27.5 SYSTEM DESIGN

*  *  *  *  *

6. The extent and nature of mechanization and automation

In a system employing ADP equipment, adequate documentation varies according to the circumstances involved but it is necessary for the success of any operation. The types of documentation specified below are deemed to be necessary to provide an understanding of the design of the system. Programmed instructions and operator instructions are not required to be submitted for approval of the accounting system design.

a. The planned use of ADP and other mechanical equipment including the following:

(1) A statement of objectives pertaining to the use of automation and the degree to which the system will be automated.

(2) An overall narrative description and accompanying flow chart of the general flow of information through the system. This should tie in with the general description of the accounting system.

(3) A description of the equipment configuration and capabilities, and the computer language(s) which will be utilized in programming the processing operations. Where specific equipment has not been selected, the description should include a statement of the general equipment requirements for processing and storage and associated peripheral operations, and a statement of the primary computer language to be used.

b. The design specifications which describe the logic of the proposed ADP system, including

(1) Flow charts showing the sequence of operations to be performed by each proposed computer run.

(2) For each proposed computer program, a brief description of the functions to be performed, processing frequency, type of input, and the resulting product(s).

(3) Descriptions of the physical characteristics of the data elements to be contained in the transaction records and data files, including the media (punched card, magnetic tape, etc.) to be used.

(4) Descriptions of controls to be provided over data

(a) inputs, including the types and purposes of edit and other purification or validation routines;

(b) processing, including the plan for back-up operations;

(c) storage, including the plans for reconstruction of the data files; and

(d) outputs.

(5) Identification of audit trails in the automated system with special attention given to systems in which conventional audit trails (see item 7 below) will be obscured in the processing operations and alternative procedures will be necessary.

7. <u>The internal controls to be maintained</u>

a. A description of the manner in which financial, manpower, and property resources are controlled and safeguarded by the regular authorization, approval, documentation, recording, reconciling, reporting, and related accounting processes.

b. An outline of controls over quantity, timeliness, reliability, and accuracy of inputs, processing, and outputs (whether for manual, automated, or mechanical

systems), sufficient to demonstrate reasonable assurance of accurate recording of transactions and reporting of their effects in the accounting period in which they occur.

c. A statement of the basis for auditability of the system in terms of results of operation and current condition, and identification of the audit trails throughout the system. This includes a description of the manner in which a particular element of data that exists in the files can be traced backward to the source of the transaction that created it and forward to its position in a report.

# REVIEW GUIDE FOR FEDERAL AGENCY ACCOUNTING SYSTEMS

## SECTION 18--AUTOMATIC DATA PROCESSING (ADP)

In a system employing ADP equipment, adequate documentation varies according to the circumstances involved but it is necessary for the success of any operation. The process of system design approval from the viewpoint of its ADP aspects involves the assurance that the system (1) has adequate audit trails, (2) is adequately controlled, and (3) provides for a minimum of redundancy and duplication of processing. To obtain this assurance, it is necessary to gain a fairly comprehensive knowledge of the entire system and how it is planned to operate. The following questions are intended to be used as a guide to determine the adequacy of ADP documentation to provide the basis for system comprehension.

### OBJECTIVES

1. Is there a statement of objectives pertaining to the use of automation?

2. Does the statement include the degree to which the accounting system will be automated?

   a. Does it specify the functions or actions which will be automated and those which will be manual?

   b. Does it specify the relationship of the accounting system with other systems?

### DESCRIPTION

1. Is there an overall narrative description of the automated portion of the system?

2. Does the description tie in with the general description of the accounting system?

3. Is there a flow chart of the general flow of information through the automated portion of the system?

4. Is the flow chart keyed to the narrative?

5. Does the flow chart tie in with the general charts depicting the major accounting processes?

6. Does the above documentation adequately provide a basis for understanding the purposes and interrelationships of the various computer runs?

EQUIPMENT CONFIGURATION

1. Is there a description of the equipment configuration?

   a. Does the description include a statement as to the capabilities (and limitations) of the equipment to handle the processing of data for the accounting system?

   b. Does the description include:

      (1) Computer manufacturer and model number?
      (2) Size of internal memory?
      (3) Type and quantity of file storage devices?
      (4) Type and quantity of input/output devices?
      (5) Information on other peripheral devices?

2. Is there a list of the general-purpose and utility software which is planned for use with the system?

3. Is there a statement of the primary computer language which will be utilized in programming the processing operations?

   a. Does the statement include information on what other language(s) will be used?

   b. Does it specify to what extent the other language(s) will be used?

SYSTEM LOGIC

1. Are there flow charts which depict the sequence of operations to be performed by each proposed computer run or process?

2. Are these flow charts keyed to the flow of data so that it can be traced through the various levels of detail down to the program level?

3. Are there narrative descriptions for each proposed computer program?

   a. Do these descriptions include:

      (1) The functions to be performed?

      (2) Processing frequency and relationship to cut-off dates?

      (3) Types of input?

      (4) The resulting product(s) (output)?

   b. Are the program descriptions concise and yet sufficiently comprehensive to permit a clear understanding?

   c. Are the descriptions tied in to the computer run flow charts mentioned in 1. above?

4. Are there descriptions of the physical characteristics (size, alpha/numeric, etc.) of the data elements to be contained in the transaction records and data files?

   a. Do the descriptions clearly indicate the media (punched card, magnetic tape, etc.) to be used for each record and file?

   b. Are the descriptions in the form of layouts, charts, or listings?

5. Are there adequate descriptions of controls included in the automated system? (Refer to pp. 49 to 60 for the internal control check list.)

   a. Are the control descriptions identifiable as to:

      (1) Input, including:

         (a) Types and purposes of edit routines?

(b) Types and purposes of other validation or purification routines?

(2) Processing, including:

(a) Types of programmed controls to be used?

(b) Plans for operational controls in the data processing center?

(c) Plans for back-up operation?

(3) Storage, including:

(a) Plans for reconstruction of the data files?
(b) Plans for security of the data files?

(4) Outputs, including:

(a) Plans for error detection and control?
(b) Plans for control and distribution of products?

b. Is there a list of the controls built into the equipment by the manufacturer?

c. Are the controls incorporated in the manufacturer's software (operating system) identified?

d. Is the system free of any duplication of manual and automated controls?

(1) Are controls automated whenever feasible?

(2) Are the automated controls established as close to the source of the data as possible and feasible?

(3) Are the controls simple and easy to maintain?

6. Are audit trails in the automated system adequately identified?

a. Do the records or references provide the means to adequately:

(1) Trace any transaction forward to a final total?

(2) Trace any transaction back to the original source document--or input?

(3) Trace any final total back to the component transactions?

b. Does the system of processing provide:

(1) A historical record of activity in the accounts?

(2) A periodic printout of a trial balance of the computer-based general ledger and subsidiary accounts?

7. Is the automated system designed to perform efficiently?

a. Are data:

(1) Manipulated only when necessary?
(2) Not moved excessively?

b. Are operations that are performed manually:

(1) Only those that could not be handled more efficiently by the computer?

(2) Generally those that do not duplicate automated operations?

(3) Not intended to check on the accuracy of the computer?

c. Are only necessary transaction listings produced?

d. Is the exception principle employed for computer-produced reports whenever possible?

e. Are reports designed to obviate unnecessary duplication of data elements in the same report or between reports?

f. Are procedures prescribed which will prohibit the maintenance of duplicated manual records by operating personnel?

g. Does the system have the capability to prepare special listings when required and to provide for the interrogation of every data element in the master record?

h. Does the system provide for the preparation of all reports from a single recording action and processing run for each transaction?

APPENDIX II

## INTERNAL CONTROLS

The centralization of data processing activities and the concentration of data processing functions in ADP demand that increased emphasis be given in the review of internal controls to ascertain their effectiveness. The evaluation of internal controls must rest on a review of the system documentation to obtain knowledge of how the system is expected to operate. Furthermore, the evaluation should be based upon the effectiveness of the "system of controls," i.e., the location of specific controls within the system which will provide their most efficient utilization and in the most economical manner. Accordingly, efforts in this area should be to achieve a proper balance of system controls--one that equates the incremental cost of including certain controls with the risk of loss due to their omission. The adequacy of the network of internal control in ADP is the key element to be depended upon in determining the reliance to be placed upon the accuracy of the system. The basic points of interest are:

1. The consequences of an error (consideration should be given to each field in the input data).

2. The points in the data processing at which an error may be introduced into the data.

3. The adequacy of controls introduced for prevention, detection and correction of input errors.

Controls can generally be classified into (1) those involving manual operations, (2) those involving computer operations, and (3) those which are built into the equipment. They can be further classified into controls which pertain to (1) external and off-line activities, (2) input, (3) processing and storage, and (4) output.

The recommended approach for use in evaluating internal controls involves studying the flow of data to identify the critical processing points where controls are necessary and then to determine what controls are planned for these points. Listed below are some general principles which should be considered in making the review.

APPENDIX II

1. Automated controls should originate as close to the source of the data as possible and feasible and not be duplicated further downstream in the data flow.

2. Necessary controls should be planned for and established during the design phase of the ADP system. Note also that only those controls which satisfy a need should be included.

3. Controls should be automated whenever it is feasible and they should be simple and easy to maintain to preclude disruption of the work flow.

4. A description of ADP control operations should be documented and assembled for reference and training purposes.

## INTERNAL CONTROL GUIDELINES

### External and Off-line Activities

1. Functional responsibilities should be separated to provide for a separation between the duties of systems analysts, programmers, and computer operators.

2. Source Documents

   a. Time frames should be established for the processing of source documents from point of receipt to the input preparation operation.

   b. A transmittal document should be used to control the flow of documents from the originating source to the input preparation operation.

   c. Processing delays should be identified for management review and correction.

   d. A quality review of source documents should be provided for, especially when the documents will affect the files.

e. Retention time periods for original source documents, unless specified by law or regulation, should allow sufficient time for the detection and correction of errors. Filing methods during this time period should provide for easy accessibility for research purposes.

f. A suspense system should be established to control the document flow from the point of receipt until they are input. Uncleared suspense documents should be thoroughly researched and procedures should be established to provide for the disposition of uncleared suspense documents.

g. Authority to initiate source documents must be limited.

h. A number must be assigned each document for identification purposes.

3. When data transmission is used, controls must be established to assure that transmission is correct and no messages are lost. Some common types of controls include message counts, character counts, and dual transmission.

Input

1. Independent control must be established over data submitted for processing (through the use of batch totals, documents counts, predetermined control and hash totals, sequential numbering, etc.) to detect loss or nonprocessing.

2. Controls over Input Preparation.

   a. When practical, keypunch documents should be mechanically verified; alternatively they should be visually verified.

   b. No further processing of source documents should be permitted following the input preparation operation.

c. Procedures should be established for the return to the originating source of illegible or incomplete source documents prior to input preparation. A record control over these rejected documents should be maintained to assure their reinput or cancellation.

d. Operators of the equipment for input preparation should be prohibited from altering data on source documents. They should also be denied access to computer programs.

3. Reversing Entries

a. A system of codes should be developed to identify and categorize by reason each reversing entry whether manually or computer initiated.

b. The identification number of the reversing entry should be the same as the original transaction or should be cross-referenced thereto.

c. All reversals should be accumulated and summarized periodically, and the summaries provided to management for quality control utilization.

d. Reversals which affect data elements of interfacing systems should be properly controlled and promptly submitted to the affected systems.

e. Documents prepared as the basis for reversals should provide sufficient justification and contain proper authorization.

4. Management Notices (Exception Reporting)

a. A system of management review codes should be developed to identify those transactions which have been designated by management to warrant special review or attention. The number of items so coded should be held to a minimum to retain the effectiveness of the principle of exception reporting.

b. All transactions so coded should be suspensed by the computer and a notice output and forwarded to the appropriate management level for review. Uncleared suspense items should be thoroughly researched and delinquency data accumulated and summarized for review by higher management levels.

c. For some transactions, preposting review may be required; in which case programmed controls should provide this insurance.

d. Adequate controls should be provided to insure that only authorized actions are possible to clear suspensed transactions.

5. Error Corrections and Rejects

a. All error corrections should be reviewed and approved by persons independent of the data processing department.

b. A system of codes should be developed for error correction documents which would categorize error corrections by cause and a code number should be assigned each such transaction.

c. Details on error correction and rejected transactions should be separately accumulated and made available for use by management.

d. Procedures should be established for periodic summarizations of errors and rejects by cause and for furnishing the summaries for management corrective action.

e. Error corrections which affect data elements of interfacing systems should be properly controlled and promptly submitted to the affected system.

f. Documents used for initiating error corrections should contain adequate justification and proper authorization.

g. If computerized suspense control file is planned, procedures should be established to summarize delinquent transactions by source for purposes of research and review.

h. A cross-reference file should be maintained to identify the error correction transaction with the original transaction, where applicable.

6. Miscellaneous Input Control Considerations

a. To reduce the possibility of error at the point of origin, specific operating instructions should be planned and simple standardized forms should be designed and prenumbered or precoded as applicable.

b. Specific procedures for the communication of data from the point of origin to the data processing unit should be planned. Applicable controls over data movement such as batch controls, transaction counts, turn-around documents, suspense files, etc., should be considered.

c. Procedures should be prescribed to preclude duplicate processing of input data.

## Processing

1. General Considerations

   a. The data processing unit should maintain a schedule of anticipated input and controls should be established to insure that some transmission is received from all scheduled input sources. If there is no input from a source in a given time period, the source should be required to transmit a negative message.

   b. Procedures should be established to insure that all input is processed to the computer.

   c. A properly controlled library should be planned for the storage of tapes, disks, etc. The library should (1) provide limited access, (2) maintain schedules and controls for issuance of tapes and disks, (3) maintain a catalog and index of tapes and disks including blanks, (4) provide for maintenance of proper physical conditions (temperature, humidity, etc.), (5) provide for adequate storage and control of classified data where applicable.

2. Programs

   a. Programmers, analysts, system managers, operators, etc., should be denied uncontrolled access to program tapes and disks.

   b. Procedures should be established to provide for off-site storage of duplicate program tapes, disks, and/or source or object decks.

   c. Plans should provide for the program changes or modifications to be documented and retained for management review and approval.

   d. Plans should provide for the console operator to be prohibited from modifying programs and to be denied access to manual records used to supplement or support the programs.

3. Edit Routines

Appropriate edit routines should be included in the system to detect data which are invalid, incompatible, unreasonable, inconsistent, or incomplete.

a. Some common editing functions are listed below:

(1) Character checks: Checks each character for numeric, alphabetic, or blank.

(2) Field checks: Determines whether all required data is included in the input (completeness) and is in proper sequence within the transaction.

(3) Limit checks: Checks certain fields within a transaction to determine whether the data fall within a prescribed range.

(4) Validity checks: Checks certain fields based on known limits, stored information, or computer results.

(5) Sequence check: To check that incoming data records are in proper sequence.

(6) Logical relationships (or consistency): to determine whether components of input data have a logical relationship among themselves or to a master file.

(7) Reasonableness tests: to detect gross errors in calculation or a balance which exceeds a predetermined limit.

(8) Comparing: to check data fields against each other to prove the accuracy of operations involving matching, merging, coding, balancing, reproducing, or record selection from the file.

(9) Batch checks: to determine completeness of input batches. These could include:

(a) record counts--number of records input.

(b) control totals--summation of fields containing quantitative data.

(c) hash totals--summation of fields containing identifying numerical data.

b. Data should pass through all applicable edit routines prior to rejection and the reject notice should reflect all causes. In any case, procedures should be established to preclude the console operator from skipping an edit routine.

c. Error corrections and input of rejected transactions should be subject to the same edit routines as initial transactions.

d. Listings should be prepared for management of all edits which are performed on each type of transaction.

e. Where computer logic can correct an error disclosed by an edit routine, a separate record or tape should be made of the correction.

f. Edit routines should be compatible with the requirements of interfacing systems.

g. Edit rejects should be reported to the originating source for investigation and correction as applicable.

4. Processing Runs

a. For updating of balances, a comparison should be made by the computer of the initial balance plus the current transaction with the after-posting balance.

b. When tapes are merged or sorted, control totals should be checked and the new totals recorded.

c. Provision should be made for a computer halt for those cases which present "impossible" situations and in all cases where errors or exceptions occur, management notices should be printed out and the record "flagged" accordingly.

d. For cases in which self-balancing figures (totals) are included in processing activities, provisions should be made for checking balances after each processing run.

e. Procedures should provide for the accumulation on separate tape of processing actions selected for management review to facilitate printing.

f. When transactions lose their input identification, a new identification number should be developed and cross-referenced to the prior one.

g. Control totals or hash totals should be assigned whenever necessary to insure against the loss of data during processing.

5. Suspense Routines

a. Suspense transactions should be assigned an identifying number to enable effective matching with subsequent input and the data when they are suspensed.

b. Summaries should be prepared for overdue suspensed items.

c. Processing against suspense tapes should occur along with routine processing.

d. Procedures should be established to prevent the clearing of suspensed transactions by the console operator.

6. Programmed Controls

a. Appropriate programmed controls should be included in the various processing routines to avoid undetected errors caused by (1) omissions or inaccuracies in the programs, (2) failure of the console operator to perform properly, or (3) possible equipment malfunction.

b. Necessary control procedures should be adopted to insure against the loss of stored data.

c. Control procedures should be provided to insure against the accessing of wrong files in producing output products.

d. Plans should be made for programmed instructions to provide for recording of operator actions which affect in any way the data being processed.

7. Equipment

a. The built-in controls should be ascertained to determine that they are not duplicated by programmed controls but are supplemented by them.

b. Plans should be made for providing operators with explicit instructions (console run books) for each computer run.

8. Storage

a. Plans should provide for minimum access for records retrieval.

b. Planned procedures should provide for file reconstruction in case of emergency.

c. Plans should provide for security of the data files.

Output

1. Transaction registers should be required for all systems transactions. It is not necessary, however, for these registers to be in a "hard copy" medium.

2. Routine output products should be limited to the products needed to meet particular requirements in accordance with the design criteria.

3. Provision should be made for error feedback from output recipients.

4. Provision should be made for control over output distribution.

APPENDIX II

5. Programmed edit routines of output may be desirable to test the reasonableness of the data or to make comparisons with independently maintained control figures.

# APPENDIX III

## ILLUSTRATIVE EXAMPLE OF

## AN INVENTORY AUDIT APPLICATION

## USING HASKINS & SELLS AUDITAPE SYSTEM

## ON A HONEYWELL 1250 COMPUTER

APPENDIX III

## Contents

APPENDIX III

# ILLUSTRATIVE EXAMPLE OF AN INVENTORY AUDIT APPLICATION USING HASKINS & SELLS AUDITAPE SYSTEM ON A HONEYWELL 1250 COMPUTER

## DESCRIPTION OF THE AUDITAPE SYSTEM

The Auditape System uses a generalized set of computerized audit routines designed to extract data from the computer and manipulate it to satisfy a particular job. The system includes the auditape, the Instruction Sheet for Computer Operator, a set of specification sheets, and an Auditape System Manual.

The auditape is a reel of magnetic computer tape containing a set of generalized routines to perform specific functions. These routines are in machine language, ready for immediate use.

The Instruction Sheet for Computer Operator, combined with messages printed during processing, includes explanations necessary to operate the equipment.

The specification sheets are the means by which a person adapts the Auditape System to his purpose and to the input records available. The specification sheets are used as the source documents from which specification cards are keypunched. The specification cards are read into the computer memory and combined there with the instructions read in from the auditape to complete the program for the particular routine being processed.

The Auditape System Manual provides general information about the system and specific instructions regarding the functions of each routine and the related specifications required.

APPENDIX III

The Auditape System includes the following routines.

Edit routine:
--Subtotal subroutine (note a)
--Include/exclude subroutine (note a)
Print/punch routine
Summarize routine
Mathematical routine
Audit sample design and selection routine
Audit sample evaluation routine

[a]Processes simultaneously with the edit routine.

Several other routines are being developed and some of the existing ones are being expanded to add to the capability and flexibility of the system.

Edit routine. This routine causes selected data to be read from any specified position in the input record regardless of its format and written in a specified field on an output tape in the auditape format. The output tape then becomes the input tape for any of the other routines in the system. The subtotal subroutine or the include/exclude subroutine can be processed simultaneously with the edit routine. These subroutines provide subtotals of input data in certain specified classifications and can include or exclude input data based on certain specified criteria.

Print/punch routine. The results of other routines are written on an output tape in the auditape format. Using these tapes as input, the print/punch routine can be used to provide printed or punched card output or both. This routine includes options to permit the fields of data in the auditape record to be printed in any desired order and to print descriptive headings over each column of data.

Summarize routine. The summarize routine can be used to summarize details of records by some identifying characteristic, such as Federal Stock Class or date.

Mathematical routine. The mathematical routine performs addition, subtraction, multiplication, or division of amounts in any two quantitative fields in the auditape

record, or of amounts in one of such fields, and a specified constant amount.

Audit sample design and selection routine. The audit sample design and selection routine computes the approximate optimum sample size to obtain the statistical precision and reliability specified for a particular sample and selects the items to be included in the sample.

Audit sample evaluation routine. The audit sample evaluation routine computes the effect of any errors, found in sample items, upon the preliminary precision limit used in the audit sample design and selection routine.

Auditape is basically an information retrieval and analysis system for extracting significant data from the computer and manipulating it to satisfy a particular job. It was designed for use by persons who have no specialized knowledge of computers or programming languages and who have had only a nominal amount of instructions.

APPENDIX III

## COMPUTER SYSTEM REQUIREMENTS

The inventory audit application discussed in this study was prepared for processing on a Honeywell 1250 computer. By exercising different options in completing the auditape specification sheets the same inventory audit application could be processed on other computer systems that include the following components and features.

### Honeywell Series 200 Tape Systems

Processing unit--Series 200 models 110, 120, 125, 200, 1200, 1250, 2200, 4200, and 8200 with the following features:

Memory capacity of at least 8,192 characters (8K).
Advanced programming.

Card reader or reader/punch.

Printer with at least 100 print positions or a console typewriter.

Magnetic tape units (one-half inch)--one unit for the Auditape System and additional units, as required, for input and output for specific applications.

### IBM 1400 Series Tape Systems

Processing unit--1400 series, or System 360 with 1401 emulator with the following features:

Memory capacity of at least 8,000 characters (8K).
Advanced programming.
High-low-equal compare.

Card read-punch.

Printer with at least 100 print positions or console typewriter.

Magnetic tape units--one unit for the Auditape System and additional units as required for input and output for specific applications.

The inventory application can also be processed on certain IBM System 360 computers with the proper input tapes. The Haskins & Sells Auditape System Manual contains the necessary instructions.

If the required equipment is not available at a particular location but input data is available on tapes or disks that are written or can be transcribed into punched card or IBM or Honeywell tape codes, the transcribed data can be processed with the Auditape System at another location.

APPENDIX III

## DESCRIPTION OF INVENTORY AUDIT APPLICATION

The inventory records used in this auditape application are maintained on magnetic tape. The record for each stock item consists of 80 characters of information, including such data elements as warehouse code, unit of issue, stock number, unit cost, and quantity on hand. Dollar amounts for each item were not extended; therefore, the total dollar value of the inventory was not recorded on tape.

This study will demonstrate how the Auditape System can be used to calculate the total dollar value of recorded inventory and to select and print out a statistical sample designed to provide 95-percent assurance that the error in inventory would not exceed 1 to 2 percent of the recorded value.

To accomplish these objectives, we used the Auditape System to extract needed data from the agency's inventory tape, to calculate the total dollar amount of inventory by multiplying unit cost by the quantity on hand, and to select and print out an appropriate statistical sample of the stock items. In our step-by-step procedure we:

1. Determined by discussion with agency data processing personnel that the inventory tape could be processed on an available Honeywell 1250 computer.

2. Obtained a duplicate reel of the agency's inventory tape and a copy of the record layout for audit use. See appendix IIIa for a sample inventory-record layout.

3. Acquired a detailed understanding of the inventory-record layout through study and discussion with agency personnel.

4. Determined that the following data on each stock item would be extracted from the agency's inventory tape and written on an output tape in the auditape format, as follows:

| Data | Auditape Field |
|---|---|
| Warehouse code | 1 |
| Unit of issue | 2 |
| Julian date | 3 |
| Stock number | 6 |
| Unit cost | 8 |
| Quantity on hand | 9 |

See appendix IIIa for a sample layout of the agency's inventory record and the auditape record.

5. Prepared the edit routine specification sheets to extract inventory data from the agency tape and write it on an output tape in the auditape format. Appendix IIIa includes an auditape layout containing sample data extracted from the agency's inventory tape. See appendix IIIb for completed edit routine specification sheets.

6. Prepared the mathematical routine specification sheets designed to multiply unit cost by quantity on hand and store the result in Auditape Field 10. See appendix IIIc for completed specification sheets.

7. Prepared the audit sample routine specification sheets to select a statistical sample in accordance with a predetermined precision limit and reliability level. See appendix IIId for completed specification sheets.

8. Prepared the print/punch routine specification sheets to list or print selected information or each stock item included in the sample. See appendix IIIe for completed specification sheets.

9. Prepared an instruction sheet for the computer operator. (See app. IIIf.)

10. Keypunched specification cards from the auditape specification sheets.

11. Processed the inventory application on a Honeywell 1250 computer by following detailed instructions,

on the previously prepared instruction sheet for the computer, combined with messages printed by the computer during processing.

Results of the work performed by the computer are shown on the printout in appendix IIIh. As an aid in understanding the Auditape System operation, the computer processing steps are discussed below.

1. The edit routine extracts specified data from the agency's inventory tape (warehouse code, unit of issue, Julian date, stock number, unit cost, and quantity on hand) and records the information on a new reel of tape in the auditape format similar to the example shown in appendix IIIa. Upon completion of the editing process, the computer automatically prints out the record count and totals of the information assigned to Auditape Fields 8 and 9. (See app. IIIh, p. 102.) All 13,737 stock items are processed in slightly less than 2 minutes.

2. The mathematical routine multiplies the unit cost (Auditape Field 8) by the quantity on hand (Auditape Field 9) and records the extended inventory value in Auditape Field 10. The computer again prints out a record count, and totals of Auditape Fields 8, 9, and 10. Field 10 includes the extended inventory amount or $7,866,381.79. (See app. IIIh, p. 105.)

3. The audit sample design and selection routine computes the approximate optimum sample size and selects the appropriate 251 sample items. (See app. IIIh, p. 108.)

4. The print/punch routine prints the 251 sample items on a workpaper for the auditors' use. (See app. IIIh, pp. 111 to 114.)

If the auditors' subsequent detailed review of the sample items disclosed no errors, he could state with 95-percent confidence that the maximum error in the total population or recorded inventory would not exceed $80,000, the specified precision limit, or about 1 percent of the $7,866,381.79 recorded value of the inventory.

To demonstrate the use of the audit sample evaluation routine, we assumed that an auditor found the following errors of overstatement during a detailed review of the sample items.

| Amount of sample item containing error | Assumed amount of error |
|---|---|
| $ 605 | $ 100 |
| 64,782 | 2,000 |
| 3,600 | 500 |
| 404 | 10 |
| 6,714 | 250 |
| 217 | 50 |
| 11,532 | 1,000 |
| 168,474 | 5,000 |
| 34,142 | 4,000 |

Specification sheets for the audit sample evaluation routine were prepared as shown in appendix IIIg. Processing this routine on the computer resulted in the printed output shown on pages 115 through 118 of appendix IIIh. Taking into consideration the effect of the nine errors, the auditor can now state with 95-percent confidence that the maximum error in the population will not exceed $120,908.77. (See app. IIIh, p. 118.)

A total elapsed time of 10 minutes was needed to process this inventory application on the computer. Work performed by the computer to satisfy the study objectives included:

--Calculating the total dollar value of recorded inventory by multiplying unit cost by the quantity on hand for 13,737 stock items.

--Computing an optimum sample size, selecting the appropriate items, and printing the 251 items on a workpaper with descriptive headings over each column of data.

A complete printout resulting from computer processing is included in appendix IIIh.

# AGENCY INVENTORY RECORD AND AUDITAPE RECORD LAYOUTS

## AGENCY INVENTORY TAPE LAYOUT

| STK. AT | I.C. | H.C. | BUYER | STOCK NUMBER | WHSE. | BULK PACK | EOQ | MOP. | LEAD TIME | UNIT ISSUE | DATE | TOTAL HOLD | FUTURE QUANTITY | BACK ORDER | UNIT COST PRICE | DUE-IN | ON HAND | SELLING PRICE | CONTIN-GENCY. | DEMAND FORECAST | | SC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 6 7 8 9 10 11 12 13 14 15 | 16 17 | 18 19 20 21 | 22 23 24 | 25 26 | 27 28 | 29 | 30 31 32 | 33 34 35 36 37 | 38 39 40 41 42 | 43 44 45 46 47 | 48 49 50 51 52 | 53 54 55 56 57 | 58 59 60 61 62 | 63 64 65 66 67 | 68 69 70 71 | 72 73 74 75 76 | 77 78 79 80 | 81 |
| 1 | 2 | W | 6 | 7 7 3 3 3 2 7 3 8 7 8 | A | 0 0 0 0 | 0 2 | 5 | 3 4 | 0 | E A | 1 8 1 | 0 0 0 0 0 | 3 0 0 0 0 | 7 0 0 0 | 1 2 0 2 | 4 0 5 1 | 0 0 0 1 | 4 0 0 0 | 0 0 1 2 | 0 2 7 4 | 0 2 6 0 0 0 1 8 6 | ± |

## AUDITAPE RECORD LAYOUT

| FLD 1 (2) | FIELD 2 (6) | FIELD 3 (6) | FIELD 4 (10) | FIELD 5 (6) | FIELD 6 (14) | FIELD 7 (12) | FIELD 8 (12) | FIELD 9 (12) | FIELD 10 (12) | FIELD 11 (12) | FIELD 12 (12) | RESERVED (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 3 4 5 6 7 8 9 10 11 12 13 14 | 15 16 17 18 19 20 21 22 23 24 | 25 26 27 28 29 30 31 32 33 34 | 35 36 37 38 39 40 41 42 43 44 | 45 46 47 48 49 50 51 52 53 54 | 55 56 57 58 59 60 61 62 63 64 | 65 66 67 68 69 70 71 72 73 74 | 75 76 77 78 79 80 81 82 83 84 | 85 86 87 88 89 90 91 92 93 94 | 95 96 97 98 99 100 101 102 103 104 | 105 106 107 108 109 110 111 112 113 114 | 115 116 117 118 119 120 121 122 123 124 |
| A | E A | 1 8 1 | | | 7 7 3 3 3 2 7 3 8 7 8 | | 2 4 6 5 1 | | 1 2 | | | |
| WHSE CODE | UNIT OF ISSUE | JULIAN DATE | NOT-USED | NOT-USED | STOCK NUMBER | NOT-USED | UNIT COST | QUANTITY ON HAND | RESERVED FOR EXTENDED INVENTORY VALUE | NOT - USED | NOT - USED | |

NOTE: THE AUDITAPE EDIT ROUTINE CAUSES SELECTED DATA TO BE READ FROM ANY SPECIFIED POSITION IN THE AGENCY TAPE RECORD (ABOVE) AND WRITTEN IN A SPECIFIED FIELD ON AN OUTPUT TAPE IN THE AUDITAPE RECORD FORMAT (BELOW).

APPENDIX IIIa

# APPENDIX IIIb

Form 309-5.1 (4-68)

## HASKINS & SELLS AUDITAPE SYSTEM

## SPECIFICATION SHEETS FOR EDIT ROUTINE

### IDENTIFICATION DATA

**Routine Code** — E T (01 02)

**Card Sequence Number** — 0 1 (03 04)

**Identification of Application**

Enter any alphabetical or numerical characters desired to identify this application. — I N V E N T Ø R Y (05 06 07 08 09 10 11 12 13 14)

**Block to be Left Blank** — (15)

### COMPUTER SYSTEM CHARACTERISTICS

**Print Capability**

If an on-line printer is available, enter a P; if only a console typewriter is available, enter a T. (If neither is available, this system cannot be used.) — P (16)

**Memory Capacity**

Indicate the internal memory capacity of the computer by using the following code:

| Characters of memory | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Enter in block 17 | | | | |
| For IBM Computers | 4 | 5 | 6 | Not Applicable |
| For Honeywell Computers | 4 | 5 | 6 | 7 |

— 7 (17)

**Type of Input**

Indicate whether the data to be edited is on punched cards or magnetic tape by entering C or T respectively. — T (18)

**Type of Output**

Indicate whether a magnetic tape of records in the Auditape format is to be created as output by entering Y (for yes) or N (for no). — Y (19)

**Block to be Left Blank** — (20)

### FIELD ASSIGNMENTS

Describe briefly the data to be assigned to each of the fields provided in this routine, and furnish the necessary information by entries in the blocks provided. If any entry does not require use of all the blocks provided, enter the required data in the rightmost blocks and enter zeros in all blocks to the left. If any field is not to be used, leave all blocks provided for that field blank.

**Field 1** (2 positions available)
Description of data WAREHOUSE CODE

Low-order (rightmost) position of data in input records — 0 0 1 7 (21 22 23 24)

Number of characters (1 or 2) — 1 (25)

APPENDIX IIIb



Field 2 (6 positions available)
Description of data UNIT OF ISSUE

Low-order position of data in input records 0029 (26 27 28 29)

Number of characters (1 to 6) 2 (30)

Field 3 (6 positions available)
Description of data JULIAN DATE

Low-order position of data in input records 0032 (31 32 33 34)

Number of characters (1 to 6) 3 (35)

Field 4 (10 positions available)

If Fields 4 and 5 are to be linked, enter a 5 in block 36, and leave blocks 37 to 43 blank. (36)

Description of data NOT USED

Low-order position of data in input records (37 38 39 40)

Number of characters (01 to 10) (41 42)

Field 5 (6 positions available)

If Fields 5 and 6 are to be linked, enter a 6 in block 43, and leave blocks 44 to 50 blank. (43)

Description of data NOT USED

Low-order position of data in input records (44 45 46 47)

Number of characters (01 to 06; if linked with Field 4, 01 to 16). (48 49)

Field 6 (14 positions available)

If Fields 6 and 7 are to be linked, enter a 7 in block 50, and leave blocks 51 to 56 blank. (50)

Description of data STOCK NUMBER

Low-order position of data in input records 0016 (51 52 53 54)

Number of characters (01 to 14; if linked with Field 5, 01 to 20) 12 (55 56)

As to Fields 7 through 12, use the following code in the blocks provided for each of these fields to specify whether the field will be used for any quantitative data and to classify the data as to other pertinent characteristics:

| CLASSIFICATION | CODE |
|---|---|
| If the field will not be used for quantitative data, and it will contain: | |
| Any alphabetical characters | A |
| Only numerical characters | N |
| If the field will be used for quantitative data, and negative amounts are indicated by: | |
| The standard method (B bit or 11-zone punch over the low-order digit), or are not included in the data | S |
| An unusual (non-standard) method | U |

If U is entered in any block, additional specifications are required – see sheets for card ET 02 (page 6).

As to Fields 7 through 12, if the field will be used for quantitative data (S or U), also specify the position of the decimal point in the input record by entering the number of digits to the right of the decimal point. If the field will not be used for quantitative data (A or N), leave the block provided blank.

Field 7 (12 positions available)
If Fields 6 and 7 are linked, the combined field cannot be totaled.

Description of data NOT USED

| | | |
|---|---|---|
| Low-order position of data in input records | | 57 58 59 60 |
| Number of characters (01 to 12; if linked with Field 6, 01 to 26) | | 61 62 |
| Classification code (A, N, S, or U) | | 63 |
| Digits to the right of the decimal point (if S or U, 0 to 9) | | 64 |

Field 8 (12 positions available)
Description of data UNIT COST

| | | |
|---|---|---|
| Low-order position of data in input records | 0054 | 65 66 67 68 |
| Number of characters (01 to 12) | 06 | 69 70 |
| Classification code (A, N, S, or U) | S | 71 |
| Digits to the right of the decimal point (if S or U, 0 to 9) | 3 | 72 |

Field 9 (12 positions available)
Description of data QUANTITY ON HAND

| | | |
|---|---|---|
| Low-order position of data in input records | 0066 | 73 74 75 76 |
| Number of characters (01 to 12) | 06 | 77 78 |
| Classification code (A, N, S, or U) | S | 79 |
| Digits to the right of the decimal point (if S or U, 0 to 9) | 0 | 80 |

APPENDIX IIIb



## IDENTIFICATION DATA

Routine Code — E T (01 02)

Card Sequence Number — 0 2 (03 04)

## FIELD ASSIGNMENTS (CONTINUED)

Field 10 (12 positions available)
Description of data NOT USED

Low-order position of data in input records — (05 06 07 08)

Number of characters (01 to 12) — (09 10)

Classification code (A, N, S, or U) — (11)

Digits to the right of the decimal point (if S or U, 0 to 9) — (12)

Field 11 (12 positions available)
Description of data NOT USED

Low-order position of data in input records — (13 14 15 16)

Number of characters (01 to 12) — (17 18)

Classification code (A, N, S, or U) — (19)

Digits to the right of the decimal point (if S or U, 0 to 9) — (20)

Field 12 (12 positions available)
Description of data NOT USED

Low-order position of data in input records — (21 22 23 24)

Number of characters (01 to 12) — (25 26)

Classification code (A, N, S, or U) — (27)

Digits to the right of the decimal point (if S or U, 0 to 9) — (28)

Block to be Left Blank — (29)

## OPTIONAL SUBROUTINES

Indicate whether the Subtotal or Include/Exclude Subroutines are to be used by entering Y (for yes) or N (for no). If Y is entered, additional specifications are required – see sheets for card ET 03 (page 7). — N (30)

## MAGNETIC TAPE CHARACTERISTICS

**If input is cards, leave blocks 31 through 54 blank.**

**Parity and Banner Characteristics**

For Honeywell Series 200 indicate the parity and banner characteristics of the tape record by entering one of the following codes:

| Characteristics | Code |
|---|---|
| Odd parity, bannered records | 1 |
| Odd parity, unbannered records | 2 |
| Even parity, bannered records | 3 |
| Even parity, unbannered records | 4 |

For IBM 1400 Series leave this block blank. [1] (31)

**Number of Reels**

Enter the number of reels of input records to be edited. (01 to 99) [0 1] (32 33)

**Header Labels**

Indicate whether header labels are used on the tape of records to be edited by entering Y or N. [Y] (34)

**Length of Records and Blocks**

If both the individual input records and any groups of such records blocked on the tape for processing are fixed-length, enter an F. If either the individual records or the blocks of records are of variable-length, enter a V. [F] (35)

Enter the number of characters (including record marks, if any) in each individual fixed-length record, or in the longest variable-length record. (0001 to 9999) [0 0 8 1] (36 37 38 39)

Indicate whether the individual records are blocked on the tape or are unblocked by entering a B or U respectively. [B] (40)

**If the records are unblocked, leave blocks 41 through 54 blank.**

If the records are blocked, enter the number of characters (including record marks, if any) in each fixed-length block, or in the longest variable-length block. (0001 to 9999) [0 8 1 0] (41 42 43 44)

Enter the character used to pad fixed-length blocks; if "blanks" are used, leave block 45 blank. [9] (45)





**If the Auditape System is to be used with Honeywell Series 200 equipment, leave blocks 46 through 54 blank.**

**Additional Data for Variable-Length Blocked Records on IBM Computer Systems. (Indicated by V in block 35 and B in block 40)**

Indicate the type of format of the variable-length records to be processed by entering the appropriate letter, A through F. (Refer to the Auditape System Manual for a description of the types.) [ ] (46)

Enter the number of characters at the beginning of each block of records which are not a part of the individual records, such as tape block character counts or identification data. (Enter zeros if there are no such characters.) [ ] (47 48 49)

For record format types B and E, enter the low-order position of the field in the individual record that contains the 3 digits indicating the number of characters in that record. (003 to 999). [ ] (50 51 52)

For record format types D, E, and F, enter the number of the field in the Auditape record which is to contain the identification data from the beginning of each block of records. [ ] (53 54)

## UNUSUAL NEGATIVE INDICATORS

If any of the negative indicators are unusual (classification code U) enter the necessary information below.

**Negative Indicator**

If the negative indicator consists of a zone bit or punch over another character, indicate the zone used by entering in block 55 the related keypunch symbol shown below:

| Zone Bit | Card Punch Zone | Card Punch Digits | Keypunch Symbol |
|---|---|---|---|
| A | 0 | 2, 8 | ‡ |
| B | 11 | | – |
| AB | 12 | | + |

[ ] (55)

If the negative indicator consists of a character in a position by itself, enter in block 56 the character used. [ ] (56)

**Position of Negative Indicator**

For each field in which an unusual negative indicator is used, enter in the blocks provided below its position in the input records. If any entry does not require use of all the blocks provided, enter the required data in the rightmost blocks and enter zeros in all blocks to the left. If any field does not use an unusual negative indicator, leave all blocks provided for that field blank.

| | | | | |
|---|---|---|---|---|
| Field 7 | [ ] | [ ] | [ ] | [ ] (57 58 59 60) |
| Field 8 | [ ] | [ ] | [ ] | [ ] (61 62 63 64) |
| Field 9 | [ ] | [ ] | [ ] | [ ] (65 66 67 68) |
| Field 10 | [ ] | [ ] | [ ] | [ ] (69 70 71 72) |
| Field 11 | [ ] | [ ] | [ ] | [ ] (73 74 75 76) |
| Field 12 | [ ] | [ ] | [ ] | [ ] (77 78 79 80) |

## IDENTIFICATION DATA

Routine Code [E][T] (01 02)

Card Sequence Number [0][3] (03 04)

## SUBTOTAL OR INCLUDE/EXCLUDE SUBROUTINES

**Subroutine Identification**

Indicate which subroutine or combination is desired by entering one of the following codes:

| Subroutine or Combination | Code |
|---|---|
| Subtotal subroutine only – If all of the input records are to be included and subtotals are desired for specified types of records, enter | ST |
| Include subroutine only – If only specified types of input records are to be included and subtotals are not desired, enter | IN |
| Include and subtotal subroutines – If only specified types of input records are to be included and subtotals are desired, enter | IS |
| Exclude subroutine only – If specified types of input records are to be excluded, enter | EX |

Subroutine or Combination [ ][ ] (05 06)

**Types of Records**

Describe the data that will identify in general the specific code identifications of records to be subtotaled, included, or excluded, and indicate the location of such codes in the input records. Specifications for Card ET 04 are required to identify in detail the specific code identifications to be so treated.

Description of data NOT USED

Low-order position of data in input records [ ][ ][ ][ ] (07 08 09 10)

Number of characters (01 to 74) [ ][ ] (11 12)

Indicate the number of specific codes to be subtotaled, included, or excluded (01 to maximum computed by the following formula, but not in excess of 99). [ ][ ] (13 14)

# APPENDIX IIIb



**Formula for maximum number of specific codes when the Auditape System is to be used on an IBM computer system.**

$$M = \frac{(C-R)}{(I+S)} - 1$$

Where:

M = Maximum number of codes (round computation downward only) _____

C = Capacity available for subroutines: _____

| Capacity of computer | 8K | 12K | 16K |
|---|---|---|---|
| Capacity available – if entry in page 1 – ET 01, block 19 is: | | | |
| Y | 2,702 | 5,412 | 8,122 |
| N | 3,863 | 7,863 | 11,863 |

R = Reserved Area _____

If an output tape is to be created (page 1 – ET 01, block 19), enter on this line whichever of the following is applicable

For card input 0

For tape input the larger of:

Individual record size (page 5 – ET 02, blocks 36–39) _____

Block size (page 5 – ET 02 blocks 41 – 44) _____

If an output tape is not to be created, enter on this line whichever of the following is applicable: _____

For card or tape input enter the largest of:

Minimum requirement 1290

Individual record size (page 5 – ET 02, blocks 36–39) _____

Block size (page 5 – ET 02, blocks 41–44) _____

I = Number of identification characters (from page 7 – ET 03, blocks 11–12) _____

S = Additional requirements if Subtotal subroutine is used <u>and</u> classification code for Field 8 is (from page 3 – ET 01, block 71): _____

| | |
|---|---|
| A, N, or blank | 21 |
| S or U | 35 |

**Formula for maximum number of specific codes when the Auditape System is to be used on a Honeywell computer system.**

$$M = \frac{(C - R)}{(I + S)} - 1$$

Where:

M = Maximum number of codes (round computation downward only) _____

C = Capacity available for subroutines: _____

| Capacity of computer | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Capacity available – if entry in page 1 – ET01, block 19 is: | | | | |
| Y | 955 | 5,050 | 7,080 | 8,590 |
| N | 1,475 | 5,570 | 9,660 | 13,750 |

R = Reserved Area _____

Enter in the space below for the size computer on which the application is being processed, the larger of individual record size (page 5-ET02, blocks 36-39) or block size (page 5-ET02, blocks 41-44)

| Capacity of Computer | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Buffer Limit | 300 | 2,447 | 3,100 | 4,096 |
| Record Length | _____ | _____ | _____ | _____ |

If record length entry above is greater than the corresponding limit, enter the record length as tape area requirement; if not, enter twice the record length.

Tape area requirement _____

Minimum requirement:

If an output tape is to be created (page 1-ET01, block 19) 450

If an output tape is not to be created 970

Enter for Reserved Area the larger of tape area requirement or the applicable minimum requirement.

I = Number of identification characters (from page 7-ET03, blocks 11-12) _____

S = Additional requirements if Subtotal subroutine is used and classification code for Field 8 is (from page 3-ET01, block 71): _____

| | |
|---|---|
| A, N, or blank | 21 |
| S or U | 35 |

# APPENDIX IIIb



## SPECIFIC CODE IDENTIFICATIONS

Subdivide the 74 blocks provided for specific codes in each of the card images below into fields equal in size to the field in the input record upon which the Subtotal or Include/Exclude Subroutines are to operate. In each field so created, enter the specific codes for which subtotals are desired, or which are to be included or excluded. Do not leave any blocks blank between fields within the same card. Any unused blocks at the end of the card images should be left blank. Use as many cards as are necessary to enter all of the specified codes.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | T | 0 | 4 | 0 | 1 | | | | | | | | | | | | | | |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | | | | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | | | | | | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | | | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | T | 0 | 4 | 0 | 2 | | | | | | | | | | | | | | |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | | | | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | | | | | | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | | | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | T | 0 | 4 | 0 | 3 | | | | | | | | | | | | | | |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | | | | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | | | | | | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | | | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | T | 0 | 4 | 0 | 4 | | | | | | | | | | | | | | |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | | | | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | | | | | | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | | | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | T | 0 | 4 | 0 | 5 | | | | | | | | | | | | | | |
| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | | | | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | | | | | | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | | | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |

tory by multiplying unit cost by the quantity on hand for 13,737 stock items.

--Computing an optimum sample size, selecting the appropriate items, and printing the 251 items on a workpaper with descriptive headings over each column of data.

A complete printout resulting from computer processing is included in appendix IIIh.



# APPENDIX IIIc

Form 309-5.4 (4-68)

**HASKINS & SELLS AUDITAPE SYSTEM**

**SPECIFICATION SHEETS FOR MATHEMATICAL ROUTINE**

## IDENTIFICATION DATA

**Routine Code** — M A (01 02)

**Card Sequence Number** — 0 1 (03 04)

**Identification of Application**

Enter the same identification that was used in the routine that produced the tape used as input to this routine — I N V E N T ϕ R Y (05 06 07 08 09 10 11 12 13 14)

**Block to be Left Blank** — (15)

## COMPUTER SYSTEM CHARACTERISTICS

**Print Capability**

If an on-line printer is available, enter a P; if only a console typewriter is available, enter a T. (If neither is available, this system cannot be used.) — P (16)

**Memory Capacity**

Indicate the internal memory capacity of the computer by using the following code:

| Characters of memory | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Enter in block 17 | | | | |
| For IBM Computers | 4 | 5 | 6 | Not Applicable |
| For Honeywell Computers | 4 | 5 | 6 | 7 |

7 (17)

**Hardware Multiply/Divide Feature**

Indicate whether this special feature is available as a part of the computer, by entering Y (for yes) or N (for no). — Y (18)

**Blocks to be Left Blank** — (19 20)

## INPUT CHARACTERISTICS

**Reels of Input**

Enter the number of reels of input data for this routine. — 0 1 (21 22)

**Blocks to be Left Blank** — (23 24)

## PROCESSING SPECIFICATIONS

**Mathematical Operation**

Indicate the mathematical operation to be performed by entering one of the following codes:

| Operation | Code |
|---|---|
| Addition (X + Y) | A |
| Subtraction (X – Y) | S |
| Multiplication (X · Y) | M |
| Division (X ÷ Y) | D |

M (25)

# APPENDIX IIIc



**Quantity Field Numbers**

Enter the numbers of the fields in the Auditape record which contain the quantities.
If a constant is to be specified for either quantity, enter CC.

Quantity X (07 to 12, or CC) — 0 8 (26 27)

Quantity Y (07 to 12, or CC) — 0 9 (28 29)

**Result Field Number**

Enter the number of the field in the Auditape record to which the result is to be assigned. (07 to 12) — 1 0 (30 31)

Enter the number of digits desired to the right of the decimal point. The result will be rounded accordingly. (0 to 9) — 2 (32)

**Blocks to be Left Blank** — (33 34)

**Constant Quantity**

If a constant quantity has been specified for X or Y above, enter the number to be used (including leading zeros); otherwise, leave blocks 35 through 47 blank. If the quantity is negative, place a minus sign (11-zone punch) over the digit in block 46.

| 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

Enter the number of digits to the right of the decimal point in the above constant. (0 to 9) — (47)

# APPENDIX IIId

Form 309-5.5 (4-68)

**HASKINS & SELLS AUDITAPE SYSTEM**

**SPECIFICATION SHEETS FOR AUDIT SAMPLE DESIGN AND SELECTION ROUTINE**

## IDENTIFICATION DATA

**Routine Code** — A S (01 02)

**Card Sequence Number** — 0 1 (03 04)

**Identification of Application**

Enter the same identification that was used in the routine that produced the tape used as input to this routine. — I N V E N T Ø R Y (05 06 07 08 09 10 11 12 13 14)

**Block to be Left Blank** — (15)

## COMPUTER SYSTEM CHARACTERISTICS

**Print Capability**

If an on-line printer is available, enter a P; if only a console typewriter is available, enter a T. (If neither is available, this system cannot be used.) — P (16)

**Memory Capacity**

Indicate the internal memory capacity of the computer by using the following code:

| Characters of memory | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Enter in block 17 | | | | |
| For IBM Computers | 4 | 5 | 6 | Not Applicable |
| For Honeywell Computers | 4 | 5 | 6 | 7 |

7 (17)

**Hardware Multiply/Divide Feature**

Indicate whether this special feature is available as a part of the computer, by entering Y (for yes) or N (for no). — Y (18)

**Blocks to be Left Blank** — (19 20)

## INPUT CHARACTERISTICS

**Reels of Input**

Enter the number of reels of input data for this routine. — 0 1 (21 22)

**Blocks to be Left Blank** — (23 24)

## SAMPLE DESIGN DATA

**Type of Sample**

Indicate whether the sample objective is monetary or numerical precision by entering M or N respectively. — M (25)

**Precision Limit (MP or NP)**

Enter the precision limit to be used – expressed in whole dollars for monetary precision (MP) or in number of items for numerical precision (NP). (Enter leading zeros as necessary to fill all blocks.) — 0 0 0 8 0 0 0 0 (26 27 28 29 30 31 32 33)





89

# APPENDIX IIId



**Reliability Factor (R)**

Enter the reliability factor to be used. (The entry should include one integer and one decimal.)

| 3 | 0 |
|---|---|
| 34 | 35 |

**Random Number**

Enter an eight-digit random number

| 8 | 8 | 2 | 8 | 2 | 7 | 1 | 7 |
|---|---|---|---|---|---|---|---|
| 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 |

If the sample objective is numerical precision, leave all remaining blocks blank.

**Field to be Sampled**

Enter the number of the input-tape field that contains the monetary amounts to be sampled. (07 to 12)

| 1 | 0 |
|---|---|
| 44 | 45 |

**Subsample Option**

Indicate whether the subsample option is to be used by entering Y or N.

| N |
|---|
| 46 |

**Primary Cut-Off**

If the subsample option is to be used, leave all remaining blocks blank. If not, enter the primary cut-off to be used. (This entry should not exceed MP/R, and should be expressed in whole dollars with leading zeros as necessary to fill all blocks.)

| 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |

Form 309-5.2 (4-68)

## HASKINS & SELLS AUDITAPE SYSTEM

## SPECIFICATION SHEETS FOR PRINT/PUNCH ROUTINE

### IDENTIFICATION DATA

**Routine Code** — P T (01 02)

**Card Sequence Number** — 0 1 (03 04)

**Identification of Application**

Enter the same identification that was used in the routine that produced the tape (if any) used as input to this routine. — I N V E N T Φ R Y (05 06 07 08 09 10 11 12 13 14)

**Block to be Left Blank** — (15)

### COMPUTER SYSTEM CHARACTERISTICS

**Print Capability**

If an on-line printer is available, enter a P; if only a console typewriter is available, enter a T. (If neither is available, this system cannot be used.) — P (16)

**Memory Capacity**

Indicate the internal memory capacity of the computer by using the following code:

| Characters of memory | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Enter in block 17 | | | | |
| For IBM Computers | 4 | 5 | 6 | Not Applicable |
| For Honeywell Computers | 4 | 5 | 6 | 7 |

7 (17)

**Blocks to be Left Blank** — (18 19)

### ASSUMED SPECIFICATIONS

This routine has been designed to assume the following specifications:

One reel of tape input
Printed output only
Printer with 132 positions
All fields in the input tape to be printed in field-number order, without optional column headings.

Entries are required in the blocks below only if alternative specifications are to be made.

### ALTERNATIVE SPECIFICATIONS

**Type of Input**

If the input data is punched cards, enter a C. (If a C is entered, blocks 57 to 64 must be completed.) — (20)

**Reels of Input**

If there are two or more reels, enter the total number of reels of input. — (21 22)

**Blocks to be Left Blank** — (23 24)

**Printed Output**

If printed output is not desired, enter an N. — (25)

# APPENDIX IIIe



**Printed Positions Available**

If only 100 positions are available, enter 100.

| | | |
|---|---|---|
| | | |
| 26 | 27 | 28 |

**Order of Printing**

If some fields are not to be printed, the order of printing is to be changed, or any fields are to be printed more than once, indicate the order of printing as follows:

For unlinked fields specify the field number. (01 to 12)

For linked fields specify:
45 – if Fields 4 and 5 are linked
56 – if Fields 5 and 6 are linked
67 – if Fields 6 and 7 are linked

| Print Columns | | |
|---|---|---|
| First | 0 | 1 |
| | 29 | 30 |
| Second | 0 | 6 |
| | 31 | 32 |
| Third | 0 | 2 |
| | 33 | 34 |
| Fourth | 0 | 8 |
| | 35 | 36 |
| Fifth | 0 | 9 |
| | 37 | 38 |
| Sixth | 1 | 0 |
| | 39 | 40 |
| Seventh | | |
| | 41 | 42 |
| Eighth | | |
| | 43 | 44 |
| Ninth | | |
| | 45 | 46 |
| Tenth | | |
| | 47 | 48 |
| Eleventh | | |
| | 49 | 50 |
| Twelfth | | |
| | 51 | 52 |

**Optional Headings**

If optional column headings are desired, enter a Y and complete the specifications for optional column headings. [Y] 53

**Punched Card Output**

If punch card output is desired, enter a Y. (Only a sequence number, and Fields 2 through 9 will be punched.) [ ] 54

**Blocks to be Left Blank** 55 56

**Card Input Field Usage**

If the input data is cards (block 20), indicate the applicable classification code and number of positions to the right of the decimal for each field as follows (for linked fields, enter an L for the first such field and the required data for the second):

Code A or N – Enter the applicable code.

Code S or U – Enter the number of digits to the right of the decimal point. (0 to 9)

| | |
|---|---|
| Field 2 | 57 |
| Field 3 | 58 |
| Field 4 | 59 |
| Field 5 | 60 |
| Field 6 | 61 |
| Field 7 | 62 |
| Field 8 | 63 |
| Field 9 | 64 |

If the input data is cards, a punched card with the characters LAST CARD in columns 1 to 9 must follow the last input card.

---

## OPTIONAL COLUMN HEADINGS

Enter in the blocks below the characters desired for column headings for the fields to be printed. The shaded block shown for each field separates the characters that will be printed on the first and second line of each column heading. Four optional-column-heading cards with routine code and card sequence number are required even though headings may not be specified for all fields.

Routine Code and Card Sequence Number

| P | T | 0 | 2 | 0 | 1 |
|---|---|---|---|---|---|
| 01 | 02 | 03 | 04 | 05 | 06 |

| Field Numbers | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | W | H | S | E | ■ | | C | Ø | D | E | | | | | | | | | | | |
| | | | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | | | | | | | | |
| 2 | | | U | N | I | T | ■ | | I | S | S | U | E | | | | | | | | | | |
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | | | | | | | | | |
| 3 | | | | | | | ■ | | | | | | | | | | | | | | | | |
| | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | | | | | | | | | | |
| 4 or 4 and 5 If linked | | | | | | | | | | | ■ | | | | | | | | | | | | |
| | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | | |
| 5 | | | | | | | | | | | ■ | | | | | | | | | | | | |
| | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | | | | | | | | | | |

# APPENDIX IIIe



Routine Code and Card Sequence Number: P T 0 2 0 2 (01–06)

| Field Numbers | 07–27 | 28–47 | 49–66 |
|---|---|---|---|
| 6 or 5 and 6 if linked | STØCK NUMBER | | |
| 7 or 6 and 7 if linked | | | |
| 8 | | | UNIT C |

Routine Code and Card Sequence Number: P T 0 2 0 3 (01–06)

| Field Numbers | 07–27 | 28–48 | 49–69 |
|---|---|---|---|
| 9 | QUANTITY ØN HAND | | |
| 10 | | EXTENDED VALUE | |
| 11 | | | |

Routine Code and Card Sequence Number: P T 0 2 0 4 (01–06)

| Field Numbers | 07–27 |
|---|---|
| 12 | |

APPENDIX IIIf

Form 309-6.2 (4-68)

HASKINS & SELLS AUDITAPE SYSTEM

INSTRUCTION SHEET FOR COMPUTER OPERATOR
FOR HONEYWELL SERIES 200, ½ INCH TAPE SYSTEMS

Company, Division, etc. U.S. GENERAL ACCOUNTING OFFICE

Application Identification INVENTORY

Date or Period 1970

1. The materials necessary to process this application consist of:
   a. A Haskins & Sells Auditape.
   b. Specification cards keypunched from specification sheets.
   c. Input data identified as follows:

   ONE REEL OF MAGNETIC TAPE - INVENTORY DATA.

2. The Auditape System routines are to be processed in the following sequence, with the designated input.

| | Routine | Description of Input Data | Description of Output Data |
|---|---|---|---|
| a. | EDIT | INVENTORY TAPE | EDITED INVENTORY |
| b. | MATHEMATICAL | EDITED INVENTORY | EXTENDED INVENTORY |
| c. | AUDIT SAMPLE | EXTENDED INVENTORY | INVENTORY SAMPLE |
| d. | PRINT PUNCH | INVENTORY SAMPLE | PRINTOUT |
| e. | | | |

3. Press the STOP and INITIALIZE buttons on the console control panel.

4. Mount the Auditape on a tape unit to be assigned the number 0. The track and density characteristics of the Auditape are indicated on its label. The file-protect ring must be in place in the Auditape reel, and the tape protect-permit dial of this unit set to PERMIT.

5. Mount the tape of input data on a tape unit to be assigned the number 2 and set the tape protect-permit dial for this unit to PROTECT. If the input data is in punched cards, place the data cards in the card reader as indicated in 6b below.

6. Place the specification cards in the card reader as follows and ready the card reader:

   a. If input data is on magnetic tape, place specification cards for all routines in the card reader in the sequence in which the routines are to be processed.

   b. If input data is in punched cards, proceed as follows:
      (1) Place specification cards for the routine to be processed next in the card reader.
      (2) Follow these specification cards with the data cards.
      (3) Place a card with the characters LAST CARD punched in columns 1 through 9 behind the last data card.
      (4) Place the remaining specifications cards behind this LAST CARD.

   c. Place three blank (unpunched) cards following the last specification card.

7. Mount a scratch tape on a tape unit to be assigned the number 3 if tape output is to be obtained and set the tape protect-permit dial of this unit to PERMIT.

8. Place 14-7/8" wide continuous forms in the printer with a matching carriage tape containing a 1-punch at head-of-form. If only a console typewriter is available, place standard forms in it. Load the punch hopper if card output is specified.

9. Turn all Sense Switches off.

10. To load the Auditape System:

    a. For computers with full console panels, enter 40 into the CONTENTS buttons, zeros into the ADDRESS buttons, press BOOTSTRAP and RUN.

    b. For computers with console typewriters, press CAR RET (carriage return) and B 40 000000 and RUN.

11. Take further instructions from the messages printed by the Auditape System. Five programmed halts that do not produce a printed message may be identified by the contents of the A-and B-Address Register. If such a halt occurs, refer to the Auditape System Manual for instructions.

# APPENDIX IIIg

Form 309 – 5.6 (4-68)

**HASKINS & SELLS AUDITAPE SYSTEM**

**SPECIFICATION SHEETS FOR AUDIT SAMPLE EVALUATION ROUTINE**

**IDENTIFICATION DATA**

**Routine Code** — A E (01 02)

**Card Sequence Number** — 0 1 (03 04)

**Identification of Application**

Enter any alphabetical or numerical characters desired to identify this application. — I N V E N T Ø R Y (05 06 07 08 09 10 11 12 13 14)

**Block to be Left Blank** — (15)

**COMPUTER SYSTEM CHARACTERISTICS**

**Print Capability**

If an on-line printer is available, enter a P; if only a console typewriter is available, enter a T. (If neither is available, this system cannot be used.) — P (16)

**Memory Capacity**

Indicate the internal memory capacity of the computer by using the following code:

| Characters of memory | 8K | 12K | 16K | 20K |
|---|---|---|---|---|
| Enter in block 17 | | | | |
| For IBM Computers | 4 | 5 | 6 | Not Applicable |
| For Honeywell Computers | 4 | 5 | 6 | 7 |

— 7 (17)

**Hardware Multiple/Divide Feature**

Indicate whether this special feature is available as part of the computer, by entering Y (for yes) or N (for no). — Y (18)

**Blocks to be Left Blank** — (19 20)

**SAMPLE DESIGN DATA**

**Type of Sample**

Indicate whether the sample was designed for monetary or numerical precision by entering M or N respectively. (The entry must be the same as was made in the specification card for the Audit Sample Design and Selection Routine.) — M (21)

**Block to be Left Blank** — (22)

**Precision Limit (MP or NP)**

Enter the precision limit used in the specification card for the Audit Sample Design and Selection Routine. — 0 0 0 8 0 0 0 0 (23 24 25 26 27 28 29 30)

**Block to be Left Blank** — (31)

**Reliability Factor (R)**

Enter the reliability factor used in the specification card for the Audit Sample Design and Selection Routine.

| 30 |
|---|
| 32 33 |

**Block to be Left Blank**

| |
|---|
| 34 |

**If the sample objective was numerical precision, leave blocks 35 through 45 blank.**

**Subsample Option**

Indicate whether the subsample option was used in the Audit Sample Design and Selection Routine by entering Y or N.

| N |
|---|
| 35 |

**Block to be Left Blank**

| |
|---|
| 36 |

**Primary Cut-Off**

If the subsample option was used, leave blocks 37 through 45 blank. If not, enter the primary cut-off used in the Audit Sample Design and Selection Routine.

| 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |

**Block to be Left Blank**

| |
|---|
| 45 |

## SAMPLE EVALUATION DATA

**Adjusted Reliability Factor (R')**

Enter the reliability factor to be used for evaluating the sample. (The entry should include one integer and one decimal and must be from the Table in Section 5.6 of the Hoskins & Sells Auditape System Manual.)

| 3 | 0 |
|---|---|
| 46 | 47 |

**Block to be Left Blank**

| |
|---|
| 48 |

**Number of Errors (or Other Features of Interest)**

Enter the total number of errors (or other features to be evaluated). For monetary precision, the total should include no more than 50 errors in the top stratum, nor more than 100 errors of overstatement and 100 errors of understatement in the bottom and middle stratums combined. (Enter leading zeros as necessary to fill all blocks.)

| 0 | 0 | 9 |
|---|---|---|
| 49 | 50 | 51 |

**Block to be Left Blank**

| |
|---|
| 52 |

**Recorded Adjustments**

Enter the adjustments made – expressed in whole dollars for monetary precision or in number of items for numerical precision. (Enter leading zeros as necessary to fill all blocks. If the net adjustment is negative, place a minus sign – 11-zone punch – over the digit in block 60. If no adjustments were made, enter all zeros.)

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |

# APPENDIX IIIg



## INDIVIDUAL SAMPLE ITEMS FOR MONETARY EVALUATION

If the type of sample is numerical, cards for individual sample items should not be used.

Use one of the lines below for each sample item requiring monetary evaluation. Use as many cards as are necessary to enter all of the items to be evaluated. (See AE01, Blocks 49 – 51).

Sample Items (AE02, Blocks 09 – 20) – Enter the amount of the sample item, or subitem if applicable, in which the error was discovered. Express this amount in dollars and cents and if the entry does not require use of all the blocks provided, enter the amount in the rightmost blocks and enter zeros in all blocks to the left. If the item is negative, place a minus sign (11 – zone punch) over the digit in block 20.

Amount of Error (AE02, Blocks 22 – 23) – Enter the amount of the error (or other feature to be evaluated) in the sample item or subitem. Express this amount in dollars and cents, and if the entry does not require use of all the blocks provided, enter the amount in the rightmost blocks and enter zeros in all blocks to the left. If the effect of the error is an understatement of the population, place a minus sign (11 – zone punch) over the digit in block 33.

Error Reference (AE02, Blocks 35 – 37) – Enter any characters desired to identify the individual errors. For example, the sequence number from the printout of the sample items may be used to facilitate cross-referencing.

Last Card – A card with the characters LAST CARD in columns 1 to 9 must follow the card for the last sample item to be evaluated.

| Card Code (01 02 03 04) | Sample Item (09 10 11 12 13 14 15 16 17 18 19 20) | Amount of Error, etc. (22 23 24 25 26 27 28 29 30 31 32 33) | Error Reference (35 36 37) |
|---|---|---|---|
| AE02 | 000000060500 | 000000001000 | 001 |
| AE02 | 000000647820 | 000000020000 | 002 |
| AE02 | 000000086000 | 000000005000 | 003 |
| AE02 | 000000004400 | 000000001000 | 004 |
| AE02 | 000000671400 | 000000025000 | 005 |
| AE02 | 000000021700 | 000000005000 | 006 |
| AE02 | 000001153200 | 000000010000 | 007 |
| AE02 | 000016847400 | 000000050000 | 008 |
| AE02 | 000003414200 | 000000040000 | 009 |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |
| AE02 | | | |

# APPENDIX IIIh

COMPUTER PRINTOUT

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        THIS IS THE EDIT ROUTINE.
        TAPE INPUT SHOULD BE ON UNIT 2. OUTPUT WILL BE ON UNIT 3.

        PRESS RUN TO BEGIN PROCESSING.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM   COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        EDIT SPECIFICATION CARD IMAGES FOR CHECKING ANY INVALID ENTRIES OR OTHER ERRORS

            ........10........20........30........40........50........60........70........80
            ET01INVENTORY  P7TY 001710029200323                001612        0054065300660650

            ET02                          N101YF0081B08109

        NO ERRORS HAVE BEEN DETECTED IN THE SPECIFICATION CARDS LISTED ABOVE. PROCESSING
            IS CONTINUING.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        TAPE HEADER LABEL

        1HDR            X001 312201C104     X

        PRESS RUN TO CONTINUE.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        EDIT ROUTINE TOTALS

            RECORD COUNT
               INPUT              13,737

               OUTPUT             13,737

            FIELD  8                                   93,444,968

            FIELD  9  POSITIVE AMOUNTS                 7,840,822.

                      NEGATIVE AMOUNTS                     1,189. CR

                      NET                              7,839,633.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        THIS IS THE MATHEMATICAL ROUTINE.
        TAPE INPUT SHOULD BE ON UNIT 2. OUTPUT WILL BE ON UNIT 3.

        PRESS RUN TO BEGIN PROCESSING.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        MATHEMATICAL ROUTINE SPECIFICATION CARD DATA
            REELS OF INPUT                                          01
            MATHEMATICAL OPERATION                     MULTIPLICATION
            QUANTITY  X                                       FIELD 08
            QUANTITY  Y                                       FIELD 09
            RESULT                                            FIELD 10
            DIGITS TO THE RIGHT OF THE DECIMAL                       2
            HARDWARE MULTIPLY/DIVIDE AVAILABLE                     YES


NO ERRORS HAVE BEEN DETECTED IN THE MATHEMATICAL ROUTINE SPECIFICATION CARD.  PROCESSING
    IS CONTINUING.
```

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

MATHEMATICAL ROUTINE TOTALS

| | | BEFORE MATHEMATICAL OPERATION | AFTER MATHEMATICAL OPERATION |
|---|---|---|---|
| RECORD COUNT | | 13,737 | 13,737 |
| FIELD 8 | | 93,444,968 | 93,444,968 |
| FIELD 9 | POSITIVE AMOUNTS | 7,840,822. | 7,840,822. |
| | NEGATIVE AMOUNTS | 1,189. CR | 1,189. CR |
| | NET AMOUNT | 7,839,633. | 7,839,633. |
| FIELD 10 | | | 7,866,381.79 |

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

          THIS IS THE AUDIT SAMPLE DESIGN AND SELECTION ROUTINE.
          TAPE INPUT SHOULD BE ON UNIT 2. OUTPUT WILL BE ON UNIT 3.

          PRESS RUN TO BEGIN PROCESSING.
```

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        AUDIT SAMPLE DESIGN AND SELECTION SPECIFICATION CARD DATA
            REELS OF INPUT                                  01
            SAMPLE DESIGN
                TYPE OF SAMPLE                          MONETARY
                FIELD TO BE SAMPLED                         10
                MONETARY PRECISION LIMIT                80.000
                RELIABILITY FACTOR                         3.0
                RANDOM NUMBER                           88282717
                SUBSAMPLE OPTION                           NO
                PRIMARY CUT-OFF                         3.000
            HARDWARE MULTIPLY/DIVIDE AVAILABLE          YES


NO ERRORS HAVE BEEN DETECTED IN THE AUDIT SAMPLE SPECIFICATION CARD.  PROCESSING
    IS CONTINUING.
```

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

AUDIT SAMPLE DESIGN AND SELECTION ROUTINE - MONETARY SAMPLE

POPULATION DATA

| | BOTTOM STRATUM | MIDDLE STRATUM | TOP STRATUM | TOTAL |
|---|---|---|---|---|
| REC. COUNT | 13,271 | 457 | 9 | 13,737 |
| FIELD 8 | 88,642,596 | 4,618,533 | 183,839 | 93,444,968 |
| FIELD 9 | 5,521,085. | 2,184,655. | 133,893. | 7,839,633. |
| FIELD 10 POS. | 3,705,694.65 | 3,385,811.65 | 783,365.70 | 7,874,872.00 |
| NEG. | 700.21 CR | 7,790.00 CR | 0.00 | 8,490.21 CR |
| NET | 3,704,994.44 | 3,378,021.65 | 783,365.70 | 7,866,381.79 |

SAMPLE DATA

| | BOTTOM STRATUM | MIDDLE STRATUM | TOP STRATUM | TOTAL |
|---|---|---|---|---|
| REC. COUNT | 139 | 103 | 9 | 251 |
| FIELD 8 | 821,450 | 1,301,745 | 183,839 | 2,307,034 |
| FIELD 9 | 196,026. | 612,040. | 133,893. | 941,959. |
| FIELD 10 POS. | 161,839.25 | 1,147,864.23 | 783,365.70 | 2,093,069.18 |
| NEG. | 0.00 | 0.00 | 0.00 | 0.00 |
| NET | 161,839.25 | 1,147,864.23 | 783,365.70 | 2,093,069.18 |


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# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        THIS IS THE PRINT/PUNCH ROUTINE.
        TAPE INPUT SHOULD BE ON UNIT 2.

        PRESS RUN TO BEGIN PROCESSING.
```



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# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        PRINT/PUNCH SPECIFICATION CARD DATA

            TYPE OF INPUT                                   TAPE

            REELS OF INPUT                                   01

            INPUT RECORD FIELD USAGE

                FIELD  1                                      A      ALPHABETICAL
                FIELD  2                                      A      ALPHABETICAL
                FIELD  3                                      A      ALPHABETICAL
                FIELD  4                                  BLANK      FIELD NOT USED
                FIELD  5                                  BLANK      FIELD NOT USED
                FIELD  6                                      A      ALPHABETICAL
                FIELD  7                                  BLANK      FIELD NOT USED
                FIELD  8                                      3      THREE DECIMAL PLACES
                FIELD  9                                      0      NO DECIMAL PLACES
                FIELD 10                                      2      TWO DECIMAL PLACES
                FIELD 11                                  BLANK      FIELD NOT USED
                FIELD 12                                  BLANK      FIELD NOT USED

            PRINTED OUTPUT ELECTED                          YES

            ORDER OF PRINTING

                COLUMN  1                                 FIELD  1
                        2                                 FIELD  6
                        3                                 FIELD  2
                        4                                 FIELD  8
                        5                                 FIELD  9
                        6                                 FIELD 10

            PRINT POSITIONS AVAILABLE                       132

            OPTIONAL HEADINGS ELECTED                       YES

            PUNCHED OUTPUT ELECTED                           NO


NO ERRORS HAVE BEEN DETECTED IN THE PRINT/PUNCH SPECIFICATION CARD.  PROCESSING IS
    CONTINUING.
```

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

| LINE NO. | SEQ. NO. | RANDOM ITEM | WHSE CODE | STOCK NUMBER | UNIT ISSUE | UNIT COST | QUANTITY ON HAND | EXTENDED VALUE |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 322 | B | 25402043284 | PR | 5.108 | 82. | 418.86 |
| 2 | 2 | 351 | B | 34392243576 | BR | 1.461 | 253. | 369.63 |
| 3 | 3 | 299 | A | 34552324094 | EA | 2.143 | 618. | 1,324.37 |
| 4 | 4 | 413 | B | 37501717182 | EA | 1.690 | 1,215. | 2,053.35 |
| 5 | 5 | | C | 37505278049 | EA | 44.445 | 236. | 10,489.02 |
| 6 | 6 | | C | 37509650057 | EA | 296.655 | 61. | 18,095.96 |
| 7 | 7 | 1,683 | C | 39206409189 | EA | 21.526 | 127. | 2,733.80 |
| 8 | 8 | 1,617 | A | 40200687907 | CL | 32.378 | 90. | 2,914.02 |
| 9 | 9 | | B | 40202898616 | CL | 29.440 | 239. | 7,036.16 |
| 10 | 10 | 61 | A | 40202915908 | BA | 3.367 | 32. | 107.74 |
| 11 | 11 | 1,589 | A | 40207102074 | CL | 8.178 | 361. | 2,952.26 |
| 12 | 12 | | C | 41102032706 | EA | 115.375 | 184. | 21,229.00 |
| 13 | 13 | | C | 41102558760 | EA | 99.512 | 651. | 64,782.31 |
| 14 | 14 | | C | 41402033782 | EA | 42.690 | 558. | 23,821.02 |
| 15 | 15 | | C | 41402569913 | EA | 22.501 | 3,280. | 73,803.28 |
| 16 | 16 | | C | 41408335068 | EA | 44.894 | 476. | 21,369.54 |
| 17 | 17 | | C | 41408519319 | EA | 24.359 | 3,062. | 74,587.26 |
| 18 | 18 | | B | 42105951779 | EA | 22.150 | 203. | 4,496.45 |
| 19 | 19 | 106 | A | 42105953322 | EA | 26.000 | 30. | 780.00 |
| 20 | 20 | 1,037 | B | 42108925494 | LG | 23.130 | 60. | 1,387.80 |
| 21 | 21 | 993 | B | 43202032793 | EA | 2.342 | 425. | 995.35 |
| 22 | 22 | 21 | B | 45102424359 | EA | 0.076 | 2,804. | 213.10 |
| 23 | 23 | 28 | B | 45108925850 | EA | 13.296 | 26. | 345.70 |
| 24 | 24 | | A | 45205558696 | EA | 8.500 | 393. | 3,340.50 |
| 25 | 25 | 959 | A | 47100616956 | LG | 7.958 | 185. | 1,472.23 |

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

| LINE NO. | SEQ. NO. | RANDOM ITEM | WHSE CODE | STOCK NUMBER | UNIT ISSUE | UNIT COST | QUANTITY ON HAND | EXTENDED VALUE |
|---|---|---|---|---|---|---|---|---|
| 226 | 226 | | A | 81356633738 | RL | 1.724 | 8,379. | 14,445.40 |
| 227 | 227 | 498 | A | 81356849781 | PG | 3.770 | 257. | 968.89 |
| 228 | 228 | | A | 8135'534545 | RL | 30.863 | 103. | 3,178.89 |
| 229 | 229 | | B | 83051711618 | BC | 51.449 | 99. | 5,093.45 |
| 230 | 230 | 299 | B | 83052053069 | BO | 13.595 | 25. | 339.88 |
| 231 | 231 | 1,551 | A | 83052222417 | BO | 30.500 | 56. | 1,708.00 |
| 232 | 232 | 264 | B | 83456826860 | EA | 31.750 | 15. | 476.25 |
| 233 | 233 | 16 | B | 84152687859 | PR | 2.928 | 287. | 840.34 |
| 234 | 234 | | A | 84156344657 | PR | 1.200 | 10,709. | 12,850.80 |
| 235 | 235 | 223 | A | 84156345027 | PR | 0.439 | 956. | 419.68 |
| 236 | 236 | | A | 85202053088 | CS | 8.726 | 940. | 8,202.44 |
| 237 | 237 | 1,653 | A | 85202700065 | BX | 0.678 | 3,506. | 2,377.07 |
| 238 | 238 | | B | 85209652107 | BG | 0.535 | 11,767. | 6,295.35 |
| 239 | 239 | 240 | A | 85402767570 | CT | 10.403 | 60. | 624.18 |
| 240 | 240 | | C | 85402857001 | CT | 9.666 | 4,146. | 40,075.24 |
| 241 | 241 | | C | 85402910392 | CT | 4.049 | 1,856. | 7,514.94 |
| 242 | 242 | | C | 85406873982 | CT | 4.777 | 1,836. | 8,770.57 |
| 243 | 243 | | B | 91502319071 | CN | 2.010 | 1,985. | 3,989.85 |
| 244 | 244 | | A | 93102021302 | RM | 2.794 | 3,262. | 9,114.03 |
| 245 | 245 | 602 | B | 93102230375 | PG | 3.559 | 251. | 893.31 |
| 246 | 246 | | B | 93102347091 | RM | 3.451 | 17,505. | 60,409.76 |
| 247 | 247 | 7 | A | 93102825484 | FD | 0.100 | 215. | 21.50 |
| 248 | 248 | | A | 93105303927 | RM | 3.310 | 23,886. | 79,062.66 |
| 249 | 249 | | A | 93105551164 | RM | 3.321 | 1,780. | 5,911.38 |
| 250 | 250 | 284 | B | 95356844669 | RL | 0.184 | 1,841. | 338.74 |

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

| LINE NO. | SEQ. NO. | RANDOM ITEM | WHSE CODE | STOCK NUMBER | UNIT ISSUE | UNIT COST | QUANTITY ON HAND | EXTENDED VALUE |
|---|---|---|---|---|---|---|---|---|
| 251 | 251 | 1.362 | A | 99205081447 | EA | 7.940 | 327. | 2.596.38 |

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

PRINT/PUNCH ROUTINE TOTALS

| | |
|---|---|
| RECORD COUNT | 251 |
| UNIT COST | 2,307.034 |
| QUANTITY ON HAND | 941,959. |
| EXTENDED VALUE | 2,093,069.18 |

# APPENDIX IIIh

```
HASKINS & SELLS AUDITAPE SYSTEM  -  COPYRIGHT 1967          APPLICATION IDENTIFICATION - INVENTORY

        THIS IS THE AUDIT SAMPLE EVALUATION ROUTINE.
        IF A MONETARY EVALUATION, DETAIL ERROR CARDS SHOULD BE PLACED IN THE CARD READER.

        PRESS RUN TO BEGIN PROCESSING.
```

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

AUDIT SAMPLE EVALUATION SPECIFICATION CARD DATA

SAMPLE DESIGN DATA

| | |
|---|---|
| TYPE OF SAMPLE | MONETARY |
| MONETARY PRECISION LIMIT | 80.000 |
| RELIABILITY FACTOR | 3.0 |
| SUBSAMPLE OPTION | NO |
| PRIMARY CUT-OFF | 3.000 |

SAMPLE EVALUATION DATA

| | |
|---|---|
| ADJUSTED RELIABILITY FACTOR | 3.0 |
| NUMBER OF SAMPLE ERRORS | 9 |
| RECORDED ADJUSTMENTS | 0 |
| HARDWARE MULTIPLY/DIVIDE AVAILABLE | YES |

NO ERRORS HAVE BEEN DETECTED IN THE AUDIT SAMPLE EVALUATION SPECIFICATION CARD.
PROCESSING IS CONTINUING.

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

AUDIT SAMPLE EVALUATION - SAMPLE ESTIMATE OF ERRORS IN POPULATION

| REFER. | SAMPLE ITEMS THAT INCLUDE ERRORS AMOUNT | ERRORS IN SAMPLE ITEMS | SAMPLING INTERVALS | SAMPLE ESTIMATE |
|---|---|---|---|---|
| 001 | 605.00 | 100.00 | 44.08 | 4,408.00 |
| 002 | 64,782.00 | 2,000.00 | 1.00 | 2,000.00 |
| 003 | 8,600.00 | 500.00 | 3.60 | 1,800.00 |
| 004 | 404.00 | 10.00 | 66.01 | 660.10 |
| 005 | 6,714.00 | 250.00 | 4.47 | 1,117.50 |
| 006 | 217.00 | 50.00 | 122.89 | 6,144.50 |
| 007 | 11,532.00 | 1,000.00 | 2.81 | 2,810.00 |
| 008 | 168,474.00 | 5,000.00 | 1.00 | 5,000.00 |
| 009 | 34,142.00 | 4,000.00 | 1.28 | 5,120.00 |
| | | TOTAL BEFORE ADJUSTMENTS | | 29,060.10 |

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION - INVENTORY

AUDIT SAMPLE EVALUATION - ADJUSTED UPPER PRECISION LIMIT

| SAMPLE ESTIMATE - RANKED | PRECISION ADJUSTMENT FACTORS | PRECISION ADJUSTED ERRORS, ETC. |
|---|---|---|
| 2,000.00 | 1.00 | 2,000.00 |
| 5,000.00 | 1.00 | 5,000.00 |
| 6,144.50 | 1.75 | 10,752.88 |
| 5,120.00 | 1.56 | 7,987.20 |
| 4,408.00 | 1.46 | 6,435.68 |
| 2,810.00 | 1.40 | 3,934.00 |
| 1,800.00 | 1.36 | 2,448.00 |
| 1,117.50 | 1.33 | 1,486.28 |
| 660.10 | 1.31 | 864.73 |

| | |
|---|---|
| TOTAL PRECISION ADJUSTED ERRORS | 40,908.77 |
| LESS ADJUSTMENTS | 0.00 |
| NET PRECISION ADJUSTED ERRORS | 40,908.77 |
| PRELIMINARY UPPER PRECISION LIMIT | 80,000.00 |
| ADJUSTED UPPER PRECISION LIMIT | 120,908.77 |

# APPENDIX IIIh

HASKINS & SELLS AUDITAPE SYSTEM - COPYRIGHT 1967 APPLICATION IDENTIFICATION -

END OF JOB

APPENDIX IV

# CASE STUDY

# ON

# USE OF ALEXANDER GRANT & COMPANY'S

# AUDASSIST SYSTEM

# IN A

# REVIEW OF VETERANS ADMINISTRATION

# EDUCATIONAL ASSISTANCE PAYMENTS

APPENDIX IV

## Contents

# CASE STUDY ON USE OF AUDASSIST SYSTEM IN REVIEW OF VETERANS ADMINISTRATION EDUCATIONAL ASSISTANCE PAYMENTS

## INTRODUCTION

The General Accounting Office (GAO) used the Alexander Grant & Company Audassist system for data retrieval purposes in a review of Veterans Administration (VA) educational assistance payments. The primary objectives of the review were to test the eligibility of veterans receiving educational assistance; to determine the propriety of amounts paid as educational assistance; and to examine the causes of, and collection efforts on, educational assistance accounts receivable.

GAO obtained audit samples and analytic summaries from VA educational assistance records maintained on magnetic tape files at the VA's Data Processing Center (DPC) in Hines, Illinois. Using Audassist the following information was obtained from the automated files at DPC.

1. Preliminary 100-item samples for statistically testing characteristics of veterans receiving educational assistance.

2. Additional 400-item samples to permit increasing the preliminary sample sizes of (1) to achieve desired precision and reliability.

3. Samples of 200 items for review of the causes of, and collection efforts on, educational assistance accounts receivable.

4. Analytic schedules classifying accounts receivable by age, school, and type of institution.

Use of the VA's centralized master records in conjunction with special programming by DPC and the Audassist system facilitated the segregation of certain populations from massive record files, permitted greater flexibility in design of sampling plans, and provided more meaningful analysis of accounts receivable. It did not become necessary to

expand the review beyond the preliminary samples because of VA's favorable reception of the fieldwork performed by GAO regional offices.

## DESCRIPTION OF AUDASSIST SYSTEM

The Audassist system consists of several general-purpose program instructions designed primarily to meet the one-time or occasional data needs of auditors and other management analysts. The system permits considerable flexibility in the sequencing of instructions to age, calculate, stratify, sample, and test conditions.

The age instruction calculates the age of a record, such as an account receivable, in calendar days.

The calculation instruction performs the basic mathematical operations of addition, subtraction, multiplication, or division.

The stratification instruction permits classifying data into as many as 17 categories in a single processing run.

The sampling instruction, using one of three systematic random-sampling techniques, selects a sample or samples.

Condition-testing instructions provide a capability for identifying and processing records with certain designated characteristics.

An Audassist "package" consists of control forms, coding sheets, an instruction manual, and the Audassist program, which may be on tape or disk.

There are three phases to Audassist, each of which requires preparation of coded instruction sheets by the user. These phases are data conversion, processing, and output.

The data conversion phases creates a fixed-length record not exceeding 200 characters in length. The "converted" record may contain as many as 19 data fields of various sizes. Appendix IVa contains a standard Audassist record layout.

In the processing phase instructions (not to exceed 25 in a processing run) are sequenced to accomplish one or more data-handling objectives. The set of Audassist instructions used in this phase are set forth in appendix IVb.

APPENDIX IV

The output phase provides printouts of as many as 13 information fields. These fields may show one to three levels of control totals.

A glossary of Audassist terminology applicable to these phases is included in appendix IVc.

The present version of the Audassist system can be used on the IBM 360 series (Models 25 and over) computer systems with magnetic tape containing fixed-length records.

## DESCRIPTION OF VA EDUCATIONAL MASTER RECORDS

At the time of GAO's review, the master file of records on educational assistance at DPC consisted of 100 reels of magnetic tape containing more than two million records. Six types of transaction records are intermingled in the master file.

| Type | Description |
|---|---|
| A | Current running award |
| D | Accounts receivable |
| E | Terminated |
| H | Application only |
| I | Certificate of eligibility issued |
| J | Disallowed |

Records vary in length because of different record space requirements for information, such as that on the veteran's dependents. A record may contain as many as 1,725 characters.

Records of educational transactions are received continually at DPC in the form of cards or paper tape, which are converted to magnetic tape files. These files are used in updating the master files and producing various administrative, operating, and financial reports. The master files are updated by current transactions twice a week on an IBM 360/65 computer system with 7080 emulation. The emulator permits the third-generation 360/65 system to operate using program instructions originally written for the earlier 7080 system.

APPENDIX IV

## REVIEW OF MASTER RECORDS

Use of Audassist in the assignment required magnetic tape files to be in a fixed-length format. Certain decisions--based on evaluation of the characteristics of DPC master records in relation to review guidelines--were therefore required, to modify VA's variable-length master records. We requested that files furnished by DPC include only certain fixed-length modules of terminated and current awards. Transaction types not under audit review were excluded.

For selecting samples of veterans currently receiving educational assistance, DPC provided us with tape files of current and terminated award records pertaining to previously selected Veterans Administration Regional Offices (VARO). DPC also provided tape files containing accounts receivable data, which were required for analysis of overpayments by cause and school code. A review of the master-record layout suggested that the analysis could be expanded to provide an aging of receivables by discovery date.

GAO requests for data were included in a listing of ADP specifications. These specifications were submitted to DPC for use in developing magnetic tape working files necessary for Audassist processing.

APPENDIX IV

RECORD EXTRACTION AND FORMATTING BY DPC

DPC programmed the extraction and fixed-length formatting of current and terminated award master records in a three-phased project.

Initially DPC extracted from the educational master files a working file of all type records for the selected VAROs. The working file consisted of 12 reels of magnetic tape totaling approximately 237,000 master records.

From the working file DPC extracted segments of all current and terminated award master records for the selected VAROs and formatted the extracted records in fixed length. The resulting file consisted of four reels of magnetic tape containing 176,000 records, each with 275 characters. This file, in conjunction with Audassist, was used to obtain samples of current awards.

From the same 12-reel working file, DPC extracted also all current and terminated award master records with accounts receivable at the same VAROs and formatted the receivable records to a fixed length. This receivable file consisted of two reels of tape containing 12,460 records, each with 430 characters. These records were used to obtain samples and analyses of accounts receivable arising from the overpayment of educational assistance.

Thus two separate tape files were created for GAO.

APPENDIX IV

## SAMPLE SELECTION OF CURRENT AWARDS

GAO required a selection of 500 items for each selected VARO as a maximum-sized sample of veterans currently receiving educational assistance and, from within this sample, 100 items for preliminary tests of the characteristics of the universe. The 500-item sample was considered the maximum that would be necessary to achieve 95-percent confidence that the error rate in the sample would be within plus or minus 2 percent of the error rate in the universe. The preliminary sample of 100 items was to be used for determining the final sample size.

Audassist processing was performed at the offices of Alexander Grant & Company using an IBM 360/30 computer system. The Audassist system phases used for obtaining the samples of current awards are briefly described in the following paragraphs.

The Audassist data conversion phase converted selected data from the 275-character records in the working files developed by DPC to the shorter fixed-length record format of Audassist.

In the Audassist processing phase, the maximum- and preliminary-sized samples were selected by a systematic random-sampling method. It was possible to select both sample sizes in a single processing run by using a sequence of stratification and sampling instructions. The sample items were transcribed magnetically on tape for later printout in the output phase.

Using the output phase of Audassist, we obtained for each selected VARO separate lists of the preliminary samples and the remaining parts of the maximum samples. We also rearranged the samples in school code sequence to facilitate reference to files maintained on individual schools at the VAROs.

Documentation prepared for the Audassist phases used in the sample selections of current awards is included as appendix IVd. After deciding on the specific audit data to be extracted from the input record, our step-by-step procedures included:

1. Preparing a general flow chart depicting the work to be done. (See app. IVd, p. 148.)

2. Acquiring a detailed understanding of the input record layout. (See app. IVd, p. 149.)

3. Preparing the Input-Output Coordinator as an aid in making factor assignments. (See app. IVd, p. 150.)

4. Preparing an Audassist flow chart depicting the detailed work to be performed. (See app. IVd p. 151 and 152.)

5. Completing the Audassist coding forms:

   --Data conversion phase - (See app. IVd, p. 153.)
   --Processing phase - (See app. IVd, p. 154.)
   --Output phase - (See app. IVd, p. 155.)

6. Keypunching Audassist coding forms into punched cards.

7. Processing the application on an IBM 360/30 computer system following manual instructions combined with messages printed by the computer during processing.

Results of computer processing are included in appendix IVd, pages 156 to 163. A partial listing of the sample items is included in appendix IVd, pages 160 to 163.

APPENDIX IV

## SAMPLE SELECTION AND ANALYSES OF RECEIVABLES

Audassist was used also in obtaining samples and analytic summaries from the magnetic tape files of veterans accounts receivable for the selected VAROs. Use of Audassist system in conjunction with the accounts receivable files is illustrated in appendixes IVe and IVf.

### Sample selection

We obtained two samples--one for each VARO--of 200 veterans' accounts receivable from the combined universe of current award and terminated records. Because terminated receivable records were heavily weighted in the 200-item samples, an alternative sample was obtained. This sample, consisting of 100 current awards and 100 terminated awards, was evenly weighted.

The Audassist system phases used in obtaining the samples of receivables is briefly described in the following paragraphs.

The data conversion phase converted selected data from the working files of accounts receivable to Audassist records in fixed-length format. This reduced the size of accounts receivable records from 430 to 200 characters.

Two Audassist processing phases were used in selecting the samples. In one phase 200-item samples were selected from combined universes of current and terminated award records by the use of a systematic sampling instruction. In the same phase the condition-testing routines--tag setting and testing--produced a count of records containing more than one receivable.

In a second processing phase, 100-item samples were chosen, the current and terminated awards being treated as separate universes.

Two Audassist output runs were required, to print out the samples developed in the two processing runs.

Documentation for the various Audassist phases is not included in this report because it is similar to that shown in appendix IVd.

Analyses of accounts receivable

Using Audassist we analyzed overpayment receivables by discovery date, school code, type of institution, overpayment cause, and schools with more than four overpayments.

Audassist data conversion put working files into required Audassist record format.

Audassist processing developed analyses of receivables by discovery date, school code, and type of institution. During processing, receivable counts and dollar totals were accumulated and later were displayed in accumulator totals listings. Because these listings are an integral part of Audassist processing, it was not necessary to use separate output runs to print the counts and dollar totals. Condition-testing instructions made it possible to obtain the analyses by school code and type of institution in a single processing run.

Audassist coding procedures permitted us to circumvent separate conversion and processing phases, to obtain the analysis of accounts receivable by overpayment cause.

The analysis of receivables by school code provided information not previously available. As a result GAO desired, as a basis for further review, a listing of schools with more than four receivables. This listing was obtained by using a three-phase run of data conversion, processing, and output.

Documentation prepared for the Audassist phases used in obtaining the analyses of receivables by school code and type of training institution is included in appendix IVg.

APPENDIX IV

## ASSESSMENT OF BENEFITS OF USING AUTOMATED DATA EXTRACTION METHODS

DPC's special programming reduced the 100-reel magnetic tape file of educational master records to a manageable six-reel file. Use of the Audassist system in conjunction with the magnetic tape files enabled us to sophisticate the design of the review and obtain the data to fit the design more easily and effectively. A less desirable alternative would have been to use hard copy records maintained at the VAROs. This alternative, however would have made it more difficult and time consuming to determine the characteristics of the sampling frame, to select the samples, and to provide alternative analyses.

The experience gained in this assignment increased the auditors' capability for conducting reviews in an ADP environment. Objectives were constructively agreed upon and subsequently were modified to take advantage of new-found information.

Use of the Audassist system brought accounting-oriented auditing staff in direct contact with data processing employees and records and thereby overcame inhibitions in making fuller use of magnetic tape files.

APPENDIX IVa

STANDARD AUDASSIST RECORD LAYOUT

| DESCRIPTION | FACTOR NUMBER | HIGH-ORDER POSITION | LENGTH | CHARACTER-ISTICS PRI | ALT |
|---|---|---|---|---|---|
| | FAC 01 | 001 | 10 | CHAR | NUM |
| | FAC 02 | 011 | 10 | CHAR | NUM |
| | FAC 03 | 021 | 8 | NUM | CHAR |
| | FAC 04 | 029 | 14 | NUM | CHAR |
| | FAC 05 | 043 | 14 | NUM | CHAR |
| | FAC 06 | 057 | 10 | NUM | CHAR |
| | FAC 07 | 067 | 5 | NUM | CHAR |
| | FAC 08 | 072 | 5 | CHAR | NUM |
| | FAC 09 | 077 | 2 | CHAR | NONE |
| | FAC 10 | 079 | 2 | CHAR | NONE |
| | FAC 11 | 081 | 20 | CHAR | NUM |
| | FAC 12 | 101 | 20 | CHAR | NUM |
| | FAC 13 | 121 | 20 | CHAR | NUM |
| | FAC 14 | 141 | 20 | CHAR | NUM |
| | FAC 15 | 161 | 5 | CHAR | NUM |
| | FAC 16 | 166 | 15 | CHAR | NUM |
| AGE | AGE | 181 | 4 | -- | -- |
| GROUP CODE | GROUP CODE | 185 | 1 | -- | -- |
| | | 186-200 Not Used In Version 1. | | | |

Alexander Grant & Co. 1/1/69

APPENDIX IVb

## AUDASSIST INSTRUCTION SET

### AGE

The AGE Instruction calculates the number of days difference between the Audassist record date and a base date and places the result in the Age factor of the Audassist record. The user must supply the date format of the Audassist record and the Julian form of the base date. In addition, the user may eliminate up to seven dates from the Age calculation so that weekends, holidays, etc., may be excluded from the calculation of the age of the record.

### CALCULATE

The CAL Instruction will perform the arithmetic operations of add, subtract, multiply or divide using Audassist data as specified by the user. These four arithmetic operations may be performed on numeric factors, individual accumulators and konstants. The instruction can also be used to add two blocks of accumulators together and to clear a block of accumulators.

The instruction performs the user-specified operation on the fields designated in Operand 1 and Operand 2 and places the result in Operand 3. The results of all arithmetic operations are rounded to four decimal places.

### CONTROL BREAK

The CLB Instruction allows the user to save Audassist records based on a control factor until the user has decided to select either all or none of the records within the control factor. The control field selected by the user must always be FAC 01 in version I of Audassist. The use of this instruction requires the use of the PUT-CLB and EXT Instructions.

### END

The END Instruction indicates the end of processing of a record, resets all tags and returns control to the first instruction of the Audassist program.

EXIT

The EXT Instruction indicates the end of a control break processing routine. The EXT Instruction is always the last instruction of any CLB routine.

GET

The GET Instruction reads a record from the Audassist input file, accumulates the control factor specified in Operand 1, and counts the number of records read.

PUT

The PUT Instruction writes an Audassist record forward to the Audassist Output file and inserts one of nine possible group codes as selected by the user. When the CLB (Control Break) instruction is used, the PUT instruction writes forward all records stored during detail processing, and places the group code specified by the user into all records written forward.

SAMPLE

The SAM Instruction will allow the user to draw a sample of records in a systematic random manner, from a given population. The instruction tests a user-designated record counter to determine if a particular record is to be selected. Any record selected sets a tag to Y (yes) or N (no) which can be tested by the TST Instruction.

Three sampling plans are available: $N^{th}$ item, RN and R2N. The user must determine the value of N, the first record to be selected and, if the RN or R2N plans are used, the user must supply the starting 10-digit random number for the random number generator.

SET

The SET Instruction compares an Audassist character factor to a konstant or character factor designated by the user. The instruction sets a tag to H (high), E (equal) or L (low). This tag can be tested by the TST Instruction.

APPENDIX IVb

## STRATIFICATION

The STR Instruction allows the user to stratify the Age factor or any other numeric factor into as many as five user-defined limits. Up to four classifications are allowed for each stratification instruction with the fifth limit implied. If fewer than four classifications are used, the last limit is implied.

The STR Instruction increments a record counter indicating how many were classified within each specified limit. A user-specified numeric factor may also be accumulated within each limit. The STR Instruction also sets a tag indicating the stratum into which an individual record was classified. This tag can be tested using the TST Instruction.

## TEST

The TST Instruction tests the tag set by the SET, AGE, STR or SAM Instruction for a specific condition. The result of the tag test determines to which instruction number the program must branch. These instruction numbers are supplied by the user.

APPENDIX IVc

# AUDASSIST GLOSSARY

DATE 10/22/68

AUDASSIST

AUDASSIST IS A SERIES OF FUNCTIONALIZED COMPUTER PROGRAMS. THESE PROGRAMS INCLUDE AGE CALCULATION, STRATIFICATION, SAMPLING, CALCULATE, TAG SETTING AND TAG TESTING WHICH CAN BE LINKED TOGETHER TO ACCOMPLISH ONE OR MORE AUDIT OBJECTIVES.

DATA CONVERSION PHASE

AUDASSIST ALLOWS THE USER TO PROCESS ALMOST ANY CLIENT FILE THAT IS OR CAN BE PUT ON COMPUTER TAPE. THE DATA CONVERSION PHASE CONVERTS THE CLIENTS TAPE INTO AN AUDASSIST TAPE WHICH CAN BE OPERATED UPON BY THE PROCESSING PHASE.

PROCESSING PHASE

THIS IS THE PHASE IN WHICH THE USER LINKS THE FUNCTIONALIZED PROGRAMS TOGETHER IN ORDER TO SELECT INFORMATION FOR AUDIT. FOR EXAMPLE, THE USER MAY WANT TO CALCULATE THE AGE OF AN ACCOUNT, CLASSIFY THE ACCOUNT INTO TWO OR MORE CATEGORIES BY AMOUNT OR AGE AND BASED ON THE RESULTS OF THESE FUNCTIONS, SELECT OR REJECT THE ACCOUNT FOR FURTHER REVIEW BY THE USER.

OUTPUT PHASE

THE USER HAS SEVERAL CHOICES OF PRINTED OUTPUT. THERE IS A STANDARD LISTING WHICH DISPLAYS UP TO THIRTEEN ITEMS OF INFORMATION ABOUT AN ACCOUNT OR INVOICE AS REQUIRED. IN ADDITION, A STRATIFICATION LISTING IS AVAILABLE WHICH DISPLAYS AN AMOUNT OR AGE IN UP TO FIVE CLASSIFICATIONS IN COLUMNAR FORM. FINALLY, THE USER HAS THE CHOICE OF FOUR DIFFERENT POSITIVE CONFIRMATION FORMATS. FOR EXAMPLE, FOR ENCLOSED STATEMENTS, BALANCE ONLY, INVOICE ONLY OR AUDASSIST WILL PRINT A STATEMENT OF ACCOUNT AS PART OF THE CONFIRMATION.

APPENDIX IVc

AUDASSIST RECORD

THE AUDASSIST RECORD IS THE STANDARD WORK RECORD USED BY THE SYSTEM. THE RECORD HAS 19 FIELDS OF VARIOUS SIZES AND IS 200 POSITIONS LONG. THE FIELDS OF THIS RECORD ARE DEFINED AS FOLLOWS--

| FIELD | | CHARACTERISTICS | |
|---|---|---|---|
| NAME | LENGTH | ALPHA | NUMERIC |
| FAC01 | 10 | x | |
| FAC02 | 10 | x | |
| FAC03 | 08 | | x |
| FAC04 | 14 | | x |
| FAC05 | 14 | | x |
| FAC06 | 10 | | x |
| FAC07 | 05 | | x |
| FAC08 | 05 | x | |
| FAC09 | 02 | x | |
| FAC10 | 02 | x | |
| FAC11 | 20 | x | |
| FAC12 | 20 | x | |
| FAC13 | 20 | x | |
| FAC14 | 20 | x | |
| FAC15 | 05 | x | |
| FAC16 | 15 | x | |
| AGE | 04 | | x |
| GRP | 01 | x | |

THE REMAINING POSITIONS OF THE AUDASSIST RECORD ARE RESERVED FOR FUTURE USE.

FACTOR

FACTOR IS USED TO IDENTIFY A FIELD IN THE AUDASSIST RECORD. THE MNEMONIC REPRESENTATION FOR CODING PURPOSES IS FACXX. XX CAN BE 01 THRU 16.

CARD CODE

USED ON CODING FORM TO IDENTIFY THE SYSTEM PHASE OF THE PARAMETER CARDS.

CARD CODE IS ALWAYS ENTERED IN CODING FORM COLUMN #1.

| CARD CODE | IDENTIFICATION |
|---|---|
| 0 | SPECIAL INFORMATION |
| 1 | DATA CONVERSION |
| 2 | PROCESSING |
| 7 | CONFIRMATION PRINTING |
| 8 | STRATIFICATION LISTING |
| 9 | GENERAL LISTING |

INSTRUCTION NUMBER

INDICATES THE SEQUENCE OF THE PARAMETER CARDS WITHIN A GIVEN PHASE, I.E. CARD CODE. NUMBERS 01 THRU 25 ARE TO BE USED SEQUENTIALLY FOR THE PROCESSING PHASE.

INSTRUCTION NUMBER ALWAYS APPEARS IN CODING FORM COLUMNS 2 & 3.

INSTRUCTION MNEMONIC

USED TO INDICATE THE SHORT NAME OF THE FUNCTIONALIZED PROGRAM THAT IS TO BE USED. THE FOLLOWING ARE VALID MNEMONICS--

| | |
|---|---|
| GET | READ AN AUDASSIST RECORD |
| CLB | CONTROL BREAK |
| EXT | EXIT CONTROL BREAK |
| AGE | AGE CALCULATION |
| SAM | SYSTEMATIC RANDOM SAMPLE |
| STR | STRATIFICATION |
| CAL | CALCULATE |
| SET | TAG SETTING |
| TST | TAG TESTING |
| PUT | WRITE AN AUDASSIST RECORD |
| END | LAST CODING STATEMENT |

THE INSTRUCTION MNEMONIC ALWAYS APPEARS IN CODING FORM COLUMNS 4 THRU 6.

APPENDIX IVc

OPERAND 1

OPERAND ONE REPRESENTS THE CODING NECESSARY TO LOCATE THE FIRST SET OF DATA TO BE OPERATED UPON BY A FUNCTIONAL PROGRAM. THIS OPERAND HAS FOUR SUBPARTS CALLED TYPE, NUMBER, POSITION AND LENGTH. THE FOLLOWING DATA TYPES ARE ALLOWED FOR OPERAND 1 -- THE SPECIFIC TYPE IS DETERMINED BY THE INSTRUCTION MNEMONIC.

| | |
|---|---|
| FAC | FACTOR |
| RCT | RECORD COUNTER |
| ACM | ACCUMULATOR |
| AGE | CALCULATED AGE |

OPERAND 1 IS ALWAYS TO BE ENTERED IN CODING FORM COLUMNS 7 THRU 15.

OPERAND 2

OPERAND TWO REPRESENTS THE CODING NECESSARY TO LOCATE THE SECOND SET OF DATA TO BE OPERATED UPON BY THE FUNCTIONAL PROGRAM. THIS OPERAND HAS THREE MAIN SUBPARTS AND TWO ALTERNATE SUBPARTS. THE MAIN SUBPARTS ARE TYPE, NUMBER AND POSITION. THE ALTERNATE SUBPARTS ARE KONSTANT AND STARTING RANDOM NUMBER. THE FOLLOWING DATA TYPES ARE ALLOWED TO BE USED IN OPERAND 2 -- THE SPECIFIC TYPE FOR ANY ONE CODING LINE IS DETERMINED BY THE INSTRUCTION MNEMONIC --

| | |
|---|---|
| FMT | DATE FORMAT |
| N | SAMPLING GENERATOR TYPE N |
| RN | SAMPLING GENERATOR TYPE RANDOM N |
| R2N | SAMPLING GENERATOR TYPE RANDOM 2N |
| FAC | FACTOR |
| ACM | ACCUMULATOR |
| KON | KONSTANT |
| TAG | TAG TO BE ACCESSED |

CODING FOR OPERAND 2 ALWAYS APPEARS IN CODING FORM COLUMNS 17 THRU 29.

IF OPERAND 2 IS NECESSARY FOR THE DIVIDE OR SUBTRACT OPERATION OF THE CALCULATION PROGRAM, IT MUST BE USED FOR THE DIVISOR OR SUBTRAHEND RESPECTIVELY.

OPERAND 3

OPERAND 3 REPRESENTS THE CODING NECESSARY TO IDENTIFY THE THIRD SET OF DATA TO BE OPERATED UPON BY A FUNCTIONAL PROGRAM. THIS OPERAND HAS THREE SUBPARTS CALLED TYPE, NEXT INSTRUCTION IF EQUAL, NEXT INSTRUCTION IF NOT EQUAL OR POSITION. THE FOLLOWING DATA TYPES ARE ALLOWED IN OPERAND 3-

| | |
|---|---|
| CLB | CONTROL BREAK |
| ACM | ACCUMULATOR IDENTIFICATION |
| FAC | FACTOR |

THE SPECIFIC TYPE TO BE USED IS DETERMINED BY THE FUNCTIONAL PROGRAM USED AND OPERAND 3 ALWAYS APPEARS ON THE CODING FORM IN POSITIONS 30 THRU 38.

TYPE

TYPE IS USED TO INDICATE THE DATA LOCATION OR A FUNCTIONAL PROGRAM SUBFUNCTION. TYPES ALLOWED ARE INDICATED AS FOLLOWS --

| | |
|---|---|
| FAC | FACTOR |
| RCT | RECORD COUNTER |
| ACM | ACCUMULATOR |
| AGE | CALULATED AGE |
| FMT | DATE FORMAT |
| RN, R2N, N | SAMPLING GENERATOR TYPE |
| KON | KONSTANT |
| TAG | TAG |
| CLB | CONTROL BREAK |

DEPENDING ON THE FUNCTIONAL PROGRAM AND THE OPERANDS INVOLVED, TYPE COULD APPEAR IN CODING FORM COLUMNS 7 THRU 9, 17 THRU 19 OR 30 THRU 32.

FAC -- OPERAND TYPE MNEMONIC

FAC IS A MNEMONIC USED TO SPECIFY THE DATA ITEM IN AN AUDASSIST RECORD TO BE OPERATED UPON BY THE INSTRUCTION.

RCT -- OPERAND TYPE MNEMONIC

RCT IS A MNEMONIC TO DESIGNATE A RECORD COUNTER AS THE DATA ITEM TO BE OPERATED UPON BY AN OPERAND OF AN INSTRUCTION.

ACM -- OPERAND TYPE MNEMONIC

ACM IS A MNEMONIC TO DESIGNATE AN ACCUMULATOR AS THE DATA ITEM TO BE OPERATED UPON BY AN OPERAND OF AN INSTRUCTION.

APPENDIX IVc

NUMBER

NUMBER IN OPERANDS 1, 2 AND 3 IS USED TO INDICATE THE FACTOR NUMBER, THE ACCUMULATOR BLOCK, THE DATE FORMAT NUMBER FOR THE AGING PROGRAM AND THE INSTRUCTION NUMBER CREATING THE TAG TO BE TESTED BY THE TAG TESTING PROGRAM.

NUMBER ALWAYS APPEARS IN CODING FORM COLUMNS 10 AND 11 FOR OPERAND 1, COLUMNS 20 AND 21 FOR OPERAND 2 AND COLUMNS 35 AND 36 FOR OPERAND 3.

POSITION

POSITION IN OPERANDS 1, 2 AND 3 IS USED TO INDICATE WHICH ACCUMULATOR OR RECORD COUNTER OF A BLOCK IS TO BE USED AND 01 THRU 10 OR FACTOR SIZE IF SOMETHING LESS THAN THE WHOLE FACTOR IS NEEDED. IF POSITION IS USED IN THIS LAST SENSE, LENGTH MUST ALSO BE USED IN CODING FORM COLUMS 14 AND 15.

POSITION ALWAYS APPEARS IN CODING FORM COLUMNS 12 AND 13, 22 AND 23 OR 33 AND 34.

NEXT INSTRUCTION NUMBER

USED ON CODING FORM TO INDICATE --

1. THE NEXT INSTRUCTION TO BE PERFORMED IF THE RESULTS OF THE TAG TESTING PROGRAM ARE EQUAL, IF THERE IS A CONTROL BREAK AS A RESULT OF THE CONTROL BREAK INSTRUCTION OR IF THE PUT PROGRAM IS USED.

   THIS TYPE OF NEXT INSTRUCTION NUMBER IS ENTERED IN CODING FORM COLUMNS 33 AND 34.

2. THE NEXT INSTRUCTION TO BE PERFORMED IF THE RESULT OF THE TAG TESTING PROGRAM IS NOT EQUAL OR IF THERE IS NO CONTROL BREAK.

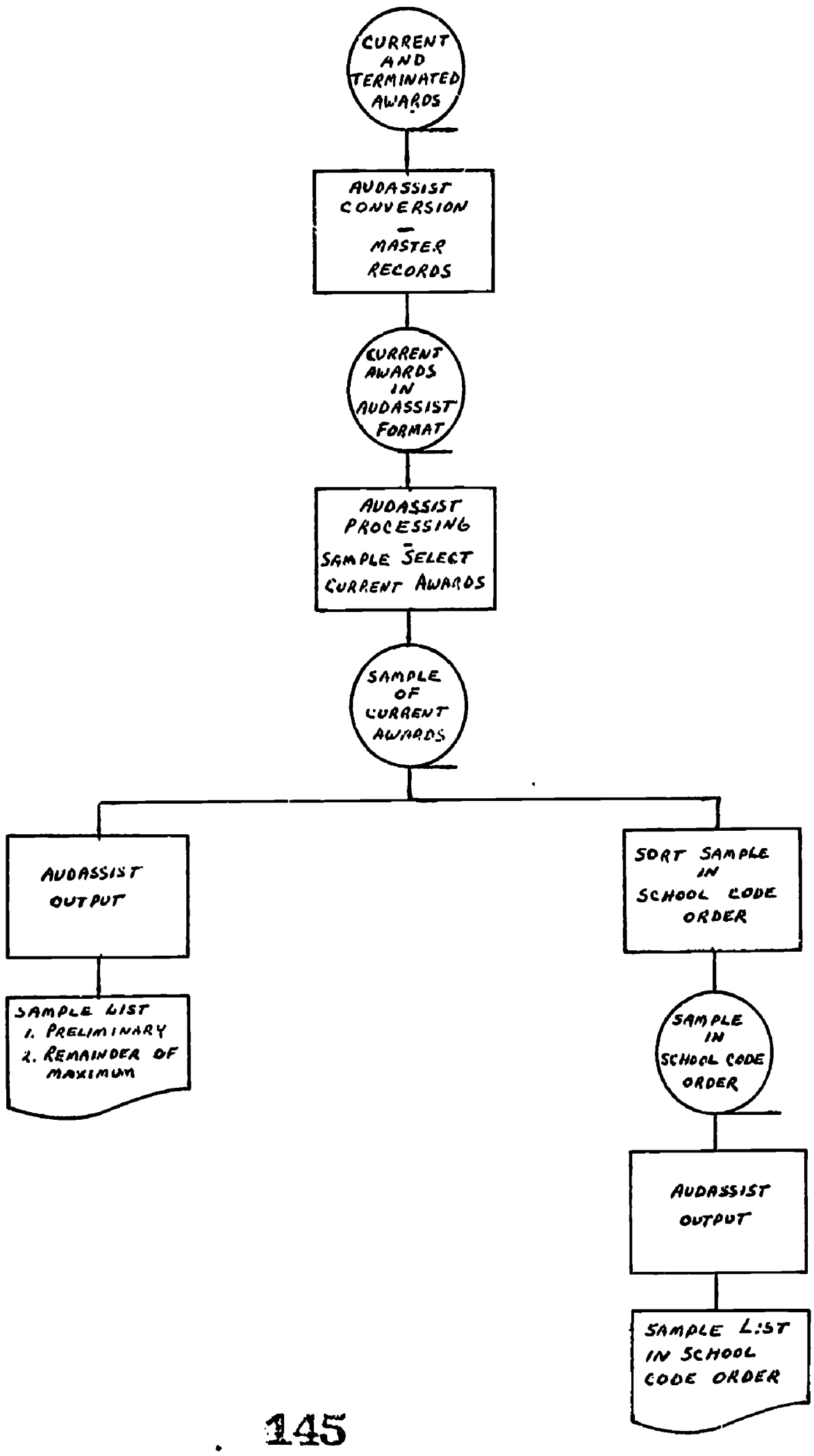
   THIS TYPE OF NEXT INSTRUCTION NUMBER IS ENTERED IN CODING FORM COLUMNS 35 AND 36.

APPENDIX IVd

## DOCUMENTATION--SAMPLE SELECTION OF CURRENT AWARDS

APPENDIX IVd

FLOW CHART--SAMPLE OF CURRENT AWARDS



## LAYOUT OF INPUT RECORDS FOR SAMPLE SELECTION OF CURRENT AWARDS

| RECORD LENGTH | FILE NUMBER: TERMINAL DIGITS | FILE NUMBER: EXPANSION | FILE NUMBER: BALANCE OF CLAIM NUMBER | PAYEE NUMBER | RECORD TYPE | PERSON ENTITLED | ACTIVITY: TYPE | ACTIVITY: YEAR | ACTIVITY: MONTH | ACTIVITY: CYCLE | STATION NUMBER | DEDUCTION/BALANCE NO. | MAIL CODE | SEGMENT INDICATOR #1 | NET AWARD: AMOUNT (OR RATE PER LESSON) | NET AWARD: YEAR | NET AWARD: MONTH | NET AWARD: DAY | CHECK AMOUNT | ENTITLEMENT CODE | EXPANSION | VET. PO. OF SERVICE | PAY STATUS | NO. ADDRESSLINES | C&P FILE INDICATOR | CHIEF ATTORNEY | CHANGE OR DISALLOWANCE REASON | SEGMENT INDICATOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b | | + | | | | | | | | | | | | | | | | + | | | | | | | | | | |
| 5 | 9 | | | 2 | 1 | 7 | 8 | | | 2 | 1 | 3 | 1 | | 12 | | | | 6 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 |

| AUDIT | TOTAL | DEPENDENCY: THIS AWARD (CH. 31 ONLY) | DEPENDENCY: SERVICE ORGANIZATION | DATE LAST CERTIFIED IN A. CH. 31: EXTENDED ENTITLEMENT IND. | DATE LAST CERTIFIED IN A. CH. 31: YEAR | DATE LAST CERTIFIED IN A. CH. 31: MONTH | DATE LAST CERTIFIED IN A. CH. 31: DAY | DATE LAST PAYMENT: YEAR | DATE LAST PAYMENT: MONTH | DATE LAST PAYMENT: DAY | ENROLLMENT MONTH | SEX | BRANCH | DUTY DATA (31-34): EOD YEAR | DUTY DATA (31-34): EOD MONTH | DUTY DATA (31-34): EOD DAY | DUTY DATA (31-34): RAD YEAR | DUTY DATA (31-34): RAD MONTH | DUTY DATA (31-34): RAD DAY | ASC | APPLICANT BIRTH DATE: YEAR | APPLICANT BIRTH DATE: MONTH | APPLICANT BIRTH DATE: DAY | DATE OF CLAIM: COUNSEL REQUEST: YEAR | DATE OF CLAIM: COUNSEL REQUEST: MONTH | DATE OF CLAIM: COUNSEL REQUEST: DAY | COMPUTED EOD CH. 34: YEAR | COMPUTED EOD CH. 34: MONTH | COMPUTED EOD CH. 34: DAY | OVER 100 DAYS | DATA AT TIME OF APPLICATION: STATE OF RESIDENCE | DATA AT TIME OF APPLICATION: ZIP CODE | DATA AT TIME OF APPLICATION: EDUCATION LEVEL | COUNSELING DATA: TOTAL DEPENDENCY REASON | COUNSELING DATA: PLAN ASSESSMENT | COUNSELING DATA: DISPOSITION | COUNSELING DATA: SRT (35) SRP (31) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | + | | | + | b | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 2 | 1 | 6 | | | | 6 | | | 1 | 1 | 14 | | | | | | 4 | 6 | | | 7 | | | 11 | | | | | 6 | | | | | |

| (Ch. 34) TOTAL DAYS IN SERVICE | PENDING C/E DATA: TYPE CERT. | PENDING C/E DATA: TYPE TRNG. | PENDING C/E DATA: CURRENT OBJECTIVE | PENDING C/E DATA: EXPANSION | PENDING C/E DATA: TYPE CERT. | PENDING C/E DATA: TYPE TRG. | PENDING C/E DATA: SPEC. ELIG. | PENDING C/E DATA: PRIOR VA TRG. | NONCREDITABLE SERVICE | ENTITLEMENT REDUCTION FACTORS: NOT ON DUTY TIME | ENTITLEMENT REDUCTION FACTORS: TIME USED | ENTITLEMENT REDUCTION FACTORS: PRIOR VA | ENTITLEMENT ACCOUNTING: ORIGINAL NET ENTITLEMENT | ENTITLEMENT ACCOUNTING: ENTITLEMENT USED | ENTITLEMENT ACCOUNTING: EXTENDED ENTITLEMENT | DELIMITING DATE: YEAR | DELIMITING DATE: MONTH | DELIMITING DATE: DAY | CURRENT OBJ. CH. 34-35 | INITIAL OBJ. CH. 34-35 | CURRENT SCHOOL CODE: PROFIT STATUS | CURRENT SCHOOL CODE: TYPE OF SCHOOL | CURRENT SCHOOL CODE: NAME OF FACILITY | CURRENT SCHOOL CODE: LOCATION OF FACILITY | PENDING SCHOOL CODE: PROFIT STATUS | PENDING SCHOOL CODE: TYPE OF SCHOOL | PENDING SCHOOL CODE: NAME OF FACILITY | PENDING SCHOOL CODE: LOCATION OF FACILITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 6 | | 1 | 1 | 1 | 1 | | | 16 | | | | 12 | | | 6 | | | 6 | | 8 | | | | 8 | | | |

| RESIDUAL AMOUNT | EXPANSION | ELECTION | INITIAL ENTRANCE DATE: YEAR | INITIAL ENTRANCE DATE: MONTH | INITIAL ENTRANCE DATE: DAY | CURRENT COURSE | EXPANSION | TRAINING TIME: TYPE HOURS | NUMBER OF HOURS | NUMBER OF DAYS PER WK. | TOTAL CHARGES | NO. CORRESPONDENCE LESSON TOTAL | NO. CORRESPONDENCE LESSONS SERVICED | LENGTH OF COURSE: TYPE | LENGTH OF COURSE: NUMBER | CHAPTER 31: EXPANSION | CHAPTER 31: COMBINED DEGREE | CHAPTER 31: MAJOR DISABILITY | CHAPTER 31: MONTHLY WAGE TRAINEE | CHAPTER 31: MONTHLY WAGE TRAINED | BLANKS | RECORD MARK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 6 | 1 | 6 | | 3 | 3 | 1 | 1 | 2 | 1 | 6 | 3 | 3 | 5 | 2 | 13 | | | | 4 | | : |

**RECORD LENGTH:**

SEGMENTS .....270
BLANKS AND RECORD MARK ... 5
TOTAL.....275

APPENDIX IVd

INPUT-OUTPUT COORDINATOR

| AUDASSIST USER'S FIELD IDENTIFICATION | USER INPUT RECORD | | | AUDASSIST RECORD | | | AUDASSIST OUTPUT | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | GENERAL LISTING FIELD NUMBER | STRATIFICATION LISTING FIELD NUMBER | CONFIRMATIONS | | | | |
| | HIGH ORDER POSITION | LENGTH | | FACTOR NUMBER | | LENGTH | | | OPTION 01 ENCLOSED STATEMENT (LINE NO.) | OPTION 02 FOLLOWING BALANCE (LINE NO.) | OPTION 03 FOLLOWING INVOICE (LINE NO.) | OPTION 04 - FOLLOWING STATEMENT (LINE NO.) | COLUMN NO |
| GROUP CODE | | | | GRP | C | 1 | 1 | 1 | 39 | 39 | 39 | 59 | |
| FILE NUMBER | ØØ6 | Ø9 | CZ | FAC01 | C | 10 | 2 | 2 | 26 | 26 | 26 | 46 | |
| PERSON ENTITLED | Ø18 | Ø7 | CZ | FAC11 | C | 20 | 3 | 3 | 34 | 34 | 34 | 54 | |
| SCHOOL CODE | 197 | Ø4 | CZ | FAC02 | C | 10 | 4 | 4 | | | 27 | | 1 |
| | | | | FAC03 | DATE | 8 | 5 | | | | | | 2 |
| CHECK AMOUNT | Ø52 | Ø6 | ZZ | FAC04 | N | 14 | 6 | 5,6,7,8,or9 (see also ayo) | 30 | 30 | 30 | | 4 |
| NET AWARD | Ø4Ø | Ø6 | ZZ | FAC06 | N | 10 | 7 | | | | | | |
| STATION NUMBER | Ø33 | Ø2 | ZØ | FAC07 | C/N | 5 | 8 | | | | | | |
| PAY STATUS | Ø62 | Ø1 | CZ | FAC08 | C | 5 | 9 | | | | | | |
| TYPE TRAINING | 152 | Ø1 | CZ | FAC09 | C | 2 | 10 | | | | | | |
| PAYEE NUMBER | Ø15 | Ø2 | CZ | FAC10 | C | 2 | 11 | | | | | | |
| CALCULATED AGE | | | | AGE | N | 4 | 12 | 5,6,7,8,or9 (see also FAC04) | | | | | |
| | | | | FAC05 | N | 14 | 13 | | | (Optional) 31 | | | |
| | | | | FAC12 | C | 20 | | | 35 | 35 | 35 | 55 | |
| | | | | FAC13 | C | 20 | | | 36 | 36 | 36 | 56 | |
| | | | | FAC14 | C | 20 | | | 37 | 37 | 37 | 57 | |
| | | | | FAC15 | C | 5 | | | | | | | |
| | | | | FAC16 | C | 15 | | | | | (Optional) 28 | | 3 |

ALEXANDER GRANT & CO. 10-7-68

INPUT-OUTPUT COORDINATOR

## AUDASSIST FLOWCHART

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION SAMPLE SELECTION-- CURRENT AWARD CASES VA STATIONS Ø1 AND 44.

| INST. # | FLOWCHART | NOTES |
|---|---|---|
| Ø1 | GET | READ A RECORD<br>GET CONTROL COUNTS ON FAC Ø4 (RECEIVABLE BALANCE) AND NR. OF RECORDS. |
| Ø2 | SAM | SAMPLE RECORD COUNT IN ØØØØ (RCT ØØØØ)<br>NTH METHOD<br>STA 44 Ø1<br>INTERVAL 7Ø 25<br>START 1Ø 21 |
| Ø3 | TST, No → 11, Y | TEST TAG SET IN INST. Ø2 FOR SAMPLE ITEM<br>Y → Ø4<br>N → END |
| Ø4 | CAL | ACCUMULATE COUNT OF SAMPLE IN ACCUMULATOR ØIØI<br>ACM 0101 + KON 1 TO ACM ØIØI |
| Ø5 | CAL | PUT SAMPLE SELECTION SEQUENCE NR. IN SAMPLE RECORD.<br>FAC Ø5 + ACM ØIØI TO FAC Ø5 |
| Ø6 | STR | SET UP RECORD COUNTER FOR SELECTION OF PRELIMINARY SAMPLE<br>STR FAC Ø4 IN ACM Ø2** |
| Ø7 | SAM | SELECT PRELIMINARY SAMPLE - NTH METHOD<br>STATION 44 Ø1<br>INTERVAL 5 5<br>START 2 4 |
| Ø8 | TST, No → 1Ø, Y → Ø9 | TEST TAG SET IN INST. Ø7 FOR PRELIMINARY SAMPLE RECORD<br>Y → Ø9<br>N → 1Ø |

ALEXANDER GRANT & CO. REV. 9-12-68

APPENDIX IVd

## AUDASSIST FLOWCHART

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION SAMPLE SELECTION-- CURRENT AWARD CASES
VA STATIONS Ø1 AND 44

| INST. # | FLOWCHART | NOTES |
|---|---|---|
| | Ø8Y / Ø8N | |
| Ø9 | PUT | PUT SUB-SAMPLE RECORD FORWARD FOR WRITE-OUT IN GROUP CODE 1. |
| 1Ø | PUT | PUT NON-SUB-SAMPLE RECORD FORWARD FOR WRITE-OUT IN GROUP CODE 2. |
| 11 | END | END OF PROGRAM ON RECORD. |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

ALEXANDER GRANT & CO. REV. 9-12-68

# APPENDIX IVd

CLIENT: GENERAL ACCOUNTING OFFICE

APPLICATION: SAMPLE -- CURRENT AWARDS - STATION Ø1

| PREPARED | DATE | INDEX |
|---|---|---|
| REVIEWED | DATE | |

**AUDASSIST CODING FORM -- DATA CONVERSION PHASE & SPECIAL INFORMATION**

| | | | | | | |
|---|---|---|---|---|---|---|
| Q | Q1 | OFF | | | ← OFFICE NUMBER | AG & CO. STREET ADDRESS → |
| Q | Q2 | OFF | | | ← OFFICE NUMBER | AG & CO. CITY, STATE & ZIP CODE → |
| Q | Q3 | CLT | | | ← CLIENT NUMBER | CLIENT NAME → SAMPLE TYPE A CASES VA STA Ø1 |

| CARD CODE | INSTRUCTION NUMBER | INSTRUCTION MNEMONIC | INPUT (CLIENT RECORD) HIGH ORDER POSITION | LENGTH | CHARACTERISTIC | DECIMALS—CHAR | OPERATION—MASK | OUTPUT (AUDASSIST RECORD) TYPE | NUMBER | LENGTH | CHARACTERISTIC | DECIMALS—CHAR | TYPE | DATE MM | DD | YY | INPUT CHARACTERISTICS INPUT TYPE | NUMBER OF VOLUMES | LABELS | EOF ID | RECORD TYPE | RECORD LENGTH | BLOCK LENGTH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Q1 | IPT | | | | | | FAC | Ø4 | | | | | DAT | 1Ø | 17 | 69 | T | Ø1 | Y | I | F | 275 | 1375 |
| 1 | Q2 | DCV | 156 | | Ø9 | C | Z | FAC | Q1 | 1Q | C | Z | | | | | | | | | | | | |
| 1 | Q3 | DCV | 197 | | Ø4 | C | Z | FAC | Q2 | 1Q | C | Z | | | | | | | | | | | | |
| 1 | Q4 | DCV | | | | | X | FAC | Q3 | Q8 | P | 4 | | | | | | | | | | | | |
| 1 | Q5 | DCV | Ø52 | | Ø6 | Z | 2 | FAC | Q4 | 14 | P | 4 | | | | | | | | | | | | |
| 1 | Q6 | DCV | | | | | X | FAC | Q5 | 14 | P | 4 | | | | | | | | | | | | |
| 1 | Q7 | DCV | Ø4Ø | | Ø6 | Z | 2 | FAC | Q6 | 1Q | P | 4 | | | | | | | | | | | | |
| 1 | Q8 | DCV | Ø33 | | Ø2 | Z | Ø | FAC | Q7 | Q5 | P | 4 | | | | | | | | | | | | |
| 1 | Q9 | DCV | Ø62 | | Ø1 | C | Z | FAC | Q8 | Q5 | C | Z | | | | | | | | | | | | |
| 1 | 1Q | DCV | 152 | | Ø1 | C | Z | FAC | Q9 | Q2 | C | Z | | | | | | | | | | | | |
| 1 | 11 | DCV | Ø15 | | Ø2 | C | Z | FAC | 1Q | Q2 | C | Z | | | | | | | | | | | | |
| 1 | 12 | DCV | Ø18 | | Ø7 | C | Z | FAC | 11 | 2Q | C | Z | | | | | | | | | | | | |
| 1 | 13 | DCV | | | | | X | FAC | 12 | 2Q | C | Z | | | | | | | | | | | | |
| 1 | 14 | DCV | | | | | X | FAC | 13 | 2Q | C | Z | | | | | | | | | | | | |
| 1 | 15 | DCV | | | | | X | FAC | 14 | 2Q | C | Z | | | | | | | | | | | | |
| 1 | 16 | DCV | | | | | X | FAC | 15 | Q5 | C | Z | | | | | | | | | | | | |
| 1 | 17 | DCV | | | | | X | FAC | 16 | 15 | C | Z | | | | | | | | | | | | |
| 1 | 18 | SEL | Ø17 | | Ø1 | C | Z | I | | | | | | | | | A | | | | | | | |
| 1 | 19 | END | | | | | | | | | | | | | | | | | | | | | | |

CONTROL FIELD

CHARACTER FIELD

DATE FIELD

NUMERIC FIELDS

CHARACTER FIELDS

← SELECTION KONSTANT—CHAR

COMMENTS

ALEXANDER GRANT & CO.

# APPENDIX IVd

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION SAMPLE - CURRENT AWARDS - STATION 01

| PREPARED | DATE | INDEX |
|---|---|---|
| REVIEWED | DATE | |

**AUDASSIST CODING FORM — PROCESSING PHASE**

| CARD CODE | INSTRUCTION NUMBER | INSTRUCTION MNEMONIC | OPERAND 1 TYPE | OPERAND 1 NUMBER | OPERAND 1 POSITION | OPERAND 1 LENGTH | OPERATION/MASK | OPERAND 2 TYPE | OPERAND 2 NUMBER | OPERAND 2 POSITION | OPERAND 2 STARTING RANDOM NUMBER / KONSTANT (4 DECIMALS) | OPERAND 3 TYPE | OPERAND 3 NUMBER | OPERAND 3 POSITION | NEXT INST. IF = OR YES | NEXT INST. IF ≠ OR NO | MISCELLANEOUS INSTRUCTION REQUIREMENTS: SAMPLING INTERVAL N | FIRST SELECTION | BASE DATE | DATES ELIMINATED | STRATIFICATION LIMIT ONE (4 DECIMALS) | STRATIFICATION LIMIT TWO (4 DECIMALS) | STRATIFICATION LIMIT THREE (4 DECIMALS) | STRATIFICATION LIMIT FOUR (4 DECIMALS) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 01 | GET | FAC | 04 | | | | | | | | | | | | | | | | | | | | | |
| 2 | 02 | SAM | RCT | 000 | | | | | | | | | | | | | | 00025 | 00021 | | | | | | |
| 2 | 03 | TST | | | | | Y | TAG | 02 | | | | | | 041 | | | | | | | | | | |
| 2 | 04 | CAL | ACM | 01 | 01 | | A | KON | 00 | 0001 | 0000 | ACM | 01 | 01 | | | | | | | | | | | |
| 2 | 05 | CAL | FAC | 05 | | | A | ACM | 01 | 01 | | FAC | 05 | | | | | | | | | | | | |
| 2 | 06 | STR | FAC | 04 | | | | | | | | ACM | 02 | ** | | | | | | | | | | | |
| 2 | 07 | SAM | RCT | 02 | 00 | | | N | | | | | | | | | | 00005 | 00004 | | | | | | |
| 2 | 08 | TST | | | | | Y | TAG | 07 | | | | | | 091 | 0 | | | | | | | | | |
| 2 | 09 | PUT | | | | | 1 | | | | | | | | 11 | | | | | | | | | | |
| 2 | 10 | PUT | | | | | 2 | | | | | | | | 11 | | | | | | | | | | |
| 2 | 11 | END | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |

ALEXANDER GRANT & CO.

# APPENDIX IVd

CLIENT: GENERAL ACCOUNTING OFFICE

APPPLICATION: SAMPLE - CURRENT AWARDS - STATION #1

| PREPARED | DATE | INDEX |
|---|---|---|
| REVIEWED | DATE | |

## AUDASSIST CODING FORM – OUTPUT PHASE

| STANDARD SECTION | | | OPERAND 1 | | | OPERATION/MASK | OPERAND 2 | | | OPERAND 3 | | DATE | | | MISCELLANEOUS INSTRUCTION REQUIREMENTS | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CARD CODE | INSTRUCTION NUMBER | INSTRUCTION MNEMONIC | TYPE | NUMBER | | | TYPE | NUMBER | | TYPE | | MM | DD | YY | TOP HEADINGS AND CONFIRMATION INSERT | | | | |
| | | | | | | | | | | | | | | | STRATIFICATION | | | | |
| | | | | | | | | | | | | | | | LEFT HEADING (FAC 01) | LEFT HEADING (FAC 11) | | LEFT HEADING (FAC 02) | |
| | | | | | | | | | | | | | | | RIGHT HEADING (STRATA 01) | RIGHT HEADING (STRATA 02) | RIGHT HEADING (STRATA 03) | RIGHT HEADING (STRATA 04) | |
| | | | | | | | | | | | | | | | LIMIT ONE | LIMIT TWO | LIMIT THREE | LIMIT FOUR | |
| 1-10 | | | | | 11-20 | | | | 21-30 | | 31-40 | | | | 41-50 | 51-60 | 61-70 | 71-80 | |
| 9 | 01 | CLP | GRP | | | D | | | | | | | | | | | | | |
| 9 | 02 | GEN | | | | T | HDG | 01 | | DAT | 1/1/76 | | | | SAMPLE TYPE A CASES VA STA 01 | | | | |
| 9 | 03 | GEN | FAC | 01 | (C) | | FLD | 02 | | | | | | | FILE NR | | | | |
| 9 | 04 | GEN | FAC | 11 | (C) | | FLD | 03 | | | | | | | PERSON ENTITLED | | | | |
| 9 | 05 | GEN | FAC | 02 | (C) | | FLD | 04 | | | | | | | SCHOOL | | | | |
| 9 | 06 | GEN | FAC | 03 | (S) | X | FLD | 05 | | | | | | | | | | | |
| 9 | 07 | GEN | FAC | 04 | (N) | 2 | FLD | 06 | | | | | | | CHECK AMOUNT | | | | |
| 9 | 08 | GEN | FAC | 06 | (N) | 2 | FLD | 07 | | | | | | | NET AWARD | | | | |
| 9 | 09 | GEN | FAC | 07 | (N) | | FLD | 08 | | | | | | | STA | | | | |
| 9 | 10 | GEN | FAC | 08 | (C) | | FLD | 09 | | | | | | | D STA | | | | |
| 9 | 11 | GEN | FAC | 09 | (C) | | FLD | 10 | | | | | | | TT | | | | |
| 9 | 12 | GEN | FAC | 10 | (C) | | FLD | 11 | | | | | | | PM | | | | |
| 9 | 13 | GEN | AGE | | (N) | X | FLD | 12 | | | | | | | | | | | |
| 9 | 14 | GEN | FAC | 05 | (N) | 0 | FLD | 13 | | | | | | | SAM SEQUENCE | | | | |
| 9 | 15 | END | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| 8 | 01 | CLP | | | | | | | | | | | | | | | | | |
| 8 | 02 | HDG | STP | | | T | LIN | 01 | | DAT | | | | | | | | | |
| 8 | 03 | HDG | STP | | | L | LIN | 01 | | | | | | | | | | | |
| 8 | 04 | HDG | STP | | | R | LIN | 01 | | | | | | | | | | | |
| 8 | 05 | STP | | | | | FAC | 04 | | | | | | | | | | | |
| 8 | 06 | END | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| 7 | 01 | CFM | GRP | | | | OPT | | | DAT | | | | | | | | | |
| 7 | 01 | CFM | GRP | | | | OPT | | | DAT | | | | | | | | | |
| 7 | 01 | CFM | GRP | | | | OPT | | | DAT | | | | | | | | | |
| 7 | 01 | CFM | GRP | | | | OPT | | | DAT | | | | | | | | | |
| 7 | 01 | CFM | GRP | | | | OPT | | | DAT | | | | | | | | | |

ALEXANDER GRANT & CO

# APPENDIX IVd

**SAMPLE PRINTOUT-- DATA CONVERSION PHASE**

ALEXANDER GRANT & COMPANY
OFFICE NUMBER
AUDASSIST

AUDIT DATE - 10/17/69
RUN DATE - 10/21/69

DATA CONVERT PHASE PARAMETER CARD EDIT AND RUN TOTALS LISTING
SAMPLE TYPE A CASES V4 STA 01

| ---STD---- C INS C # | MNE | --OPER 1--- POS | LN | C D H P | M S K | ---OPER 2---- TYP | # | LN | C D H P | ---OPER 3--- TYP | MM | DD | YY | -SEL-- KOD | IPT TYP | # OF VOL | L B L | ECF TYP | RCD TYP | RCD LGTH | BLK LGTH | RECORDS IN ERROR INPUT | OUTPUT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 01 | IPT | | | | | FAC | 04 | | | DAT | 10 | 17 | 69 | | T | 01 | Y | I | F | 275 | 1375 | | |
| 1 02 | DCV | 006 | 09 | C Z | | FAC | 01 | 10 | C Z | | | | | | | | | | | | | | |
| 1 03 | DCV | 197 | 04 | C Z | | FAC | 02 | 10 | C Z | | | | | | | | | | | | | | |
| 1 04 | DCV | | | | X | FAC | 03 | 08 | P 4 | | | | | | | | | | | | | | |
| 1 05 | DCV | 052 | 06 | Z Z | | FAC | 04 | 14 | P 4 | | | | | | | | | | | | | | |
| 1 06 | DCV | | | | X | FAC | 05 | 14 | P 4 | | | | | | | | | | | | | | |
| 1 07 | DCV | 040 | 06 | Z Z | | FAC | 06 | 10 | P 4 | | | | | | | | | | | | | | |
| 1 08 | DCV | 033 | 02 | Z O | | FAC | 07 | 05 | C Z | | | | | | | | | | | | | | |
| 1 09 | DCV | 062 | 01 | C Z | | FAC | 08 | 05 | C Z | | | | | | | | | | | | | | |
| 1 10 | DCV | 152 | 01 | C Z | | FAC | 09 | 02 | C Z | | | | | | | | | | | | | | |
| 1 11 | DCV | 015 | 02 | C Z | | FAC | 10 | 02 | C Z | | | | | | | | | | | | | | |
| 1 12 | DCV | 018 | 07 | C Z | | FAC | 11 | 40 | C Z | | | | | | | | | | | | | | |
| 1 13 | DCV | | | | X | FAC | 12 | 20 | C Z | | | | | | | | | | | | | | |
| 1 14 | DCV | | | | X | FAC | 13 | 20 | C Z | | | | | | | | | | | | | | |
| 1 15 | DCV | | | | X | FAC | 14 | 20 | C Z | | | | | | | | | | | | | | |
| 1 16 | DCV | | | | X | FAC | 15 | 05 | C Z | | | | | | | | | | | | | | |
| 1 17 | DCV | | | | X | FAC | 16 | 15 | C Z | | | | | | | | | | | | | | |
| 1 18 | SCL | 017 | 01 | C Z | 1 | | | | | | | | | | | | | | | | | | |
| 1 19 | FIN | | | | | | | | | | | | | | | | | | | | | | |

NO FATAL ERRORS FOUND

# APPENDIX IVd

```
                                        ALEXANDER GRANT & COMPANY
AUDIT DATE - 10/17/69                        OFFICE NUMBER
RUN DATE   - 10/21/69                          AUDASSIST
                              DATA CONVERT PHASE PARAMETER CARD EDIT AND RUN TOTALS LISTING
                                        SAMPLE TYPE A CASES VA STA DL

---STD----  --OPER 1---  N  ---OPER 2----  ---OPER 3---                 #  L                          RECORDS
C INS              C O  S            C O                  -SEL-  IPT OF  B EOF RCD RCD  BLK            IN ERROR
C  #   MNC  POS  LN H P  K  TYP  A LN H P  TYP MM DD YY   KCN   TYP VDL L TYP TYP LGTH LGTH   INPUT OUTPUT
-------------------------------------------------------------------------------------------------------------------

                                                                                                  **NONE**
-------------------------------------------------------------------------------------------------------------------

                                        DATA CONVERT PHASE CONTROL TOTAL ACCUMULATIONS

                                        TOTAL RECORDS IN                          39,490
                                        TOTAL RECORDS OUT                         12,881 *

                                        CONTROL TOTAL AMOUNTS

                                              INPUT                1,025,092.9700
                                              OUTPUT               1,004,994.2100

THIS AUDASSIST JOB IS ABOUT TO BE COMPLETED, MANUALLY UNLOAD ANY TAPES THAT ARE TO BE SAVED.
ANSWER FOR TO CONTINUE
```

* = A TYPE RECORDS

# APPENDIX IVd

**SAMPLE PRINTOUT-- PROCESSING PHASE**
ALEXANDER GRANT & COMPANY
OFFICE NUMBER
AUDASSIST
PROCESSING PHASE ACCUMULATOR TOTALS LISTING
SAMPLE TYPE A CASES VA STA 01

RUN DATE - 10/21/69

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 01---+ |
|---|---|
| ACM 01 | 515.0000 |
| RCT | 0 |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 0 |

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 02---+ |
|---|---|
| ACM 01 | .0000 |
| RCT | 515 * |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 515 |

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 03---+ |
|---|---|
| ACM 01 | .0000 |
| RCT | 0 |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 0 |

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 04---+ |
|---|---|
| ACM 01 | .0000 |
| RCT | 0 |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 0 |

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 05---+ |
|---|---|
| ACM 01 | .0000 |
| RCT | 0 |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 0 |

+----ACCUMULATOR DESCRIPTIONS----+

| +--POSITION--+ | +----BLOCK 06---+ |
|---|---|
| ACM 01 | .0000 |
| RCT | 0 |
| ACM 02 | .0000 |
| RCT | 0 |
| ACM 03 | .0000 |
| RCT | 0 |
| ACM 04 | .0000 |
| RCT | 0 |
| ACM 05 | .0000 |
| RCT | 0 |
| BLK ACM TOT | .0000 |
| BLK RCT TOT | 0 |

* = COUNTER FOR SELECTING PRELIMINARY SAMPLE.

# APPENDIX IVd

RUN DATE - 10/21/69

ALEXANDER GRANT & COMPANY
OFFICE NUMBER
AUDASSIST
PROCESSING PHASE ACCUMULATOR TOTALS LISTING
SAMPLE TYPE A CASES VA STA 01

PROCESSING PHASE CONTROL TOTAL ACCUMULATIONS

| | |
|---|---|
| TOTAL RECORDS IN | 12,881 * |
| TOTAL RECORDS OUT | 515 |
| TOTAL ERROR RECORDS | 0 |

CONTROL TOTAL AMOUNTS

| | |
|---|---|
| INPUT | 1,004,994.2100 |
| OUTPUT | 39,350.3300 |
| ERRORS | .0000 |

* = COUNTER FOR SELECTING MAXIMUM SAMPLE

# APPENDIX IVd

SAMPLE PRINTOUT - OUTPUT PHASE
AUDASSIST
GENERAL LISTING
SAMPLE TYPE A CASES VA STA 01
SAMPLE TYPE A CASES VA STA 01

AUDIT DATE - 10/17/69
RUN DATE --- 10/24/69

| G | FILE NR | PERSON ENTITLED | SCHOOL | CHECK AMOUNT | NET AWARD | STA | | P STA | TT | PN | SAM SEQUENCE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 96 089918 | | 0003 | 130.00 | 130.00 | 01 | ¤ | G | B | 43 | 494. |
| 1 | 10 238513 | | 0005 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 49. |
| 1 | 75 238551 | | 0005 | 185.00 | 185.00 | 01 | ¤ | G | A | 00 | 389. |
| 1 | 80 230361 | | 0005 | 142.00 | 142.00 | 01 | ¤ | G | A | 00 | 414. |
| 1 | 04 233256 | | 0006 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 19. |
| 1 | 39 235755 | | 0006 | 59.98 | 59.98 | 01 | ¤ | G | B | 00 | 204. |
| 1 | 30 246541 | | 0007 | 6.80 | 6.80 | 01 | ¤ | G | E | 00 | 159. |
| 1 | 63 246563 | | 0007 | 9.24 | 9.24 | 01 | ¤ | G | E | 00 | 329. |
| 1 | 46 228007 | | 0008 | 48.15 | 48.15 | 01 | ¤ | G | B | 00 | 239. |
| 1 | 19 147623 | | 0012 | 19.73 | 19.73 | 01 | ¤ | G | E | 00 | 94. |
| 1 | 27 046393 | | 0013 | 130.00 | 130.00 | 01 | ¤ | G | B | 41 | 139. |
| 1 | 03 228104 | | 0015 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 14. |
| 1 | 32 242713 | | 0015 | 155.00 | 155.00 | 01 | ¤ | G | A | 00 | 169. |
| 1 | 84 228069 | | 0015 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 434. |
| 1 | 93 061960 | | 0015 | 130.00 | 130.00 | 01 | ¤ | G | B | 41 | 479. |
| 1 | 45 228014 | | 0025 | 195.00 | 195.00 | 01 | ¤ | G | B | 00 | 234. |
| 1 | 81 228062 | | 0025 | 142.00 | 142.00 | 01 | ¤ | G | A | 00 | 419. |
| 1 | 20 246517 | | 0027 | 95.00 | 95.00 | 01 | ¤ | G | B | 00 | 104. |
| 1 | 96 246575 | | 0027 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 499. |
| 1 | 12 238501 | | 0031 | 4.86 | 4.86 | 01 | ¤ | G | E | 00 | 59. |
| 1 | 31 242737 | | 0031 | 7.44 | 7.44 | 01 | ¤ | G | E | 00 | 164. |
| 1 | 83 228045 | | 0031 | 8.85 | 8.85 | 01 | ¤ | G | E | 00 | 429. |
| 1 | 06 235770 | | 0034 | 100.00 | 100.00 | 01 | ¤ | G | G | 00 | 29. |
| 1 | 18 205631 | | 0034 | 40.00 | 40.00 | 01 | ¤ | G | K | 00 | 89. |
| 1 | 23 235774 | | 0034 | 30.00 | 30.00 | 01 | ¤ | G | K | 00 | 119. |
| 1 | 38 235760 | | 0034 | 30.00 | 30.00 | 01 | ¤ | G | K | 00 | 199. |
| 1 | 73 238553 | | 0034 | 60.00 | 60.00 | 01 | ¤ | G | B | 00 | 379. |
| 1 | 79 233781 | | 0034 | 85.00 | 85.00 | 01 | ¤ | G | B | 00 | 409. |
| 1 | 61 246503 | | 0035 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 319. |
| 1 | 88 218609 | | 0037 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 454. |
| 1 | 37 240420 | | 0038 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 194. |
| 1 | 91 251610 | | 0048 | 30.00 | 30.00 | 01 | ¤ | G | E | 00 | 474. |
| 1 | 08 235803 | | 0050 | 18.81 | 18.81 | 01 | ¤ | G | A | 00 | 39. |
| 1 | 24 233252 | | 0050 | 28.85 | 28.85 | 01 | ¤ | G | A | 00 | 124. |
| 1 | 25 227983 | | 0050 | 85.00 | 85.00 | 01 | ¤ | G | A | 00 | 129. |
| 1 | 62 246539 | | 0050 | 60.00 | 60.00 | 01 | ¤ | G | A | 00 | 324. |
| 1 | 67 246512 | | 0050 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 349. |
| 1 | 72 242715 | | 0051 | 40.00 | 40.00 | 01 | ¤ | G | K | 00 | 374. |
| 1 | 07 236712 | | 0054 | 45.96 | 45.96 | 01 | ¤ | G | F | 00 | 34. |
| 1 | 33 242724 | | 0058 | 40.00 | 40.00 | 01 | ¤ | G | K | 00 | 174. |
| 1 | 85 211509 | | 0069 | 39.75 | 39.75 | 01 | ¤ | G | E | 00 | 439. |
| 1 | 19 246534 | | 0090 | 30.00 | 30.00 | 01 | ¤ | G | E | 00 | 9[illegible]. |
| 1 | 11 235774 | | 0091 | 0.00 | 0.00 | 01 | ¤ | P | J | 00 | 54. |
| 1 | 42 228072 | | 0099 | 60.00 | 60.00 | 01 | ¤ | G | K | 00 | 219. |
| 1 | 47 228089 | | 0107 | 27.58 | 27.58 | 01 | ¤ | G | B | 00 | 244. |
| 1 | 21 242727 | | 0112 | 60.00 | 60.00 | 01 | ¤ | G | K | 00 | 109. |
| 1 | 82 228052 | | 0121 | 20.00 | 20.00 | 01 | ¤ | G | K | 00 | 424. |
| 1 | 53 246573 | | 0125 | 90.00 | 90.00 | 01 | ¤ | G | K | 00 | 279. |
| 1 | 58 246568 | | 0128 | 7.11 | 7.11 | 01 | ¤ | G | E | 00 | 304. |
| 1 | 57 246550 | | 0138 | 13.02 | 13.02 | 01 | ¤ | G | E | 00 | 299. |

# APPENDIX IVd

AUDASSIST
GENERAL LISTING
SAMPLE TYPE A CASES VA STA 01
SAMPLE TYPE A CASES VA STA 01

AUDIT DATE - 10/17/69
RUN DATE --- 10/24/69

| G | FILE NR | PERSON ENTITLED | SCHOOL | CHECK AMOUNT | NET AWARD | STA | | P STA | TT | PN | SAM SEQUENCE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 51 228053 | | 9008 | 9.22 | 9.22 | 01 | ¤ | G | E | 00 | 264. |
| 1 | 69 242721 | | 9044 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 359. |
| 1 | 68 246517 | | 9064 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 354. |
| GROUP CODE 1 | | TOTALS | | 7,645.12 | 7,930.12 | | | | | | |
| 2 | 09 233251 | | 0001 | 85.00 | 85.00 | 01 | ¤ | G | B | 00 | 43. |
| 2 | 12 242707 | | 0001 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 60. |
| 2 | 21 228005 | | 0001 | 90.00 | 90.00 | 01 | ¤ | G | B | 00 | 106. |
| 2 | 60 228017 | | 0001 | 60.00 | 60.00 | 01 | ¤ | G | B | 00 | 311. |
| 2 | 51 197341 | | 0002 | 130.00 | 130.00 | 01 | ¤ | D | B | 42 | 263. |
| 2 | 16 050749 | | 0005 | 130.00 | 130.00 | 01 | ¤ | G | B | 42 | 77. |
| 2 | 21 235741 | | 0005 | 175.00 | 175.00 | 01 | ¤ | G | A | 00 | 107. |
| 2 | 31 235767 | | 0005 | 185.00 | 185.00 | 01 | ¤ | G | A | 00 | 162. |
| 2 | 44 235756 | | 0005 | 130.00 | 130.00 | 01 | ¤ | G | A | 00 | 230. |
| 2 | 61 227999 | | 0005 | 115.00 | 115.00 | 01 | ¤ | G | B | 00 | 316. |
| 2 | 68 235781 | | 0005 | 60.00 | 60.00 | 01 | ¤ | G | B | 00 | 352. |
| 2 | 71 218578 | | 0005 | 60.00 | 60.00 | 01 | ¤ | G | B | 00 | 366. |
| 2 | 17 238511 | | 0006 | 58.02 | 58.02 | 01 | ¤ | G | A | 00 | 85. |
| 2 | 25 234447 | | 0006 | 155.00 | 155.00 | 01 | ¤ | G | A | 00 | 130. |
| 2 | 35 238563 | | 0006 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 183. |
| 2 | 37 246573 | | 0006 | 185.00 | 185.00 | 01 | ¤ | G | A | 00 | 196. |
| 2 | 53 233379 | | 0006 | 30.00 | 30.00 | 01 | ¤ | G | A | 00 | 276. |
| 2 | 67 235745 | | 0006 | 56.06 | 56.06 | 01 | ¤ | G | A | 00 | 347. |
| 2 | 72 237787 | | 0006 | 130.00 | 130.00 | 01 | ¤ | G | B | 00 | 373. |
| 2 | 79 228035 | | 0006 | 60.00 | 60.00 | 01 | ¤ | G | B | 00 | 408. |
| 2 | 82 241378 | | 0006 | 130.00 | 130.00 | 01 | ¤ | G | A | 00 | 426. |
| 2 | 84 246544 | | 0006 | 59.98 | 59.98 | 01 | ¤ | G | B | 00 | 438. |
| 2 | 90 243958 | | 0006 | 60.00 | 60.00 | 01 | ¤ | G | A | 00 | 468. |
| 2 | 99 246564 | | 0006 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 515. |
| 2 | 09 246543 | | 0007 | 6.80 | 6.80 | 01 | ¤ | G | E | 00 | 46. |
| 2 | 11 242727 | | 0007 | 5.05 | 5.05 | 01 | ¤ | G | E | 00 | 56. |
| 2 | 21 246555 | | 0007 | 6.50 | 6.50 | 01 | ¤ | G | E | 00 | 110. |
| 2 | 44 052973 | | 0007 | 4.66 | 4.66 | 01 | ¤ | G | E | 00 | 228. |
| 2 | 46 238490 | | 0007 | 4.66 | 4.66 | 01 | ¤ | G | E | 00 | 240. |
| 2 | 71 235772 | | 0007 | 4.66 | 4.66 | 01 | ¤ | G | E | 00 | 368. |
| 2 | 73 228078 | | 0007 | 5.05 | 5.05 | 01 | ¤ | G | E | 00 | 377. |
| 2 | 92 246528 | | 0007 | 5.97 | 5.97 | 01 | ¤ | G | E | 00 | 478. |
| 2 | 93 238538 | | 0007 | 4.66 | 4.66 | 01 | ¤ | G | E | 00 | 482. |
| 2 | 43 228008 | | 0012 | 6.00 | 6.00 | 01 | ¤ | G | E | 00 | 223. |
| 2 | 18 233249 | | 0015 | 4.89 | 4.89 | 01 | ¤ | G | D | 00 | 90. |
| 2 | 33 232379 | | 0015 | 130.00 | 130.00 | 01 | ¤ | G | A | 00 | 172. |
| 2 | 34 235185 | | 0015 | 155.00 | 155.00 | 01 | ¤ | G | A | 00 | 177. |
| 2 | 39 240589 | | 0015 | 175.00 | 175.00 | 01 | ¤ | G | A | 00 | 205. |
| 2 | 40 239354 | | 0015 | 130.00 | 130.00 | 01 | ¤ | G | A | 00 | 210. |
| 2 | 46 143239 | | 0015 | 3.94 | 3.94 | 01 | ¤ | G | E | 00 | 238. |
| 2 | 66 238493 | | 0015 | 8.03 | 8.03 | 01 | ¤ | G | E | 00 | 342. |
| 2 | 78 240835 | | 0015 | 155.00 | 155.00 | 01 | ¤ | G | B | 00 | 405. |
| 2 | 81 241271 | | 0015 | 185.00 | 185.00 | 01 | ¤ | G | A | 00 | 421. |

# APPENDIX IVd

AUDASSIST
GENERAL LISTING
SAMPLE TYPE A CASES VA STA 01
SAMPLE TYPE A CASES VA STA 01

AUDIT DATE - 10/17/69
RUN DATE --- 10/24/69

| G | FILE NR | PERSON ENTITLED | SCHOOL | CHECK AMOUNT | NET AWARD | STA | P STA | TT | PN | SAM SEQUENCE |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 33 246539 | | 8131 | 130.00 | 130.00 | 01 | G | B | 00 | 175. |
| 2 | 07 246534 | | 9005 | 7.99 | 7.99 | 01 | G | E | 00 | 36. |
| 2 | 19 242726 | | 9005 | 6.22 | 6.22 | 01 | G | E | 00 | 98. |
| 2 | 22 235755 | | 9005 | 6.22 | 6.22 | 01 | G | E | 00 | 113. |
| 2 | 48 192555 | | 9005 | 7.99 | 7.99 | 01 | G | E | 00 | 248. |
| 2 | 56 235782 | | 9005 | 6.22 | 6.22 | 01 | G | E | 00 | 291. |
| 2 | 03 200445 | | 9008 | 6.22 | 6.22 | 01 | G | E | 00 | 13. |
| 2 | 08 192575 | | 9008 | 10.72 | 10.72 | 01 | G | E | 00 | 37. |
| 2 | 18 242723 | | 9008 | 10.72 | 10.72 | 01 | G | E | 00 | 92. |
| 2 | 32 246548 | | 9008 | 6.22 | 6.22 | 01 | G | E | 00 | 170. |
| 2 | 58 242748 | | 9008 | 3.16 | 3.16 | 01 | G | E | 00 | 303. |
| 2 | 85 246562 | | 9008 | 10.72 | 10.72 | 01 | G | E | 00 | 443. |
| 2 | 94 233254 | | 9032 | 185.00 | 185.00 | 01 | G | A | 00 | 486. |
| 2 | 01 242687 | | 9044 | 130.00 | 130.00 | 01 | 0 | B | 00 | 7. |
| 2 | 05 228018 | | 9054 | 95.00 | 95.00 | 01 | G | B | 00 | 23. |
| 2 | 83 235739 | | 9064 | 130.00 | 130.00 | 01 | G | B | 00 | 430. |
| 2 | 95 242692 | | 9064 | 130.00 | 130.00 | 01 | G | B | 00 | 492. |
| 2 | 66 239414 | | 9084 | 155.00 | 155.00 | 01 | G | B | 00 | 343. |
| 2 | 12 228024 | | 9101 | 155.00 | 155.00 | 01 | G | B | 00 | 58. |

GROUP CODE 2 TOTALS

31,705.21 31,734.32

FINAL TOTALS

39,350.33 39,664.44

# APPENDIX IVd

AUDASSIST
GENERAL LISTING
SAMPLE TYPE A CASES VA STA 01
SAMPLE TYPE A CASES VA STA 01

AUDIT DATE - 10/17/69
RUN DATE --- 10/24/69

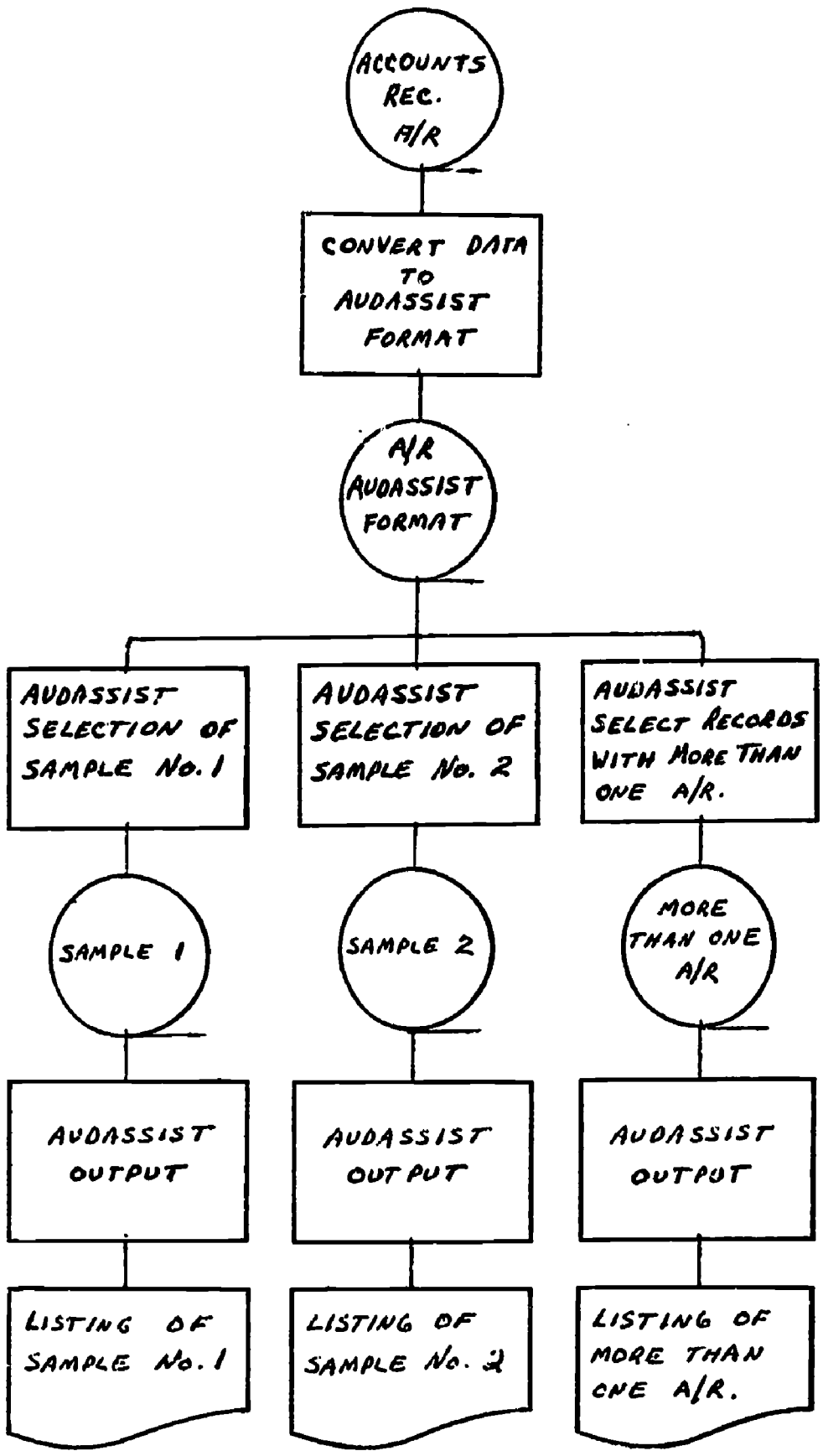
| G | FILE NR | PERSON ENTITLED | SCHOOL | CHECK AMOUNT | NET AWARD | STA | P STA | TT | PN | SAM SEQUENCE |
|---|---|---|---|---|---|---|---|---|---|---|

GENERAL LISTING TOTAL RECORDS IN 515
GENERAL LISTING TOTAL RECORDS SELECTED 515

*** AN -*- INDICATES THAT THE PRINT AREA WAS TOO SMALL TO PRINT ALL SIGNIFICANT DIGITS IN THE FACTOR PRINTED

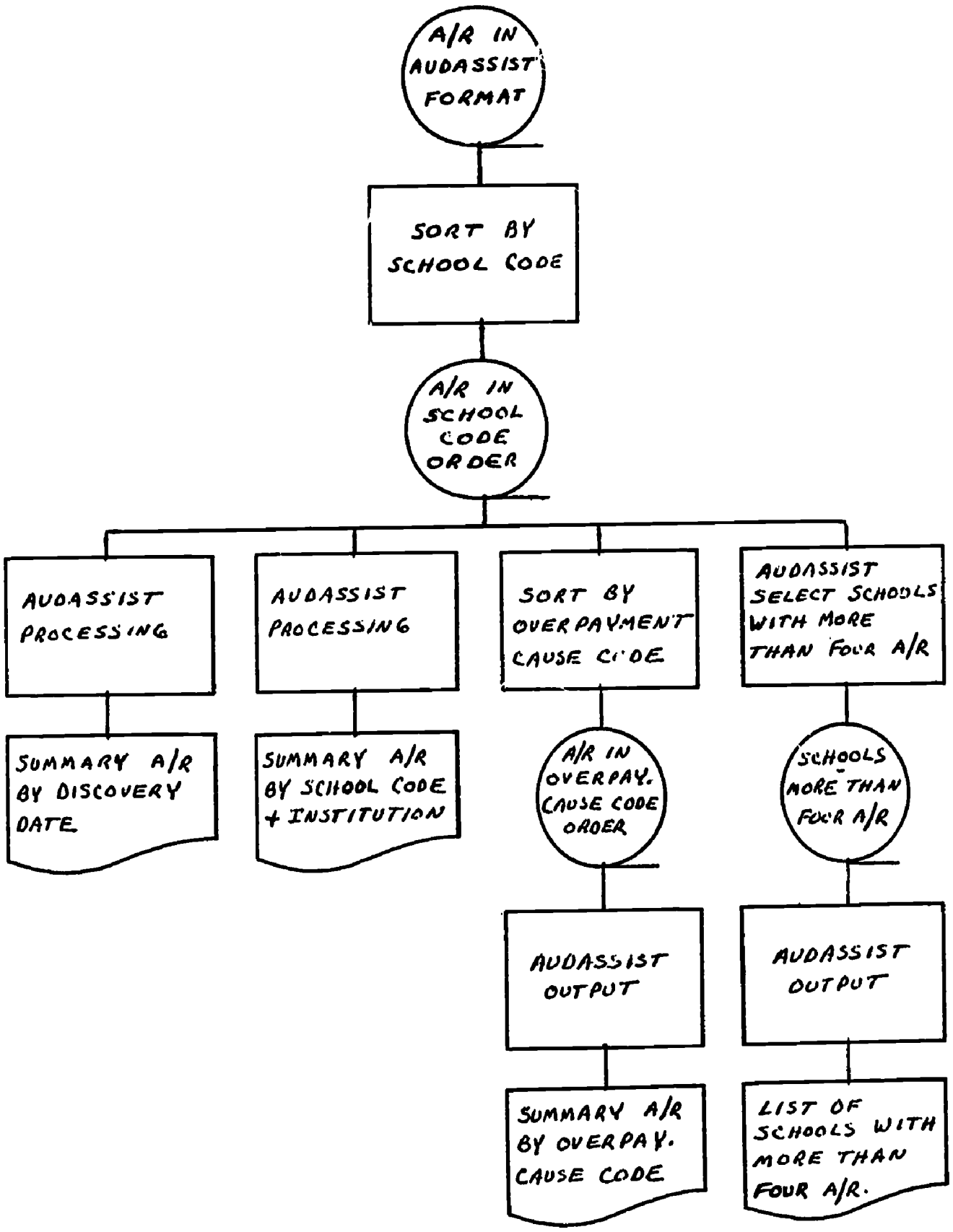
APPENDIX IVe

FLOW CHART--SAMPLE SELECTION OF ACCOUNTS RECEIVABLE



APPENDIX IVf

FLOW CHART--ANALYSES OF ACCOUNTS RECEIVABLE

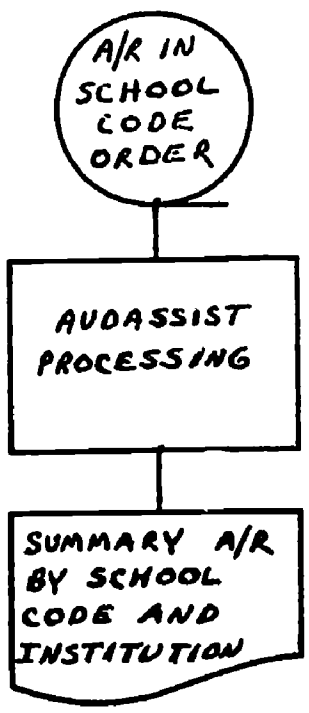


APPENDIX IVg

## DOCUMENTATION--ANALYSIS OF ACCOUNTS RECEIVABLE BY SCHOOL CODE AND TYPE OF TRAINING INSTITUTION

APPENDIX IVg

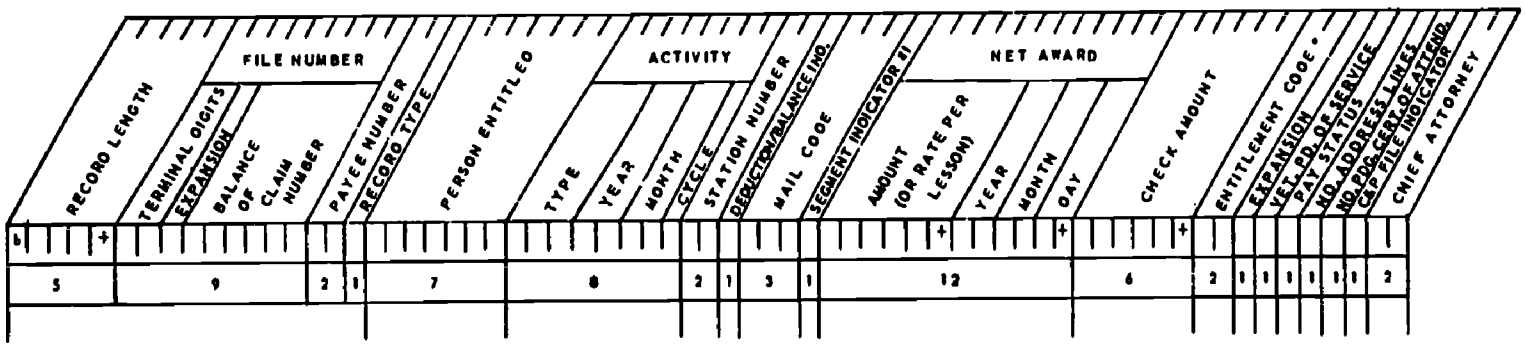
FLOW CHART--ANALYSIS OF ACCOUNTS
RECEIVABLE BY SCHOOL CODE
AND TYPE OF TRAINING INSTITUTION

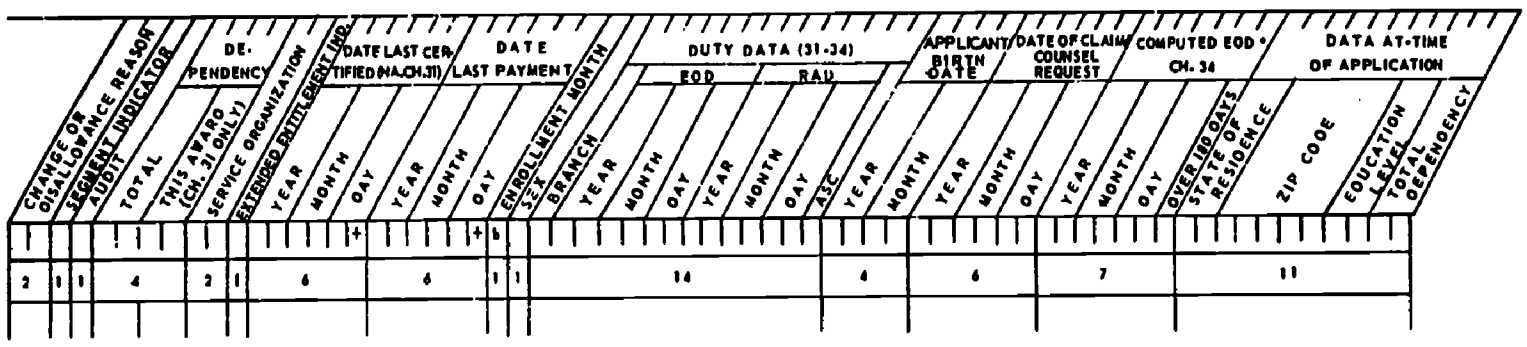


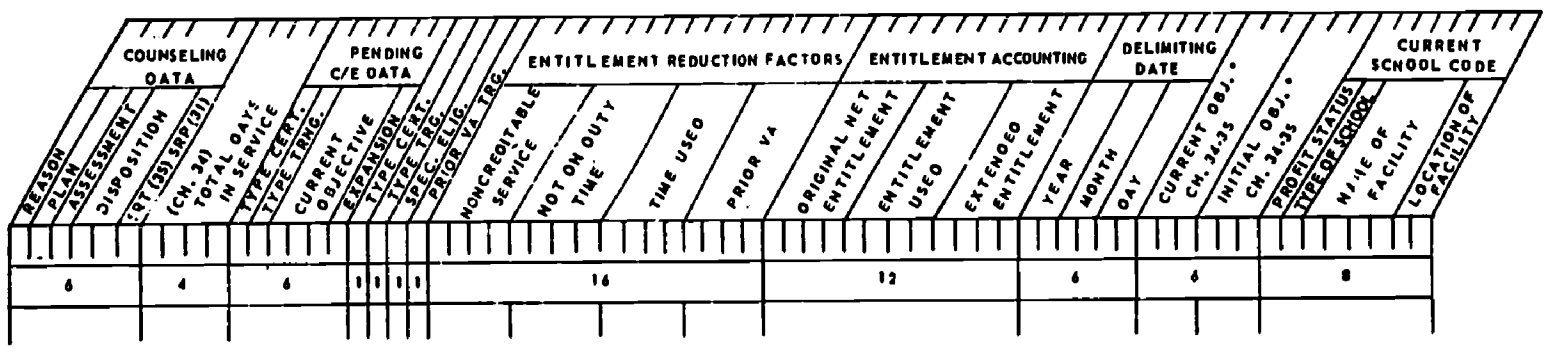

(Part of flow chart in Appendix IVf)

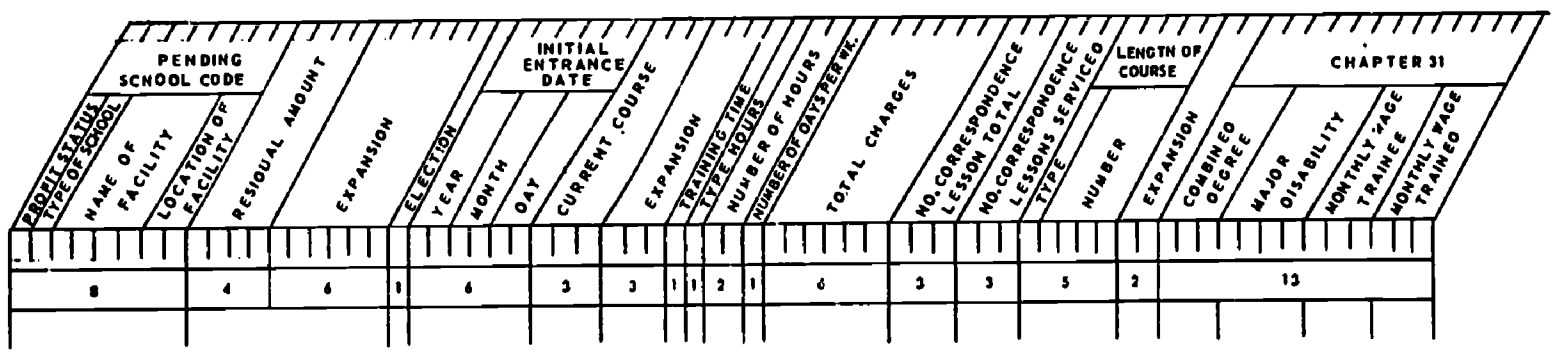
APPENDIX IVg

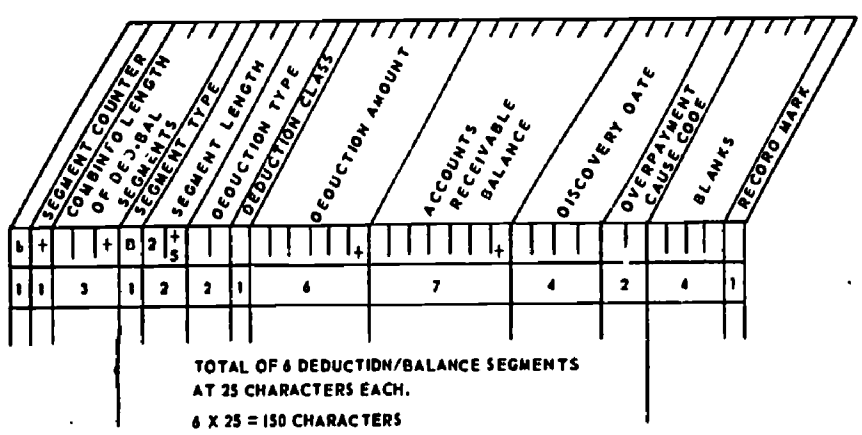
## LAYOUT OF INPUT RECORDS




TOTAL OF 6 DEDUCTION/BALANCE SEGMENTS AT 25 CHARACTERS EACH.

6 X 25 = 150 CHARACTERS

**RECORD LENGTH:**

SEGMENTS ..... 270

DEDUCTION/BALANCE SEGMENT:

CONTROL FIELD ..... 5

SIX SEGMENTS AT 25 CHARACTERS EACH..... 150 155

BLANKS AND RECORD MARK ..... 5

TOTAL ..... 430

# APPENDIX IVg

INPUT-- OUTPUT COORDINATOR

| AUDASSIST USER'S FIELD IDENTIFICATION | USER INPUT RECORD | | | AUDASSIST RECORD | | | AUDASSIST OUTPUT | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | GENERAL LISTING FIELD NUMBER | STRATIFICATION LISTING FIELD NUMBER | CONFIRMATIONS | | | | |
| | HIGH ORDER POSITION | LENGTH | | FACTOR NUMBER | | LENGTH | | | OPTION 01 ENCLOSED STATEMENT (LINE NO.) | OPTION 02 FOLLOWING BALANCE (LINE NO.) | OPTION 03 FOLLOWING INVOICE (LINE NO.) | OPTION 04 - FOLLOWING STATEMENT (LINE NO.) | COLUMN NO |
| GROUP CODE | | | | GRP | C | 1 | 1 | 1 | 39 | 39 | 39 | 59 | |
| OVERPAYMENT CAUSE | 299 | ϕ2 | Zϕ | FAC01 | C | 10 | 2 | 2 | 26 | 26 | 26 | 46 | |
| FILE NR. | ϕϕ6 | ϕ9 | CZ | FAC11 | C | 20 | 3 | 3 | 34 | 34 | 34 | 54 | |
| RECORD TYPE | ϕ17 | ϕ1 | CZ | FAC02 | C | 10 | 4 | 4 | | | 27 | | 1 |
| | | | | FAC03 | DATE | 8 | 5 | | | | | | 2 |
| A/R BALANCE (No. 1) | 288 | ϕ7 | Z2 | FAC04 | N | 14 | 6 | 5,6,7,8,or9 see also age | 30 | 30 | 30 | | 4 |
| | | | | FAC06 | N | 10 | 7 | | | | | | |
| DISCOVERY DATE (A/R 1) | 295 | ϕ4 | Zϕ | FAC07 | N | 5 | 8 | | | | | | |
| SCHOOL CODE | 197 | ϕ4 | CZ | FAC08 | C | 5 | 9 | | | | | | |
| | | | | FAC09 | C | 2 | 10 | | | | | | |
| | | | | FAC10 | C | 2 | 11 | | | | | | |
| CALCULATED AGE | | | | AGE | N | 4 | 12 | 5,6,7,8,or9 (see also FAC04) | | | | | |
| FACILITY TYPE | 196 | ϕ1 | Zϕ | FAC05 | N | 14 | 13 | | | (Optional) 31 | | | |
| | | | | FAC12 | C | 20 | | | 35 | 35 | 35 | 55 | |
| | | | | FAC13 | C | 20 | | | 36 | 36 | 36 | 56 | |
| | | | | FAC14 | C | 20 | | | 37 | 37 | 37 | 57 | |
| | | | | FAC15 | C | 5 | | | | | | | |
| | | | | FAC16 | C | 15 | | | | | (Optional) 28 | | 3 |

ALEXANDER GRANT & CO. 10-7-68

INPUT-OUTPUT COORDINATOR

APPENDIX IVg

## AUDASSIST FLOWCHART

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION ANALYSIS OF RECEIVABLES BY SCHOOL CODE AND TYPE OF TRAINING INSTITUTION

| INST. # | FLOWCHART | NOTES |
|---|---|---|
| Ø1 | GET | READ RECORD ACCUMULATE FAC Ø4 (A/R BALANCE) AND RECORD COUNT |
| Ø2 | CLB (Y / No) | CONTROL BREAK ON FAC Ø8 (SCHOOL CODE) Y → Ø3 N → Ø6 |
| Ø3 | STR | STRATIFY COUNT OF RECEIVABLES (ACM Ø1Ø5) & ACCUMULATE SCHOOL A/R BALANCE (ACM Ø1Ø4) IN ACM Ø2 ** |
| Ø4 | CAL | CLEAR ACCUMULATOR BLOCK Ø1 (ACM Ø1 **) FOR ACCUMULATIONS ON NEW SCHOOL CODE. |
| Ø5 | EXT | EXIT CLB ROUTINE |
| Ø6 | CAL | ADD A/R BALANCES TO GET SCHOOL TOTAL FAC Ø4 + ACM Ø1Ø4 = ACM Ø1Ø4 |
| Ø7 | CAL | ADD NR. OF RECEIVABLE ITEMS TO GET SCHOOL TOTAL ACM Ø1Ø5 + 1 = ACM Ø1Ø5 |
| Ø8 | STR | STR. A/R BAL. (FAC Ø4) BY TYPE SCHOOL (FAC Ø5) IN ACM Ø4 ** ≥9 ≥8 ≥7 ≥6 <6 |
| | Ø9 | |

ALEXANDER GRANT & CO.

REV. 9-12-68

## AUDASSIST FLOWCHART

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION ANALYSIS OF RECEIVABLES BY SCHOOL CODE AND TYPE OF TRAINING INSTITUTION

| INST. # | FLOWCHART | NOTES |
|---|---|---|
| | Ø8 | |
| Ø9 | TST; No → 13; Y | TAG SET IN INSTRUCTION Ø8 '5'? Y → 1Ø N → 13 |
| 1Ø | STR | STR FAC Ø4 BY FAC Ø5 IN ACM Ø5 ** ≥5 ≥4 ≥3 ≥2 <2 |
| 11 | TST; No → 13; Y | TAG SET IN INSTRUCTION 1Ø '6'? Y → 12 N → 13 |
| 12 | STR | STR FAC Ø4 BY FAC Ø5 IN ACM Ø6 ** ≥1 <1 |
| 13 | END | |
| | | |
| | | |
| | | |

ALEXANDER GRANT & CO. REV. 9-12-68

# APPENDIX IVg

| PREPARED | DATE | INDEX |
|---|---|---|
| REVIEWED | DATE | |

CLIENT: GENERAL ACCOUNTING OFFICE

APPLICATION: ANALYSIS OF RECEIVABLES - SCHOOL CODE AND TYPE OF TRAINING INSTITUTION

**AUDASSIST CODING FORM — DATA CONVERSION PHASE & SPECIAL INFORMATION**

| | | | | | |
|---|---|---|---|---|---|
| 0 | 01 | OFF | | ← OFFICE NUMBER | AG & CO. STREET ADDRESS → |
| 0 | 02 | OFF | | ← OFFICE NUMBER | AG & CO. CITY, STATE & ZIP CODE → |
| 0 | 03 | CLT | | ← CLIENT NUMBER | CLIENT NAME → |

| CARD CODE | INSTRUCTION NUMBER | INSTRUCTION MNEMONIC | INPUT (CLIENT RECORD) HIGH ORDER POSITION | LENGTH | CHARACTERISTIC | DECIMALS/CHAR | OPERATION—MASK | OUTPUT (AUDASSIST RECORD) TYPE | NUMBER | LENGTH | CHARACTERISTIC | DECIMALS/CHAR | TITLE | DATE MM | DD | YY | INPUT CHARACTERISTICS INPUT TYPE | NUMBER OF VOLUMES | LABELS | EOF ID | RECORD TYPE | RECORD LENGTH | BLOCK LENGTH | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 01 | IPT | | | | | | FAC | 04 | | | | | DAT | 10 | 31 | 69 | T | 01 | Y | I | F | 30 | 2150 | | | | | | | |
| 1 | 02 | DCV | 299 | | 020 | | | FAC | 01 | 10 | C | Z | CONTROL FIELD | | | | | | | | | | | | | | | | | | |
| 1 | 03 | DCV | 017 | | 01 | C | Z | FAC | 02 | 10 | C | Z | CHARACTER FIELD | | | | | | | | | | | | | | | | | | |
| 1 | 04 | DCV | | | | | X | FAC | 03 | 08 | P | 4 | DATE FIELD | | | | | | | | | | | | | | | | | | |
| 1 | 05 | DCV | 288 | | 07 | Z | 2 | FAC | 04 | 14 | P | 4 | NUMERIC FIELDS | | | | | | | | | | | | | | | | | | |
| 1 | 06 | DCV | 196 | | 01 | Z | 0 | FAC | 05 | 14 | P | 4 | | | | | | | | | | | | | | | | | | | |
| 1 | 07 | DCV | | | | | X | FAC | 06 | 10 | P | 4 | | | | | | | | | | | | | | | | | | | |
| 1 | 08 | DCV | 295 | | 04 | Z | 0 | FAC | 07 | 05 | P | 4 | | | | | | | | | | | | | | | | | | | |
| 1 | 09 | DCV | 197 | | 04 | C | Z | FAC | 08 | 05 | C | Z | CHARACTER FIELDS | | | | | | | | | | | | | | | | | | |
| 1 | 10 | DCV | | | | | X | FAC | 09 | 02 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 11 | DCV | | | | | X | FAC | 10 | 02 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 12 | DCV | 006 | | 09 | C | Z | FAC | 11 | 20 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 13 | DCV | | | | | X | FAC | 12 | 20 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 14 | DCV | | | | | X | FAC | 13 | 20 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 15 | DCV | | | | | X | FAC | 14 | 20 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 16 | DCV | | | | | X | FAC | 15 | 05 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 17 | DCV | | | | | X | FAC | 16 | 15 | C | Z | | | | | | | | | | | | | | | | | | | |
| 1 | 18 | SEL | 001 | | 05 | C | Z | | | | | | | | | | | 99999 | ← SELECTION KONSTANT—CHAR | | | | | | | | | | | | |
| 1 | 19 | END | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

COMMENTS

ALEXANDER GRANT & CO.

# APPENDIX IVg

CLIENT GENERAL ACCOUNTING OFFICE

APPLICATION ANALYSIS OF RECEIVABLES - SCHOOL CODE AND TYPE OF TRAINING INSTITUTION

| PREPARED | DATE | INDEX |
|---|---|---|
| REVIEWED | DATE | |

**AUDASSIST CODING FORM — PROCESSING PHASE**

REV. 4-1-68

| CARD CODE | INSTRUCTION NUMBER | INSTRUCTION MNEMONIC | OPERAND 1 TYPE | OPERAND 1 NUMBER | OPERAND 1 POSITION | OPERAND 1 LENGTH | OPERATION/MASK | OPERAND 2 TYPE | OPERAND 2 NUMBER | OPERAND 2 POSITION | OPERAND 2 KONSTANT (4 DECIMALS) | OPERAND 3 TYPE | NEXT INST. IF = OR YES NUMBER | NEXT INST. IF ≠ OR NO POSITION | MISCELLANEOUS INSTRUCTION REQUIREMENTS: SAMPLING INTERVAL N | FIRST SELECTION | BASE DATE | DATES ELIMINATED (Y Y D D D) | STRATIFICATION LIMIT ONE (4 DECIMALS) | STRATIFICATION LIMIT TWO (4 DECIMALS) | STRATIFICATION LIMIT THREE (4 DECIMALS) | STRATIFICATION LIMIT FOUR (4 DECIMALS) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 01 | GET | FAC | 04 | | | | | | | | | | | | | | | | | | | |
| 2 | 02 | CLB | FAC | 08 | | | | | | | | | 03 | 06 | | | | | | | | | |
| 2 | 03 | STR | ACM | 01 | 05 | | | ACM | 01 | 04 | | ACM | 02 | ** | 00002 | 00000 | 00001 | 50000 | 00001 | 00000 | 00000 | 50000 | |
| 2 | 04 | CAL | ACM | 01 | ** | | * | ACM | 01 | ** | | ACM | 01 | ** | | | | | | | | | |
| 2 | 05 | EXT | | | | | | | | | | CLB | | | | | | | | | | | |
| 2 | 06 | CAL | FAC | 04 | | | A | ACM | 01 | 04 | | ACM | 01 | 04 | | | | | | | | | |
| 2 | 07 | CAL | ACM | 01 | 05 | | A | KON | 00 | 00001 | 0000 | ACM | 01 | 05 | | | | | | | | | |
| 2 | 08 | STR | FAC | 05 | | | | FAC | 04 | | | ACM | 04 | ** | 00000 | 90000 | 00000 | 80000 | 00000 | 70000 | 00000 | 60000 | |
| 2 | 09 | TST | | | | | 5 | TAG | 08 | | | | 10 | 13 | | | | | | | | | |
| 2 | 10 | STR | FAC | 05 | | | | FAC | 04 | | | ACM | 05 | ** | 00000 | 50000 | 00000 | 40000 | 00000 | 30000 | 00000 | 20000 | |
| 2 | 11 | TST | | | | | 5 | TAG | 10 | | | | 12 | 13 | | | | | | | | | |
| 2 | 12 | STR | FAC | 05 | | | | FAC | 04 | | | ACM | 06 | ** | 00000 | 10000 | | | | | | | |
| 2 | 13 | END | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | |

ALEXANDER GRANT & CO.

# APPENDIX IVg

SAMPLE PRINTOUT - PROCESSING PHASE

ALEXANDER GRANT & COMPANY
OFFICE NUMBER
AUDASSIST
PROCESSING PHASE ACCUMULATOR TOTALS LISTING
AGE OF ACC RECEIVABLE STA 01 GAO

RUN DATE - 11/07/69

Receivables By School Code

| Schools with | POSITION | BLOCK 01 | BLOCK 02 | BLOCK 03 |
|---|---|---|---|---|
| 20 or more Receivables | ACM 01 | .0000 | $ 118,559.1300 A | .0000 |
| | RCT | 0 | 14 | 0 |
| 15-19 Receivables | ACM 02 | .0000 | $ 16,309.8900 | .0000 |
| | RCT | 0 | 7 | 0 |
| 10-14 Receivables | ACM 03 | .0000 | $ 18,612.2000 | .0000 |
| | RCT | 0 | 11 | 0 |
| 5-9 Receivables | ACM 04 | .0000 | $ 13,016.9400 | .0000 |
| | RCT | 0 | 20 | 0 |
| Less than 5 Receivables | ACM 05 | .0000 | $ 26,162.5500 | .0000 |
| | RCT | 0 | 109 | 0 |
| | BLK ACM TOT | .0000 | $ 192,660.7100 | .0000 |
| | BLK RCT TOT | 0 | 161 | 0 |

Receivables By Type School B

| Type School | POSITION | BLOCK 04 | BLOCK 05 | BLOCK 06 |
|---|---|---|---|---|
| 9 | ACM 01 | .0000 | $ 1,290.0100 | $ 121,695.9600 |
| | RCT | 0 | 11 | 995 |
| 8 | ACM 02 | $ 12,167.1900 | $ 27,652.0500 | $ 5,374.0000 |
| | RCT | 141 | 226 | 43 |
| 7 | ACM 03 | $ 4,139.4200 | $ 10,697.9400 | .0000 |
| | RCT | 41 | 75 | 0 |
| 6 | ACM 04 | $ 2,528.8300 | $ 7,115.3100 | .0000 |
| | RCT | 43 | 14 | 0 |
| | ACM 05 | $173,825.2700 | $ 127,069.9600 | .0000 |
| | RCT | 1,364 | 1,038 | 0 |
| | BLK ACM TOT | $ 192,660.7100 | $ 173,825.2700 | $ 127,069.9600 |
| | BLK RCT TOT | 1,589 | 1,364 | 1,038 |

NOTE:

A CUMULATIVE ACCOUNTS RECEIVABLE BALANCE, EXCLUDING RECEIVABLE BALANCE FOR OTHER THAN THE FIRST RECEIVABLE IN A RECORD.

B INTERPRETATION:
EACH 'ACM' (EXCEPT ACM ϕ5 IN BLOCKS ϕ4 AND ϕ5) INCLUDES THE CUMULATIVE RECEIVABLE BALANCE AND RECORD COUNT FOR THE SCHOOL TYPE INDICATED. ACM ϕ5 IN BLOCK ϕ4 IS BROKEN DOWN IN BLOCK ϕ5; ACM ϕ5 IS BROKEN DOWN IN BLOCK ϕ6. RECEIVABLE BALANCE EXCLUDES BALANCE FOR OTHER THAN FIRST RECEIVABLE IN A RECORD.

APPENDIX V

TEST DECKING

AT

THE FEDERAL CROP INSURANCE CORPORATION

APPENDIX V

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APPENDIX V

# TEST DECKING AT

# THE FEDERAL CROP INSURANCE CORPORATION

## INTRODUCTION

The Federal Crop Insurance Corporation (FCIC) is a wholly owned Government corporation which was created in 1938 to promote the national welfare by improving the economic stability of agriculture through a sound system of crop insurance and by providing the means for the research and experience helpful in devising and establishing such insurance. FCIC insures crops against practically all causes of crop losses, including weather, insect infestation, and plant disease. FCIC's insurance coverage totaled about $874 million on 24 different agricultural commodities for crop year 1968, and it was expected to exceed $915 million in crop year 1969. FCIC utilizes computers to a large extent in managing its insurance programs.

The General Accounting Office (GAO) performs an annual financial audit of FCIC. To ensure that the automated system contains internal processing controls adequate to provide reliable program and financial records, GAO reviewed FCIC's policies and procedures and practices and tested the computer programs which make up the automated system utilized by FCIC in processing insurance program data. Test decks were used to review and test the automated system.

## DESCRIPTION OF FCIC'S AUTOMATED SYSTEM

FCIC's National Service Office (NSO) performs many of the centralized reporting and management functions of FCIC. NSO keeps records of the insurance contracts, issues summaries of protection and premiums to policy holders from the acreage information submitted annually by the insureds, and sends out the premium billings. It receives and deposits premium payments, computes payments to be made on loss claims, and schedules approved claims for payment by the Treasury Disbursing Officer. NSO also performs the accounting work of FCIC and gathers and summarizes statistical data.

In 1961 FCIC developed a preliminary design of a total system concept, which was oriented toward a large capacity computer. During this same year, the Secretary of Agriculture announced that a Data Processing Center (DPC) would be established in Kansas City, Missouri, and informed FCIC that it would be provided processing time on DPC's computers. In August 1962 FCIC's Branch Office (subsequently renamed National Service Office) was moved to Kansas City from Chicago, Illinois, and was located in the same building with DPC. Staffing of FCIC's systems design and programming sections had gradually increased since that time. As of December 1969, FCIC had four systems design employees and 10 programming employees.

FCIC generally has followed the original system concept in converting to a computerized system. This concept divided the system by functional activity and provided for implementation of a number of subsystems over a period of time. Specific subsystems set out in the concept were:

ACCO--Contract acquisitions and changes

PROP--Program operations including acreage reports, which define the specific liability of FCIC each year, and premium billing

LOSS--Claims settlement

PRAC--Premium accounting including collections

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ADAC--Administrative accounting

STAB--Statistical tables and reports

CORA--Actuarial statistics

Implementation of subsystems began in 1964 with ACCO and PROP. These subsystems were fully implemented by 1966, and implementation of LOSS, PRAC, and STAB was accomplished in 1969. As of December 1969, FCIC was preparing computer programs for ADAC. Programming for CORA had not been started. A number of management analyses described in the original system concept either had not been started or were being accomplished only in part due to expansion of ACCO and PROP beyond their original definition.

Pursuant to a 1963 Memorandum of Understanding with the Agricultural Stabilization and Conservation Service (ASCS), FCIC utilizes the services of DPC. This agreement provides that FCIC reimburse ASCS for data processing services rendered by DPC on the basis of equipment and magnetic tape usage. Usage rates have been revised periodically on the basis of historical costs of DPC. Estimated cost of computer services for fiscal year 1970 was $135,873.

## TEST OF FCIC'S AUTOMATED SYSTEM FOR INSURANCE PROGRAMS

The automated system of FCIC is designed for purposes of controlling the farm production insurance programs, of processing program data of FCIC, and of generating statistical and other reports needed in management. GAO tested the internal processing controls of the automated system to ensure that the controls are in operation and are providing the checks they were intended to provide.

Automated activities of FCIC are presently concentrated on processing of data directly related to insurance activities rather than administrative activities. This reflects a systematic implementation of the overall system of FCIC designed in 1961. Under this concept, processing of data related to insurance activities is accomplished under four subsystems called ACCO, PROP, LOSS and PRAC. Testing of the system could be accomplished in several ways. One or more subsystems could be individually tested, or all subsystems and any interflow of data between the subsystems could be tested.

FCIC's total system concept provides for an interrelationship of data between the four subsystems. Because of this interrelationship, our test was designed to permit continuous flow processing of test data from ACCO through PROP and LOSS to recording in PRAC.

Initial analysis of the automated system, its objectives and organizational logic was performed by obtaining and reviewing the system design flow charts. These charts identified the flow of processing within and between subsystems and the individual computer programs within each subsystem. Documentation in support of each computer program was reviewed to establish the purpose, input data and its source, and output data and its use and to identify the internal controls which should exist in the various programs. To determine whether the internal controls were actually present and functioning in the manner described in the documentation of each program, we prepared test documents for entry into FCIC's processing channels.

APPENDIX V

Test documents used in our review consisted of actual forms used by FCIC in its day-to-day activities. The test documents were prepared by us and routed through regular coding and keypunch channels within FCIC to obtain the necessary cards for actual processing through the computer and to provide a test of the manual activities involved in processing data into machine readable form for processing by the computer. The test documents included error-free data and erroneous data to permit evaluation of internal controls under both conditions. Each document containing erroneous data contained only one error so as to ensure that the specific control which we desired to test was the only one which could influence processing of the data.

In FCIC's system erroneous data is to be rejected by the computer before it changes any permanent files. Rejection consists of listing the entire transaction being processed, together with an identifying error code on a rejection listing. Under normal procedures these listings are researched, necessary corrections are made to the transaction data, and the transaction is subsequently reprocessed.

Any data which we processed through the computer as a test of computer programs would necessarily affect FCIC's master files. To avoid possible alterations of these basic control records, we obtained for several counties in various States a duplicate master file and a print of the master file. Our test decks were processed with the computer programs of each subsystem and against these duplicate master files. Prior to testing, the results of processing each test item was predetermined to serve as a basis for evaluating the results of processing the test deck through the computer. Subsequent to testing through the computer, we analyzed historical listings of computer rejects from FCIC's routine processing to establish the significance of weaknesses disclosed by our testing.

Initial testing began with the ACCO subsystem and included various types of transactions and conditions for new contracts and contract changes. Analysis of the test results revealed that, except for some items being unnecessarily rejected as errors, the cited controls were present and functioning and that documentation in support of individual computer programs was accurate.

One purpose of ACCO processing is to prevent the issuing of multiple insurance contracts to a single insured or issuing contracts to uninsurable producers. This was accomplished by matching the last name and first initial of applicants to the same data in FCIC's master files of policy holders, debtors, and ineligibles. Because the match was restricted to the last name and first initial, a great number of items were unnecessarily rejected as errors. For example, our test transaction involving H. Lamonds was rejected because of the existence of two other different insureds having the same last name and first initial.

Analysis of historical records disclosed that rejections have involved as many as 10 or 11 records, none of which had the same second initial as the applicant. On the basis of this analysis, we concluded that about one third of the rejected new applications would not have been rejected had the match involved both first and second initials plus last names. Projection of the results of this analysis over the 39 States with insurance programs indicated that the cost of at least one research clerk could be eliminated annually by revising the name match computer program. FCIC agreed to revise the program to match full name or social security number, whichever method was determined to be most effective.

Testing of the PROP subsystem involved acreage reports for different types of crops and included test transactions containing various conditions designed either to update normally or to test the processing controls of the subsystem. The test also included premium calculations which were the basis for premium billings recorded in the PRAC subsystem. Our analysis of the test results revealed that, except for an error or bug in one computer program, the controls cited in the program documentation were functioning effectively and that the documentation was accurate. The error or bug was included in a recent program revision. In our test, master files were updated in a normal manner, but the transaction data also appeared on a reject listing indicating that the transaction was invalid and that the master files had not been updated. FCIC employees told us that this was the first time the error condition occurred.

No significant effect could be attributed to the bug's existence, but FCIC promised to research the problem and make any corrections.

Testing of the LOSS subsystem included transactions designed to test various controls and calculations made by the computer during processing of the preliminary notice of loss or claim and of the actual claims for indemnity. No deficiencies were disclosed by our analysis of the results of this testing.

Testing of the PRAC subsystem involved transactions designed to test controls for ensuring the propriety of the recording of cash and the processing of receivables. Analysis of the test results revealed an undocumented change in one computer program and an incorrectly documented change in another computer program. Corrections were made by FCIC.

On the basis of our review and on the basis of test-decking activities, we concluded that the overall system concept and the actual computer programs comprising the four tested subsystems were adequate to accomplish the insurance program processing activities of FCIC. We did find that routinely generated data on error conditions that was printed on listings for research by the FCIC personnel was not used for management control purposes. Error data, if fully analyzed, presents an opportunity to identify documentation problems as well as specific causes for erroneous data entering a system.

Use of test decks can be a highly effective method of ensuring that individual computer programs within a subsystem, or that computer programs in an entire system, as above, contain adequate controls and provide assurance that output data is accurate and reliable. The entire system review approach has been used by GAO primarily as a necessary step to revising financial audit techniques to take advantage of data in the automated system and of the capabilities of the computer.

APPENDIX VI

# CASE STUDY

# REVIEW OF SELECTED COMPUTER APPLICATIONS

# AT THE FEDERAL HOUSING ADMINISTRATION

APPENDIX VI

## Contents



## ABBREVIATIONS

| | |
|---|---|
| FHA | Federal Housing Administration |
| GAO | General Accounting Office |
| HUD | Department of Housing and Urban Development |
| IBM | International Business Machines |

APPENDIX VI

# CASE STUDY

# REVIEW OF SELECTED COMPUTER APPLICATIONS

# AT THE FEDERAL HOUSING ADMINISTRATION

## INTRODUCTION

This case study discusses the methodology used to conduct an audit of accounting records maintained on computers at the Federal Housing Administration (FHA), the roles of General Accounting Office (GAO) auditors involved and their relationship to technically trained computer persons and the results and benefits derived from the audit. Assisting GAO were consultants from a national public accounting firm, S. D. Leidesdorf & Co., who have had extensive experience in auditing computerized systems.

## OBJECTIVES

GAO prepares a report to the Congress on annual audits of FHA's financial statements. The overall objective of the audit is to express an opinion on whether financial statements present fairly the financial position of FHA and the results of its operations and the sources and application of its funds for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year with applicable Federal laws. This basic objective of auditing has not changed even though FHA makes extensive use of computers. The auditor must still do sufficient review and testing to render his opinion.

This case study has a more limited objective. It deals primarily with discussion of an audit approach that enables the auditor to understand and test the computer system that generates the financial data being audited. Because amounts appearing on financial statements are generated by a system, the auditor must understand, evaluate, and test the system to be satisfied that the figures generated are accurate. In a manually-based system, the auditor must understand the functions and test the work of the persons involved, whereas in a computer-based system, the auditor must understand and test the computer system.

## AUDIT APPROACH

The audit approach included a review of internal controls over selected computer applications. A detailed review and analysis of selected computer programs and the reprocessing of selected input data through auditor controlled versions of an agency's computer programs is the key to the approach. Discussion is therefore limited to the work performed to understand, evaluate, and test selected computer applications. The review of internal controls over computer operations is not discussed in detail nor is any attempt made to discuss all the work either performed or considered necessary to express an opinion on FHA's financial statements. Instead, this case study presents information about the specific audit approach including

--planning,
--inquiry,
--logic of computer program review,
--computer program review,
--designing tests of the computer system,
--preparation of program specifications,
--programming and testing, and
--production.

Concluding remarks and benefits derived from the audit approach used are presented at the end.

### Planning

GAO site auditors, representatives of GAO's Office of Policy and Special Studies, and consultants from S. D. Leidesdorf & Co., held an initial meeting to discuss FHA operations and GAO audit requirements. The group reviewed prior years' audit workpapers, FHA financial statements, and GAO audit programs. The purpose was to select key computer applications or systems for review. Some of the basic information needed to make this decision is summarized below.

FHA was established by the National Housing Act of 1934 and functioned as a constituent unit of the Housing and Home Finance Agency until 1965, when it became a part of the Department of Housing and Urban Development (HUD). The principal purposes of FHA are to

--improve home financing practices,

--act as a stabilizing influence in the mortgage field,

--encourage improvements in housing standards and conditions,

--facilitate homeownership,

--aid in the elimination of slums and blighted conditions, and

--prevent the deterioration of residential properties.

FHA achieves its purposes through administration of mortgage insurance programs under which lending institutions (mortgagees) are insured against loss in financing first mortgages on various types of housing. This mortgage insurance function gives rise to insurance claims by mortgagees who, because of mortgage defaults, have acquired the properties pledged to secure the FHA-insured mortgages. In the settlement of claims, titles to the properties are conveyed to FHA. This action gives rise to other functions including maintenance and sale of acquired properties. Of the several computer-based systems involved, two are the subject of this case study. They are the File Maintenance System which accounts for the insuring function and the Acquired Home Property System which accounts for the property that is acquired by FHA.

The File Maintenance System accounts for over 4-1/2 million mortgages which FHA insures. This system is maintained on an International Business Machines (IBM) 7074 computer with an IBM 1401 in support. The master file consists of 66 reels of magnetic tape. The insurance program is financed primarily by insurance premiums received from the borrower, or mortgagor, with the lender collecting the premiums and remitting the amount due to FHA. The accountability for such premiums, the calculation of earned and unearned premiums, and the maintenance of a master file of insured mortgages is accomplished by the File Maintenance System.

The Acquired Home Property System is maintained on the same computer equipment as the File Maintenance System. It accounts for properties acquired by FHA because of defaults

in mortgage payments and for the sale of acquired homes and the profit and loss from such sales. There were approximately 22,500 properties accounted for. Although the number of properties is low in comparison to the number of mortgages in the insurance system, the impact of any property acquired is significant because the entire cost of acquiring the property is borne by FHA and the profit or loss from its disposal also accrues directly to FHA.

These two systems, File Maintenance and Acquired Home Property, were chosen for audit because of their significant effect on the financial statements. The audit group then appointed a team to study these systems and to design a detailed audit approach. The team, under the overall direction of GAO's site audit manager, included one GAO site auditor, one auditor from GAO's Office of Policy and Special Studies, and several of the consultant's technically trained computer employees. The team first made inquiries about computer operations at FHA.

APPENDIX VI

Inquiry

Data processing services are furnished to FHA by HUD. HUD functions in a manner similar to a service bureau by providing system design and programming facilities, as well as processing services. To simplify discusson in this study, computer programs written and maintained by HUD for FHA are referred to as FHA's computer programs. The study team visited the HUD data processing center and met with the director. After explaining the audit approach, the team was assured of receiving full cooperation.

Next, the team requested documentation for both the File Maintenance and Acquired Home Property systems including

--overall flow charts which graphically depict the processing procedures that are used and

--narrative descriptions of the systems which explain in the English language (as opposed to computer symbols) the system objectives and how these objectives are to be achieved.

The overall systems flow charts were furnished, but no narrative descriptions were available. In the absence of these narratives, the study team had to rely more heavily on HUD programmers and analysts to obtain information about system operation. Condensed versions of the flow charts for the File Maintenance and Acquried Home Property systems are included in appendix VIa.

The audit team's review of the systems flow charts gave rise to a number of questions that were answered by the HUD employees responsible for systems maintenance. Working from overall systems flow charts and oral explanations given by HUD employees, the audit team selected several computer programs in each system for detailed review. The key to the audit approach discussed in this case study involves a detailed review of these selected computer programs. Therefore an understanding of the logic of computer program review is important.

Logic of computer program review

A computer operates by a series of programs which provide the instructions necessary for the computer to execute its step-by-step procedure. If these instructions are correct, the resulting processing will be correct. For a computer programmer to understand what he is to include in a program, he must be provided with detailed programming specifications. These specifications are usually designed by an analyst to reflect his understanding of management's objectives as set forth in the systems flow chart which describes what job is to be done. The programming specifications therefore become an important part of systems documentation. From these specifications the programmer draws a logic chart, or detailed block diagram, which represents his detailed solution of the order of work describing the input, output, arithmetic, and logical operations involved. The logic chart shows how the job is to be done. It serves as the basis for coding which is the process of translating each step-by-step procedure into computer instructions. The logic chart also becomes an important part of systems documentation.

The objectives of reviewing computer programs are to establish that

--management's representations, as outlined in systems flowcharts and narratives, are correctly reflected in programming specifications and

--the computer programs are in conformity with the program specifications.

To the extent that management's representations, systems documentation, and computer programs are in agreement, the auditor can have preliminary satisfaction that the computer system is operating as it should, but, to the extent that they differ, the scope of the auditor's work may have to be extended.

Learning the actual functions of processing within FHA's computerized system could not be accomplished by a review of input and output alone. The system itself makes decisions with respect to accounting calculations by using

various rules for validating data. Furthermore, the File Maintenance system is large and complex--66 reels of magnetic tape contain insurance records on 4-1/2-million mortgages which are not printed out in detail. Therefore it frequently is not possible to trace an input document to an output report because there is little or no detailed output for manual audit testing purposes. The total mortgages represent approximately $50 billion of insurance in force. To print out, even on an annual basis, each of these mortgages and related details would be prohibitively expensive. One alternative audit procedure involves a detailed review of selected computer programs to determine if the data is processed properly. The audit approach discussed here involves such a review.

Computer Program Review

Following are four computer programs selected for review by the audit team--two from the File Maintenance System and two from the Acquired Home Property System.

--File Maintenance program 21000. This program updates the FHA-insured-mortgage maintenance master file with all applicable transactions. It also generates a tape for insurance premium billings, a tape of all terminated cases, and an exception tape for all irregular items and inquiry replies. (See app. VIa, p. 207.)

--File Maintenance program 20608. This program reads cards produced from the billing tape for collection purposes, which have been sorted in premium due date sequence and produces a report of current, delinquent, and past due accounts. (See app. VIa, p. 208.)

--Acquired Home Property program 63010. This program updates the acquired home property master file and produces an accumulative transaction file. These files carry all expenses pertaining to on-hand property and are used to generate profit and loss figures for properties sold. (See app. VIa, p. 209.)

--Acquired Home Property program 63020. This program spreads unallocated expenses to on-hand properties. Two months after the properties are sold they are written on a final sales tape. (See app. VIa, p. 209.)

The four computer programs and their related documentations were assembled for review. The consultant's technical programming employees made a detailed review and analysis of these programs and prepared an English language narrative describing the step-by-step procedure that each program follows. Appendix VIb is an example of the type of analysis prepared. The audit team discussed each analysis in detail to make certain that the auditors understood just what the program was doing. Once the auditors understood the step-by-step procedure followed by the computer program, these procedures were verified to applicable laws, manuals, or other documents containing the approved procedures. To the

extent that the procedures followed by the computer programs agreed with properly approved or authorized procedures, the auditor had preliminary satisfaction that the system was designed and was programmed in accordance with management's objectives and was operating properly. The auditor's next consideration was testing or monitoring the system to ensure its consistency of processing; but, first a comment on the results of reviewing the four computer programs.

The technical programming persons found an error (bug) in program 21000, the major program in the File Maintenance System. Upon notification agency employees immediately corrected the bug. No adverse effect could be attributed to the bug's existence, however, had certain conditions occurred in processing, the bug would have affected record counts and mortgage amount totals for certain types of terminated cases. Further inquiry revealed that one punched card had been inadvertently omitted or dropped from the file the last time the program was assembled or translated into computer readable form. Agency officials reemphasized to the agency's people the importance of observing established controls designed to prevent such errors during assembly of computer programs. With the exception of this bug, no other major errors or discrepancies were found by program review.

Designing tests of the computer system

After the auditor understands how the computer programs operate and is satisfied that the procedures followed are correct, he must still determine that the data is processed on a consistent basis. One major advantage of a computer is that it will process consistently in the same manner each time, provided that the same computer program is used and controls exist to prevent interference during its use. The audit team decided to test for consistency of operation by reprocessing selected input data through auditor controlled versions of FHA's computer programs. This procedure, however, does not ensure the validity of the data entering the system. The input must still be checked back to source documents before the auditor can attest to the accuracy of system output.

Because selected input data would be reprocessed through auditor controlled versions of FHA's programs to verify consistent processing, the audit team reviewed the manual audit steps carried out in prior years to determine which steps could be automated and incorporated with the test for consistency. The team concluded that certain auditing procedures could be accomplished by modifying existing computer programs and by writing several new programs. This approach permitted the auditors to combine several functions including

--testing for consistency of processing,

--selection of sample cases for verification to source documents,

--accumulation of summary totals for comparison to balance sheet figures, and the

--production of all output normally produced by FHA's program.

These automated auditing procedures enabled the auditors to maintain a high-quality audit and at the same time accomplish the procedures at computer speeds.

APPENDIX VI

The audit plan to be followed as a result of amending FHA's computer programs and preparing new ones is shown in appendix VI c. The flow charts depict a condensed version of FHA's File Maintenance and Acquired Home Property systems together with the audit team's decisions on how to audit the systems. A discussion follows.

The work to be performed as the result of modifying File Maintenance program 21000 includes

--producing summary totals for earned and unearned premiums and totals of insurance in force according to the section of the National Housing Act under which the mortgages are insured,

--selecting an attribute sample from the master insured mortgage file for verification to source documents,

--providing the capability for selecting master records on the basis of case numbers specified by auditor prepared finder cards, and

--producing a value estimate sample for use in projecting the total dollar amount of insurance in force under section 203 of the National Housing Act. (Because of the large volume of mortgages under section 203 of the act, 58 of the total 66 reels of tape, sample reels were to be selected for processing instead of the entire file. All data on all other sections of the act would be processed and verified on a 100-percent basis.)

Reprocessing selected input data through the newly modified File Maintenance program 21000 (renumbered 26101) would now produce specified summary totals, output tapes containing a master attribute sample, and a value estimate sample, plus the same output of FHA's original program, i.e., transactions processed, terminations, an updated master file, a billing tape, and exceptions. (See app. VI c, p. 220.)

The audit team also decided to write additional computer programs.

--Program 26102. Print the master attribute sample file created by File Maintenance program 26101.

--Program 26103. Select and print a sample from the transaction file which was input to File Maintenance program 26101.

--Program 26111. Match the billing tape produced by File Maintenance program 26101 with the updated master file. This match is performed to determine if all items on the updated master file that should be billed are on the billing tape.

--Program 26112. Age outstanding premium billing collection items and print a detailed trial balance.

--Value estimate program (no number). Print a value estimate report. The consultant's current ratio estimate computer program would be modified to accept tape input produced by File Maintenance program 26101.

Essentially the same procedure was followed for the Acquired Home Property System. The audit team identified those audit steps which could be automated and then developed a plan to accomplish the procedure by either modifying existing computer programs or writing new ones.

Once the audit team decided what computer programs had to be modified or prepared from scratch, the specific requirements had to be communicated to a programmer in a form that he could understand. In the computer environment, this information is conveyed by use of narrative descriptions referred to as specifications.

APPENDIX VI

## Preparation of program specifications

Because the site auditor was ultimately responsible for the audit, he participated directly in the preparation of the specifications. Two levels of specifications were prepared. As the first level, the overall or general specifications outlined the desired audit objectives. For example, the general specifications for File Maintenance program 26101 required the program to generate summary totals, select an attribute sample, provide the capability for selecting records on the basis of auditor established criteria, and select a value estimate sample. As the second level, these overall specifications were further refined into detailed programming specifications by the computer trained auditors and the consultant's technical employees. A set of specifications for one program, which shows the necessary level of detail is included in appendix VI d. A complete set of all specifications were reviewed in detail and approved by the GAO audit mamager before they were turned over to the consultant's programmer.

## Programming and testing

Following the detailed specifications, the consultant's programmers amended agency programs and wrote new ones as required. All programs were coded in AUTOCODER, the same computer language used by FHA. In most cases the choice of computer language is restricted to that used by the agency.

Once the programs were written, they were keypunched into cards and made ready for assembly. The assembly of a program involves taking the programmer's source statements or coding already punched into cards and converting them by machine translator into code which the computer can understand. An example of the programmer's coding and the related machine generated code is included in appendix VI e. The actual program assembly and testing for accuracy was performed on computers at HUD. Because the audit team was treated as any other customer, they had an opportunity to review and observe internal controls in an operating environment. The auditors made appropriate comments on controls, such as maintenance of equipment, tape library operations, and overall system security.

APPENDIX VI

The site auditor worked closely with the consultant's programmers during assembly and testing. After the auditor approved all test results, plans were made for running actual production.

Production

Actual production or processing on HUD computers was scheduled for several different days as data tapes were received. All agency data tapes to be used were duplicated on reels supplied to HUD by the audit team. These reels represented a permanent record of the data that the team was processing and offered a method of retrieval in case any data was inadvertently destroyed.

To determine that the data tapes furnished were correct and consistent with information previously furnished, selected files were printed out and compared to the file layouts furnished in agency documentation. These comparisons and tests did not reveal any discrepancies, therefore, production could begin.

File Maintenance System

The audit team mounted the necessary data tapes on the IBM 7074 computer and reprocessed selected data through program 26101, the auditor's modified version of FHA's major program for updating the insured mortgage master file. The computer run produced the following output.

--Summary totals for earned and unearned premiums and insurance in force.

--An attribute sample from the updated master file for tracing to source documents.

--A value estimate sample for projecting the amount of insurance in force under section 203 of the National Housing Act.

--All output normally produced by FHA's unmodified program including transactions processed, terminations, an updated master file, a billing tape, and an exceptions tape.

With this computer output available, the audit verification work began. The auditors verified the applicable computer generated summary totals of earned and unearned premiums and insurance in force to figures reported on FHA's

financial statements. No significant discrepancies were found.

The attribute sample from the updated master mortgage insurance file was written on tape by the IBM 7074 computer. The audit team used the previously prepared program 26102 on an IBM 1401 computer to print out the sample items. All the sample items were checked manually to source documents and found to be correct.

The value estimate sample was also written on tape by the IBM 7074 computer. These selected sample items were used as input to the consultant's previously prepared value estimate computer program.

The audit team discovered that the sample estimate, or mean, calculated by the program differed significantly from the mean obtained by dividing the total amount of mortgage insurance in force by the number of mortgages reported by FHA. In fact, the mean calculated from FHA's figures did not even fall within the upper and lower confidence levels calculated by the value estimate program. Further inquiry revealed that the reels of data selected at random by the auditor for use in drawing the sample were not representative of the universe. The audit team discovered also that the files were maintained in State order within sections of the National Housing Act. Another method of selecting a representative sample had to be devised. The team finally decided to manually select a representative sample of mortgage case numbers from the universe. These numbers were used in combination with FHA's inquiry system which permits retrieval of case information from the master file. During the regular monthly update run, the sample information was retrieved. These items were then used as input to the consultant's value estimate program and successfully processed. The mean previously calculated from FHA's figures for insurance in force was well within the newly calculated confidence levels. In fact, it closely approximated the new sample mean. The auditors were therefore satisfied that the reported amount of insurance in force under section 203 of the National Housing Act was acceptable.

To test the reliability and accuracy of transactions entering the system, the audit team used previously prepared program 26103 to select and print a sample from the

transaction file which was input to the File Maintenance update run. These sample items were manually verified to source documents, and no discrepancies were found.

The audit of the accounts receivable included a review of the premium-billing procedures and verification of the account balance. FHA's normal procedures require that a billing tape be produced as output of File Maintenance program 21000. This billing tape, which is supposed to contain all mortgages for which premiums are due in the coming month, is converted into punched cards which replenish an open-item card file containing all accounts receivable. To check the functioning of these billing procedures, the audit team used previously prepared program 26111 to match or compare the billing tape with the updated master file which contained all mortgages regardless of when their premiums were due. The program was designed to determine if insured mortgages due for billing had been actually written on the billing tape. Any mortgages supposed to be billed but not on the billing tape (nonmatching items) were to be printed out for the auditor's review. When the match was made, no exceptions were printed out. The auditor was satisfied that the premium billing tape contained the proper items.

The accounts receivable balance consisted of all billed premiums unpaid as of the end of the month. As payments were received, the applicable punched card was pulled from the file. Therefore the total dollar amount of cards remaining in the open-item card file at any one time represented the account balance. To establish a proper cutoff as of the balance sheet date, the audit team had the file of punched cards converted to magnetic tape by a standard card to tape program. An auditor observed conversion of over 125,000 cards to tape. As a result, the auditor had a frozen accounts receivable file that could be processed at magnetic tape speeds. To ascertain the status of the account, an aged trial balance was desired. Because FHA's aging program did not supply the necessary aging categories for audit evaluation, the audit team used previously prepared program 26112 to age the outstanding premium collection items and to print a detailed trial balance. There were no significant differences with the figures shown on the agency trial balance.

The computer running time used to process all data applicable to the File Maintenance System totaled about 11 hours--6 hours on the IBM 7074 and 5 hours on an IBM 1401 computer. Assuming that the system remains relatively stable, computer running time will remain about the same on future audits.

Acquired Home Property System

The Acquired Home Property System was subject to the same review procedures used for auditing the File Maintenance System. Several of FHA's computer programs were modified and several new programs were written. The flow charts on pages 222 and 223 of appendix VIc depict the work performed. No significant discrepancies were found during the audit of acquired home properties.

A total of about 5 hours of computer time was used to process all data applicable to acquired home properties.

APPENDIX VI

## CONCLUSIONS

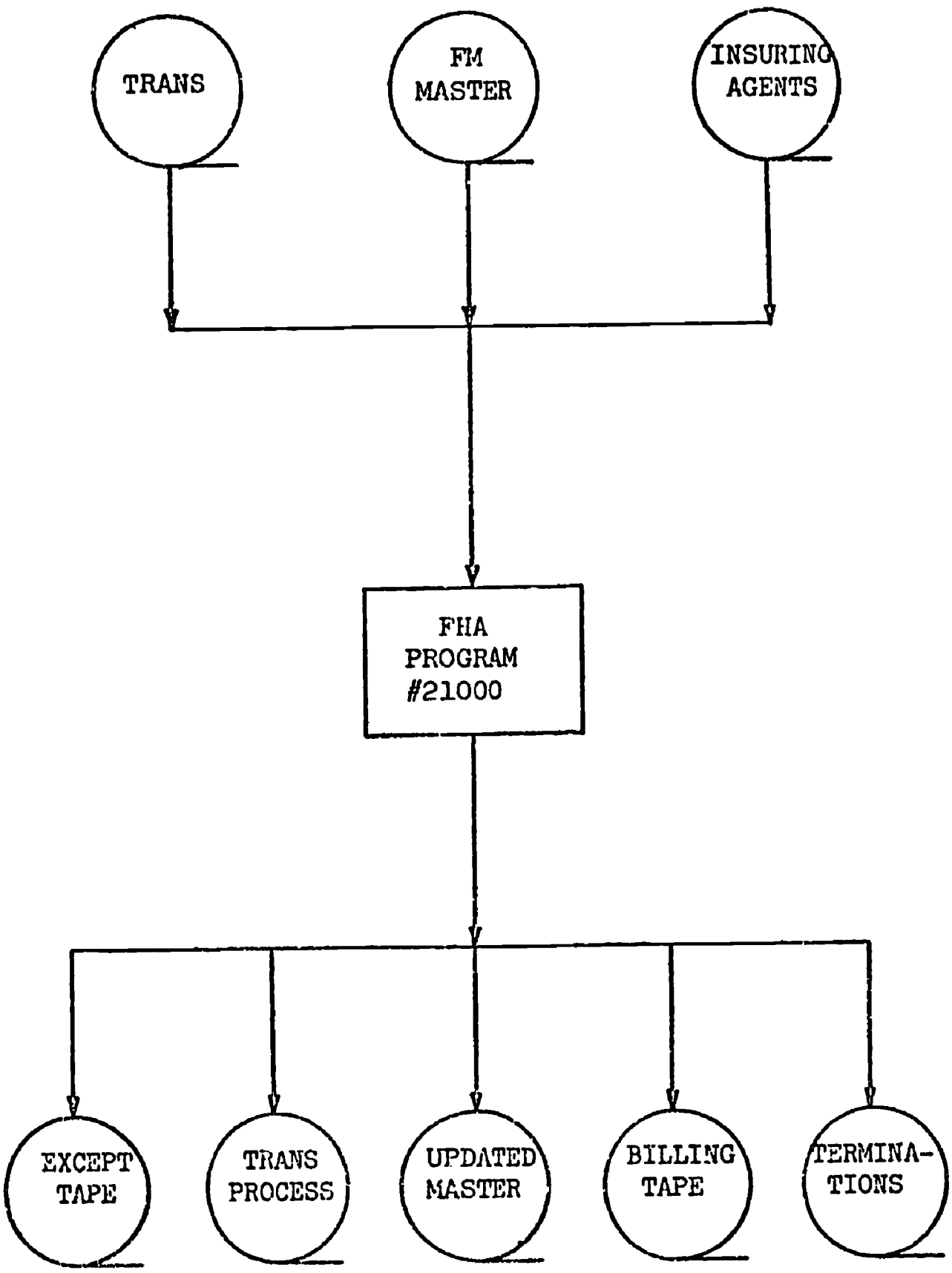
The primary benefit of the audit approach used was the degree of familiarization gained by the auditors with the actual system used by FHA, and the greater degree of assurance that data generated by the system was reliable. The auditors were able to perform a more thorough review and maintain a high-quality audit in the face of a growing complex computer system.

At FHA, it had become increasingly difficult to audit around the computer. We recognized that, for the staff auditor to remain a decisionmaker, as opposed to merely observing the efforts of technical persons, a significant amount of time had to be devoted to learning the system and supervising the programming and operation of computer audit routines. Several months were spent in doing this work. Because the agency had invested thousands of man-days designing and refining the system, it is reasonable to expect that considerable time would be needed to evaluate such a system. The experience gained by the auditors on this project uniquely qualifies them to supervise other audit work on computer-based systems. Furthermore, the project proved that auditors can work harmoniously with technical computer persons in implementing computer-auditing procedures.

APPENDIX VIa

CONDENSED FLOW CHART

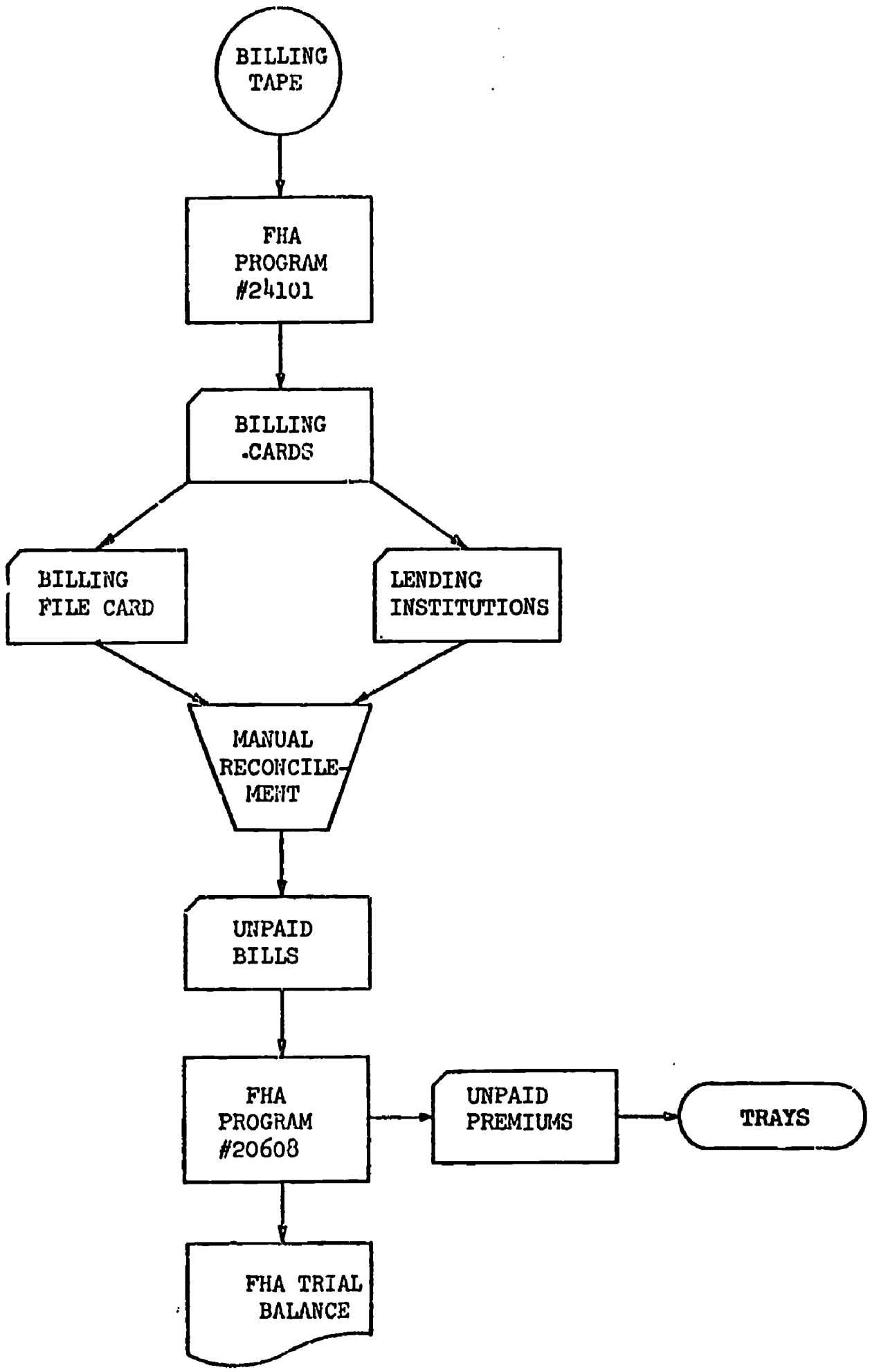
FILE MAINTENANCE



APPENDIX VIa

CONDENSED FLOW CHART

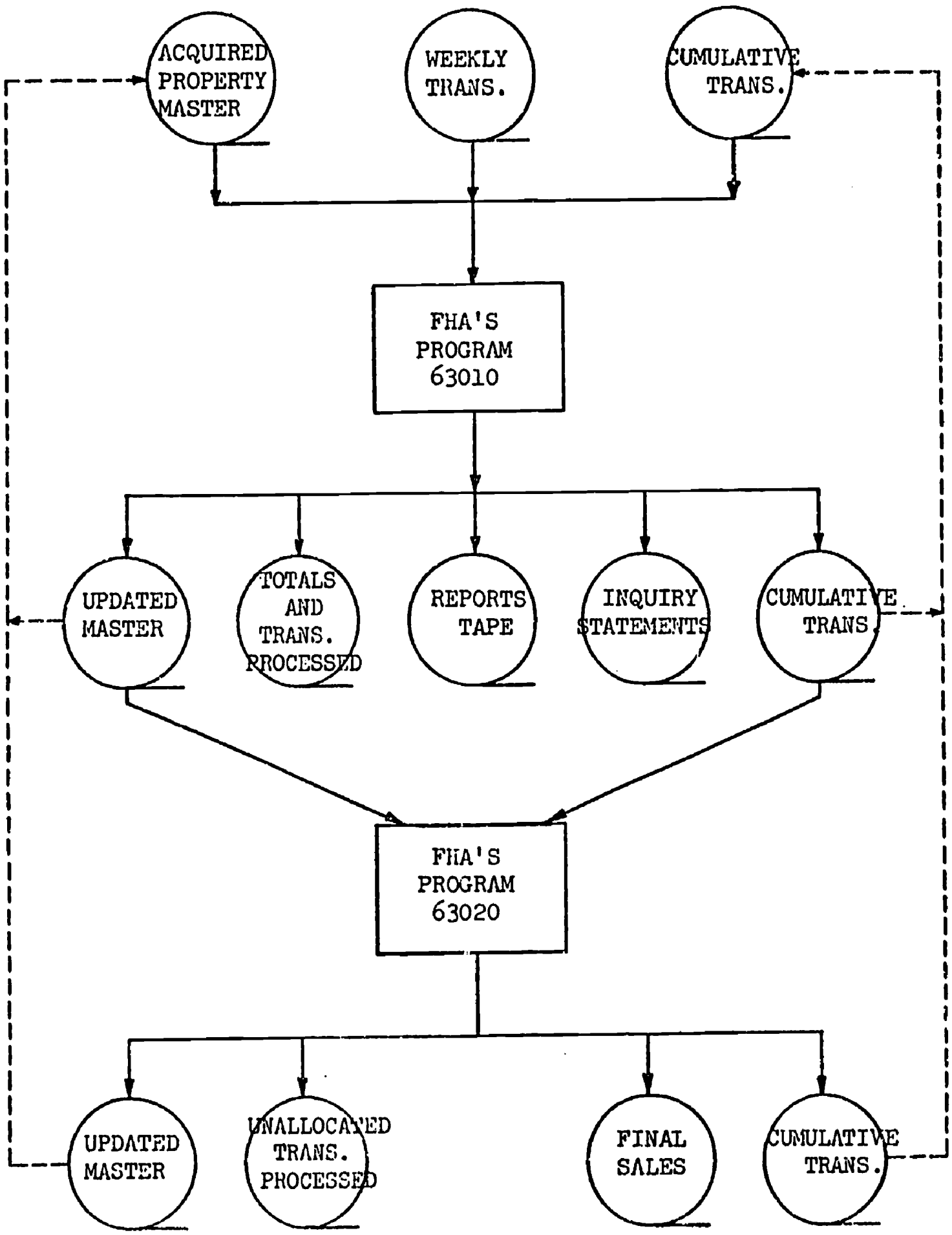
FILE MAINTENANCE--ACCOUNTS RECEIVABLE



APPENDIX VIa

CONDENSED FLOW CHART

ACQUIRED HOME PROPERTY SYSTEM



APPENDIX VIb

REVIEW OF FHA's ACQUIRED HOME

PROPERTIES UPDATE PROGRAM #63020

I. Abstract of Program #63020

This program distributes the unallocated receipts among the on-hand cases on the Acquired Property Master file on a monthly basis. During the program, the master file is also zero balanced and updated by dropping final sales and placing them on a Final Sales statement tape.

II. Files (See Appendix VIb1)

A. Acquired Property Master File - 63000 (Input and Output)

The Master File which this program maintains consists of one Master Record for each FHA Acquired Home Property. Each Master Record is uniquely identified by an FHA Case and Sub-case number as well as a Section of Act number. The File is in sequence by Section of the Act, FHA Case Number, and Sub-case Number. The Section of the Act identifies the particular section of the Act authorizing FHA mortgaged properties to be acquired under which this particular property was actually acquired. There are currently about 40 such acts, not all of which are actually represented in this file, with an additional 10 to 20 expected shortly.

Within the Master Record, data is recorded separately for that portion of the property which remains unsold, i.e. On Hand Property, and that portion which is Sold Property.

B. Accumulative Transaction File - 63001 (Input and Output)

The AHP Phase II Accumulative Transaction File is a detailed backup for the Master File. It consists of an Opening Balance Record and a string of Transaction Records (if any are effective for the period) for each Master Record. The Opening Balance record is an accumulatory record with identifying data and dates plus accumulatory fields

for each of the dollar amounts carried in the transactions (there are 14 different dollar amounts with each transaction type capable of updating from 1 to 10 of them). Upon creation it contains zero totals. The transactions are exact copies of the monetary transactions previously processed against the Master.

C. Final Sales File - #63123 (Output)

This file contains property records of sold master records (under conditions outlined in the program flow) and closing balance records.

D. Unallocated Transactions Processed File - #63002 (Output)

This file contains debit transactions for both sold master records and on-hand master records (see program flow) and a credit record developed from the master record for total unallocated expenses.

III. Narrative of Program #63020

The program is segmented into four sections. Section 'A' performs data manipulation and calculates the unallocated expenses per on-hand cases. The total unallocated expenses and number of cases will be checked at end of job. Section 'B' is the main processing for Sold master records. Section 'C' is the main processing for On-Hand master records and Section 'D' is the end of job balancing processing.

Section A

(The assumption is made that today's date and the total number of On-Hand cases is contained in word 0109 at the beginning of the program.)

1. If the number of cases is zero, the job halts and must be restarted.

2. The date in the format YYDDD is converted to the format MMDDYY.

3. Read the First Master Record. This record is unique. It contains the total amount of money to be allocated in On-Hand maintenance and operating expense.

   The ON-HAND maintenance and operating expense field of this master is stored to be checked end-of-job. This field is divided by the total number of cases and the quotient and remainder of this are stored as the total un-allocated expenses per case. This total too is checked at end-of-job.

   If the remainder is not zero, some additional processing occurs to eliminate it during the On-Hand section of the program.

4. Read First Transaction Record.

5. The expense field on the first master is zeroed and is PUT on the Master Out tape.

6. Every transaction record that matches this first master on case number and is Section of the Act 0001 is PUT on the Transaction Out Tape.

7. A credit item is built from this unique master with the total unallocated expense for ON-HAND maintenance and operating expense given a minus sign. This record is PUT on the Transaction Out Tape.

8. This same credit record with the total expense field zeroed is also PUT on the Transaction Processed Tape.

   After this initial processing, the main program logic is entered.

<u>Main Program Compare</u> -

1. A master record is read and the high order position of type sale is tested for a 2.

2. If it is a 2, the master is a SOLD master and the sales processing is entered. If it is not a 2, the master is an ON-HAND master and the ON-HAND processing is entered.

Section B - Sold Cases Processing.

1. For each sold Master, the Date of Sale processed is compared to today's date. If the difference between factors of these two dates is greater than 2, the settlement status is checked.

   1.1 Otherwise, the case number of the master is compared to the transaction record. See Step 17.

   The formula for date comparison follows:

   D=Date of Sale Processed
   T=Today's Date

$$(YR)_D (12) + (MO)_D = (YR)_T (12) + (MO)_T$$

2. If the settlement status is not 14 or 24, the case numbers are compared. This comparison is the same one referred to in 1.1, above.

3. If the status is 14 or 24, the master field of Sold Profit on C of C is checked for non zero. If it is, a profit switch is set on, and the master is keyed and a profit exists.

4. A Property Record item is built from the master record and if the profit switch is on, the statement code is made a 20, otherwise it is 30.

5. The property record is PUT on the Final Sales Tape.

6. The balance record area is zeroed and the master case number is compared to the transaction case number. This comparison is distinct from the comparison referred to earlier in the date routine in Step 1.

7. If the case numbers or the sub case and Section of the Act numbers are unequal, the net investment is computed for the master just completed and the balance record is compared to the master. The computation and balancing are explained later.

8. If the numbers are equal, the first transaction record, which is the opening balance, is moved to the closing balance area and is PUT on the Final Sales Tape. If the profit switch is on, the transaction input record is also PUT on the Transaction Output Tape.

9. A new transaction input record is read and the case number comparison in step 6 is entered. For all transaction records with the same case number, except the first, the program begins to accumulate totals (see Appendix VIb2) for the balance record. After the accumulation, the transaction is put on the Final Sales Tape and if the profit switch is on, it is also put on the Transaction Out Tape.

10. If the case numbers are unequal, the Master record is now balanced against the accumulated transactions in the closing balance area. This is the explanation referred to in Step 7.

11. The net investment is computed as the sum of all fields in the balance area not including (a) Profit on Sale (b) Loss on Sale, and (c) Profit on C of C case.

12. Next, every field on the Balance Record is checked against the corresponding field on the master. If they all agree, the case is in balance and the balance area becomes the closing balance record and is PUT on the Final Sales Tape. If they do not agree, go to Step 14.

    If the profit switch is on, the Master input is PUT on the Master output and a new master is read and we return to our main processing loop, i.e. main program compare.

13. If the profit switch is not on, a '1' is added to the number of masters deleted, a new master is read and we return to our main processing loop.

14. The master is out of balance if any field disagrees with the master. The balance area is keyed as out of balance and as a closing balance and is PUT on the Final Sales Tape.

15. An opening balance record is created with (1) Sale Loss (2) Sale Profit and (3) Profit on C of C case zeroed out.

16. If the profit switch is on, the master is PUT the Master Tape Out; a new master is read and the main program compare is entered. If the switch is off, the opening balance record is PUT on the Transaction Out Tape and then the master processed as described above in this step.

17. For Sold Masters with date factors less than 2 apart or settlement status not equal to 14 or 24 the case numbers between the master and the transaction are compared.

18. If they are unequal, the Master is PUT on Master Tape Out and a New Master is read, and the main program compare is entered.

19. If they are equal, the sub case and Section of the Act are compared, if they are equal the Transaction In is PUT on Transaction Out and a New Transaction is read and the case number is compared in Step 17.

20. If they are unequal, the master processing is used as in Step 18.

Section C - On-Hand Cases Processing

1. For each ON-HAND master, a "1" is added to a computer for total ON-HAND cases and the maintenance amount per case is added to the total allocated counter. It is these two counters that will be checked at end-of-job against the figures from word 0109 and the unique Master record.

   It is in this routine that the following occurs:

   If the remainder of maintenance amount per case (pennies) is zero, instructions are executed that result in the maintenance and operating expense field on the master and the amount field on the credit record being zeroed.

If the remainder is not zero, however, the remainder has 1¢ subtracted from it; the maintenance amount per case has $1 added to it; the amount field in the credit record has $1 stored in it; the maintenance and operating expense field on the master first has $1 added to it and is immediately overlayed with $1.

This special processing will continue until the remainder has been eliminated, which will be the number of cases needed to make it zero.

2. The master case number is compared to the transaction case number.

3. If they are not equal and the sequence switch is on, the files are out of sequence and the job is terminated.

4. If the switch is not on, a credit item is built from the master record and PUT on the Transaction Out tape. The credit item is keyed as a debit (second word has a zero in the low order) and PUT on the Transaction Processed tape. The Master record is put on the Master Out Tape. A new Master input is read and the main program compare reentered.

5. If the case numbers are equal, then the master and transaction sub case number and Section of the Act are compared.

6. If they are unequal, the file sequence is checked and the same procedure indicated above in Step 3.

7. If the sub case number and Section of the Act are equal, the Transaction is PUT on the Transaction Out Tape; a new transaction is read and case numbers are compared as indicated above, in Step 2.

## Section D - End of Job Processing

### End-of-Job Totals

The total cases in location 0109 is compared to the accumulated total of ON-HAND Masters. Any discrepancy is typed out.

The total expenses computed is compared to the total expenses from the unique master record. If there had been a remainder, I don't understand how an equal compare could ever occur.

Although file record counts are kept by the program, they are never used.

APPENDIX VIb1

INPUT-OUTPUT CONFIGURATION PROGRAM 63020

| NAME | CHANNEL | UNIT | TYPE | FORM | RECORD LENGTH |
|---|---|---|---|---|---|
| Master Input | 2 | 3,4 | 1 | 1 | 59 Words |
| Transaction Input | 2 | 1,2 | 2 | 2 | 25 Words |
| Master Output | 1 | 0,4 | 3 | 1 | 59 Words |
| Transaction Output | 1 | 1,2 | 4 | 2 | 25 Words |
| Transactions Processed | 1 | 3 | 4 | 2 | 25 Words |
| Final Sales | 2 | 0 | 4 | 2 | 21 Words |

## ACCUMULATION PROCEDURE FOR TRANSACTION RECORDS

| STATUS | FIELDS |
|---|---|
| 14, 24, 33, 36 | ACQUISITION COSTS |
| 09, 65, 69 | SALES PRICE<br>TAXES<br>MAINTENANCE & OPERATING EXPENSES<br>SALES EXPENSES |
| 08, 26, 28 | ACQUISITION COST<br>ADDITIONAL ACQUISITION COST<br>ASSET VALUE AT REPOSSESSION<br>NET RECEIVABLE AT DEFAULT<br>TAXES<br>MAINTENANCE & OPERATING EXPENSES |
| 67 | INTEREST ALLOCATED |
| 68 | CERTIFICATE OF CLAIM PAID<br>INTEREST OF C OF C PAID |
| 50, 51, 52, 53, 55, 56, 60 | DEPENDING UPON TYPE ANY FIELD MAY BE UPDATED |
| 11, 12, 21, 22, 31, 32, 34, 35 | ACQUISITION COST |
| 99 | MAINTENANCE & OPERATING EXPENSES |

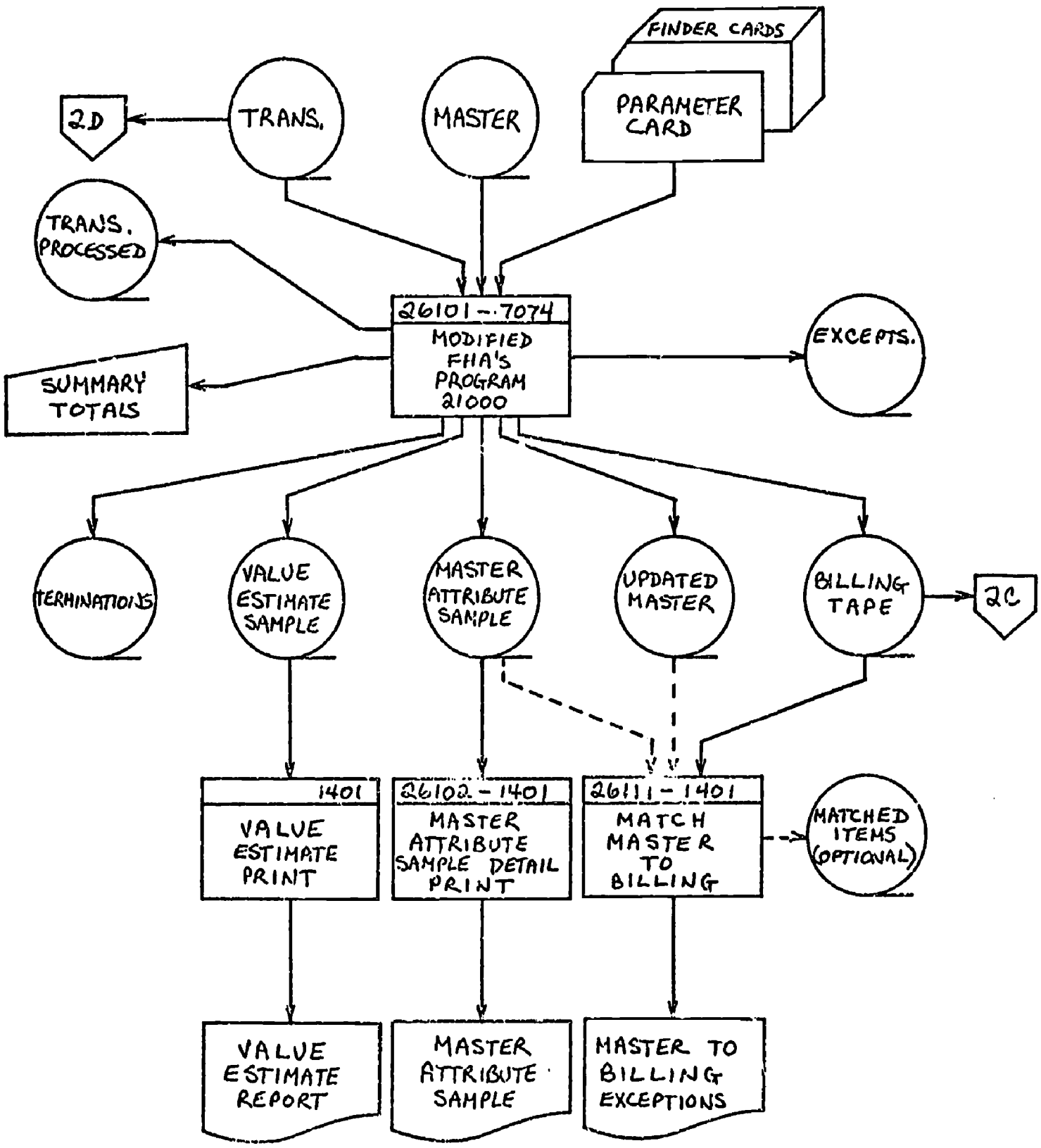
APPENDIX VIc

FLOW CHARTS DEPICTING CHANGES MADE

TO FHA PROGRAMS FOR AUDIT PURPOSES

File Maintenance System





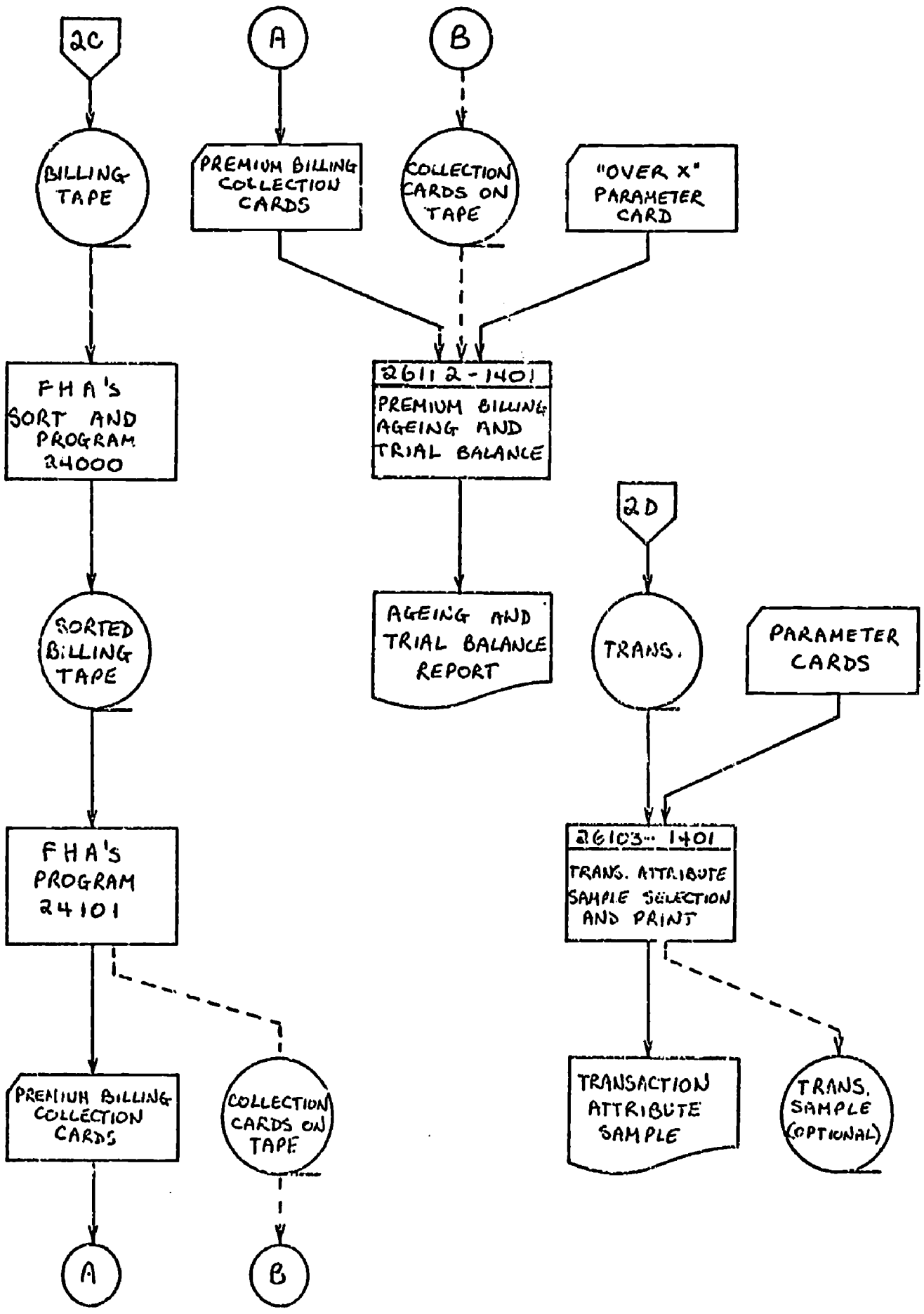
APPENDIX VIc

FLOW CHARTS DEPICTING CHANGES MADE

TO FHA PROGRAMS FOR AUDIT PURPOSES

File Maintenance System





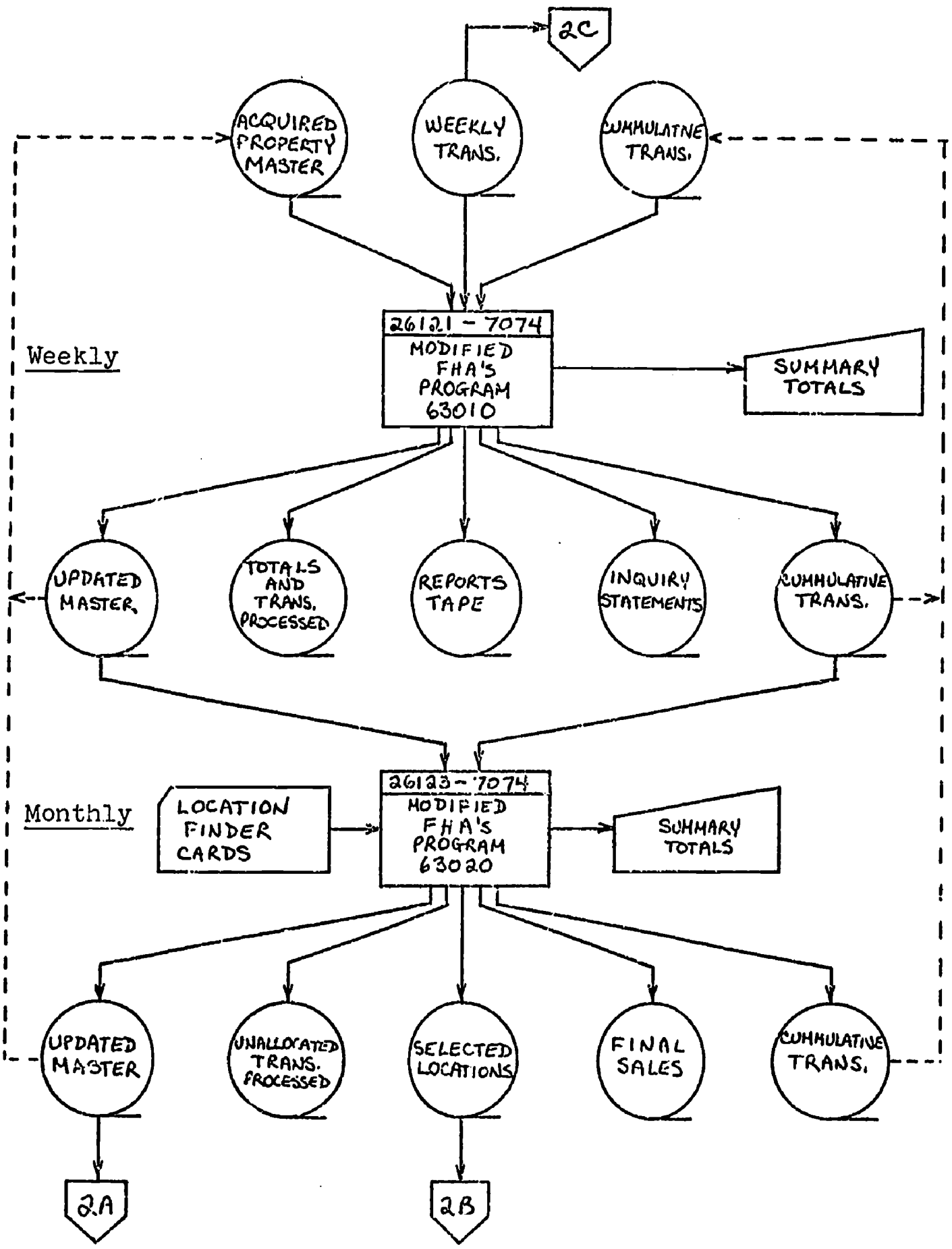
APPENDIX VIc

FLOW CHARTS DEPICTING CHANGES MADE

TO FHA PROGRAMS FOR AUDIT PURPOSES

Acquired Property System



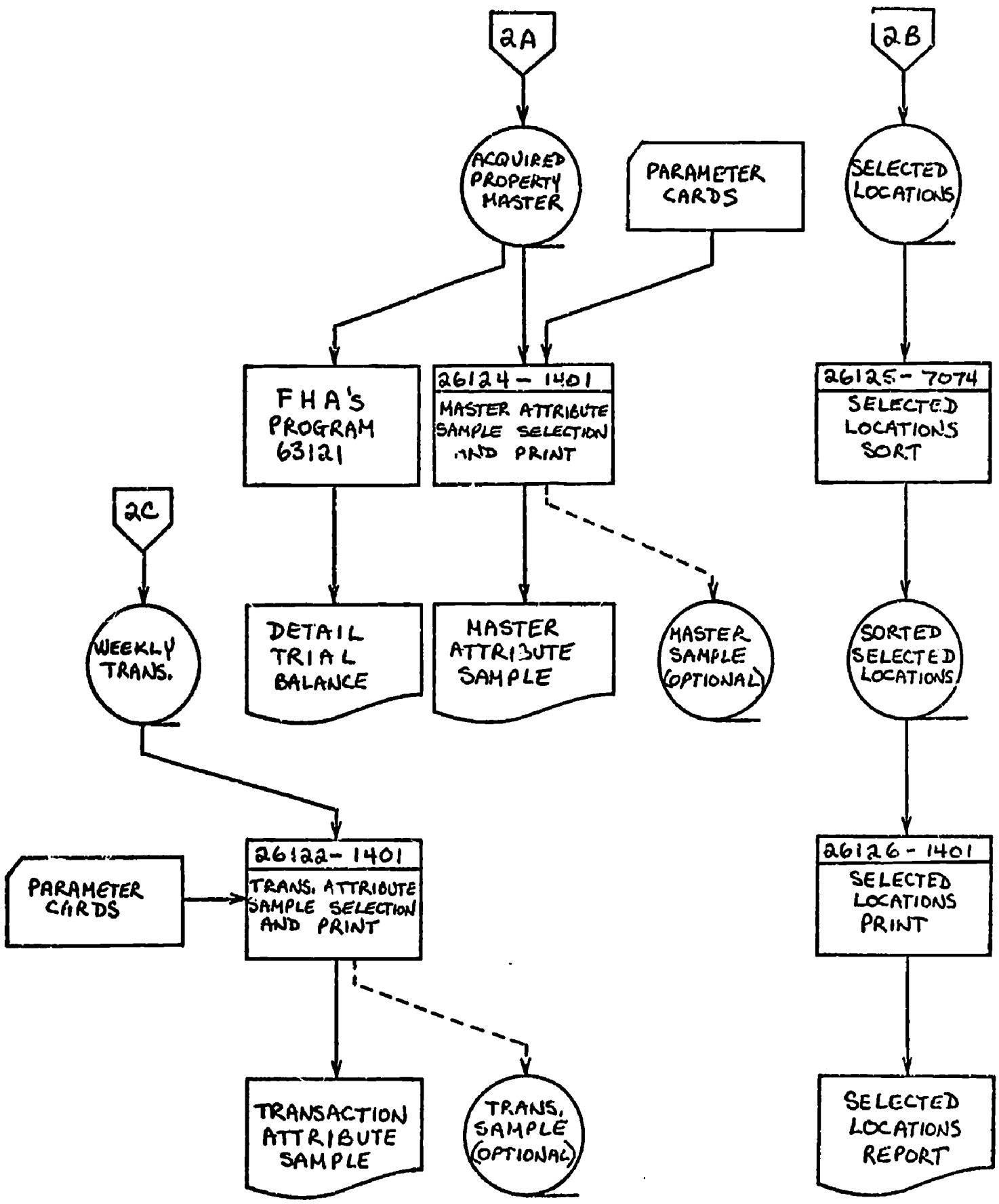


FLOW CHARTS DEPICTING CHANGES MADE

TO FHA PROGRAMS FOR AUDIT PURPOSES

Acquired Property System





APPENDIX VId

PROGRAMMING SPECIFICATIONS

Program #26101 - Modified FHA's Program #21000.

I Purpose - To modify the FHA's existing program to do the following:

A. to select an attribute sample of the Master Insured Mortgage File on an every Nth, over X basis,

B. to select Master records (on case number) as specified by finder cards,

C. to produce totals, by section of Act, for earned and unearned premiums and unpaid mortgage balances,

D. for Section 203, to produce a sample of the Master from which to project the above totals for the entire Section 203.

NOTE: Because of the volume in Section 203, sample reels will be used in lieu of the entire file.

All inputs, outputs and processing will remain as in the current FHA's Program #21000.

II Input

A. Standard date card.

B. Parameter cards - format attached.

C. Finder cards (optional) - format attached.

D. Remainder of input as in the existing programs.

III Processing

A. Read date card. Compare the program number on the date card to "26101". If not equal, come to locked halt (HALT 1111). Store dates for subsequent use.

NOTE: On all locked halts, program will be re-loaded.

B. Read parameter cards and store Nth and "over x" fields.

PROGRAMMING SPECIFICATIONS

C. Read finder cards. Sequence check finder cards on the following fields (major to minor)

Section Number
Case Number

If out of sequence, come to locked halt (HALT 2222).

D. Open two additional output files.

1. Attribute sample - ident "FHAFMMSTSM".

2. Value estimate sample - ident "FHAVALEST ".

Place Julian date from date card in all output headers. Assign both files above, file number 26101.

E. Determine which field will be used for the value estimate and write every Nth field, from Section 203 only, on to the value estimate tape. Accumulate number of records selected and total amount.

F. Determine which field will be used for the "over x" of the attribute sample.

G. Write every Nth record and all that are "over x" on to the attribute sample tape in the same format as the master input. Insert a reason code (1 = every Nth, 2 = over x) in the record.

H. Match the finder cards to the master on section number and case number. If equal, write the record on the attribute sample tape with reason code 3.

I. Accumulate total earned and unearned premiums and unpaid mortgage balance for each section of the act and grand totals of the above (allow 2 words per accumulator).

J. At a break in section number, type out the above sub-totals for that section.

K. At end of job, type out the grand totals accumulated per I, above, and value estimate totals per E, above.

IV <u>Output</u>

Same as existing program plus

A. Summary Totals.

B. Value estimate sample.

C. Master attribute sample.

APPENDIX VId

## PROGRAMMING SPECIFICATIONS

Program #26101

Parameter Card:

| C.C. | FIELD | FORMAT (or contents) |
|---|---|---|
| 1 | Card Code | "2" |
| 3 | Finder Cards indicator | 0 = no finder cards<br>1 = finder cards present |
| 4 | Value Estimate field code | 1 = unpaid mortgage balance<br>2 = original mortgage amount |
| 5 | Attribute Sample "over x" field code | same as above |
| 6-10 | Nth value for value estimate | XXXXX |
| 11-15 | Nth value for attribute sample | XXXXX |
| 16-20 | over x value for attribute sample | XXXXX |

Finder Cards:

| C.C. | FIELD | FORMAT (or contents) |
|---|---|---|
| 1 | Card code | "3" |
| 7-10 | Section number | XXXX |
| 11-20 | Case number | XXXXXXXXXX |

Last finder card should have all 9's in section number and case number.

In both formats, all unused columns will be zeros and a plus zone (+) over columns 10, 20, 30, 40, 50, 60, 70, and 80.

APPENDIX VIe

## PROGRAM ASSEMBLY

| PROGRAMMER CODING | MEANING | MACHINE GENERATED CODE |
|---|---|---|
| 1401 Autocoder | | |
| R | Read a card | 1 |
| W | Write a line | 2 |
| P | Punch a card | 4 |
| MCE | Move characters and edit | E |
| H | Halt | . |
| M | Multiply | @ |
| D | Divide | % |
| A | Add | A |
| S | Subtract | S |

# APPENDIX VII

## CUSTOM-DESIGNED COMPUTER MATCH ROUTINE

## FOR AN IBM 1401 COMPUTER

APPENDIX VII

## Contents

APPENDIX VII

# CUSTOM-DESIGNED COMPUTER MATCH ROUTINE

# FOR AN IBM 1401 COMPUTER

## INTRODUCTION

This match routine was designed to accept as input those magnetic tapes prepared by the Haskins & Sells Auditape System. The routine will compare records on two magnetic tapes and identify and list either matched or unmatched records. Input data must be on magnetic tape.

The computer program instructions are contained in 167 punched cards. The user indicated by means of two additional punched cards the fields on which comparisons are to be made and the type of output desired.

## SPECIFICATIONS FOR INPUT FILES

Records in both magnetic tape input files must be in the format described below.

| Field number | Field location | Field length |
|---|---|---|
| 1 | 1 and 2 | 2 |
| 2 | 3 to 8 | 6 |
| 3 | 9 to 14 | 6 |
| 4 | 15 to 24 | 10 |
| 5 | 25 to 30 | 6 |
| 6 | 31 to 44 | 14 |
| 7 | 45 to 56 | 12 |
| 8 | 57 to 68 | 12 |
| 9 | 69 to 80 | 12 |
| 10 | 81 to 92 | 12 |
| 11 | 93 to 104 | 12 |
| 12 | 105 to 116 | 12 |
| Not used | 117 to 128 | 12 |
| Record mark | 129 | 1 |

The input tapes prepared by the Auditape System include an 80 character nonstandard header label and a tape mark in lieu of a trailer label. Each record is 129 characters in

length, including a record mark. The blocking factor is 20, which creates a block size of 2,580 characters.

The input files must be in ascending sequence on field number 6. A comparison on field number 6 is mandatory in the program and always will be made first. The choice of other fields for comparison is made by the user through the use of punched request cards described below.

REQUEST CARDS

There always must be two punched cards placed behind the program deck. The format of the first card is as follows:

| Columns | Punching |
|---|---|
| 1 and 2 | Must contain "AA" to be recognized by the computer. |
| 3 | Punch "M" if matched records are to be listed. Punch "U" if unmatched records are to be listed. Column 3 must contain "M" or "U." |
| 4 | Punch "Y" if user wants unmatched listing to include records not matching on field 6. Otherwise leave blank. |

The format of the second card is as follows:

| Columns | Punching |
|---|---|
| 1 and 2 | Must contain "BB" to be recognized by the computer. |
| 3 to 5 | Express the number of a field selected by user for comparison in three figures using zero prefixes. For example, punch "008" if field 8 is selected. |
| 6 to 8 | Punch the number of another field selected. (See notes.) |
| 9 to 11 | do. |
| 12 to 14 | do. |
| 15 to 17 | do. |
| 18 to 20 | do. |
| 21 to 23 | do. |
| 24 to 26 | do. |
| 27 to 29 | do. |
| 30 to 32 | do. |
| 33 to 35 | do. |
| 36 to 38 | do. |

Notes:

1. Punch 999 after last field number requested. The 999 indicates that no other fields are to be compared. Columns to right of 999 will be blank.
2. Field number 6 will not be stated because it is mandatory in the program.
3. Field numbers to be chosen may be 001, 002, 003, 004, 005, 007, 008, 009, 010, 011, and 012.
4. If comparison is to be on field number 6 only, punch 999 in columns 3 to 5.

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## PADDING

The padding character on input and output files is a number 9. Input padding records are recognized by a 9 in field number 2; therefore no data record may have all 9's in field number 2.

## BLOCKING FACTOR

The blocking factor is 20 for input tape files and 10 for output tape files.

## MEMORY SIZE

The match program is for an IBM 1401 computer and requires a 12,000 character memory.

## OUTPUT

Output consists of a listing of either the matched or unmatched records as directed by the user. The records printed also are placed on magnetic tape for later reference. The output tape has spacing, identical to the printing format, between fields. An asterisk to the right of field number 1 on the printed listing indicates that the record is unmatched on field number 6.

The file placed on tape drive number 1 is called File No. 1, and the file placed on tape drive number 2 is called File No. 2. On the listing made by the computer, an "F1" at the left end of a data line indicates that the record came from File No. 1; an "F2" indicates that the record came from File No. 2.

The format of the output printed listing is as follows:

| Element number | Element name | Field location | Field length |
|---|---|---|---|
| 1 | File number | 1 and 2 | 2 |
| 2 | Field No. 1 | 3 and 4 | 2 |
| 3 | "*" for unmatched on field 6 or blank | 5 and 6 | 2 |
| 4 | Field No. 2 | 7 to 12 | 6 |
| 5 | Blank | 13 | 1 |
| 6 | Field No. 3 | 14 to 19 | 6 |
| 7 | Blank | 20 | 1 |
| 8 | Field No. 4 | 21 to 30 | 10 |
| 9 | Blank | 31 | 1 |
| 10 | Field No. 5 | 32 to 37 | 6 |
| 11 | Blank | 38 | 1 |
| 12 | Field No. 6 | 39 to 52 | 14 |
| 13 | Blank | 53 | 1 |
| 14 | Field No. 7 | 54 to 65 | 12 |
| 15 | Blank | 66 | 1 |
| 16 | Field No. 8 | 67 to 78 | 12 |
| 17 | Blank | 79 | 1 |
| 18 | Field No. 9 | 80 to 91 | 12 |
| 19 | Blank | 92 | 1 |
| 20 | Field No. 10 | 93 to 104 | 12 |
| 21 | Blank | 105 | 1 |
| 22 | Field No. 11 | 106 to 117 | 12 |
| 23 | Blank | 118 | 1 |
| 24 | Field No. 12 | 119 to 130 | 12 |
| 25 | Blank | 131 to 132 | 2 |
| 26 | Group mark word mark | 133 | |

The output tape includes a standard trailer label. Each record is 134 characters in length, including a record mark. The blocking factor is 10, which creates a block size of 1,340 characters. The format of the output tape is as follows:

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| Element number | Element name | Field location | Field length |
|---|---|---|---|
| 1 | Zero | 1 | 1 |
| 2 | File number | 2 and 3 | 2 |
| 3 | Field No. 1 | 4 and 5 | 2 |
| 4 | "*" for unmatched on field 6 or blank | 6 and 7 | 2 |
| 5 | Field No. 2 | 8 to 13 | 6 |
| 6 | Blank | 14 | 1 |
| 7 | Field No. 3 | 15 to 20 | 6 |
| 8 | Blank | 21 | 1 |
| 9 | Field No. 4 | 22 to 31 | 10 |
| 10 | Blank | 32 | 1 |
| 11 | Field No. 5 | 33 to 38 | 6 |
| 12 | Blank | 39 | 1 |
| 13 | Field No. 6 | 40 to 53 | 14 |
| 14 | Blank | 54 | 1 |
| 15 | Field No. 7 | 55 to 66 | 12 |
| 16 | Blank | 67 | 1 |
| 17 | Field No. 8 | 68 to 79 | 12 |
| 18 | Blank | 80 | 1 |
| 19 | Field No. 9 | 81 to 92 | 12 |
| 20 | Blank | 93 | 1 |
| 21 | Field No. 10 | 94 to 105 | 12 |
| 22 | Blank | 106 | 1 |
| 23 | Field No. 11 | 107 to 118 | 12 |
| 24 | Blank | 119 | 1 |
| 25 | Field No. 12 | 120 to 131 | 12 |
| 26 | Blank | 132 to 133 | 2 |
| 27 | Record mark | 134 | 1 |

The computer will halt at the end of a run and for various other conditions as indicated by 3 digit codes displayed in the "A" and "B" registers of the computer. The lists of codes and their explanation, a console operating guide, and complete program documentation are available from the U.S. General Accounting Office.

APPENDIX VIII

# USE OF TEST FILES FOR COMPREHENSIVE SYSTEM TESTING AT THE VETERANS ADMINISTRATION CENTER PHILADELPHIA, PENNSYLVANIA

## Contents



## ABBREVIATIONS

| | |
|---|---|
| ADP | Automatic data processing |
| DPC | data processing center |
| IBM | International Business Machines |
| VA | Veterans Administration |

APPENDIX VIII

# USE OF TEST FILES FOR COMPREHENSIVE SYSTEM TESTING AT THE VETERANS ADMINISTRATION CENTER PHILADELPHIA, PENNSYLVANIA

As part of our study at the Veterans Administration (VA) Center, Philadelphia, Pennsylvania, we made an extensive inquiry into the procedures and practices followed by the VA resident Automatic Data Processing (ADP) systems auditors in establishing and utilizing a test deck to test the various computer programs which make up the VA Insurance system. We believe that an explanation of the automated insurance program is necessary to provide a better understanding and appreciation of the complexities involved in using a test deck for comprehensive system testing.

## VA INSURANCE SYSTEM

The insurance system is a highly complex and integrated batch-processing system which involves the daily maintenance and updating of the insurance records of about 5.5 million veterans and servicemen. The insurance operations are conducted at VA Centers in Philadelphia, Pennsylvania, and St. Paul, Minnesota. All master record files are maintained on magnetic tape at the Philadelphia data processing center (DPC). The Philadelphia DPC uses an optical character reader for input, and both centers use International Business Machines (IBM) 1401 computers to convert punched-card input to magnetic tape. The St. Paul DPC transmits its tape input to Philadelphia through a tape-to-tape communications system. An IBM 7080 computer linked to an IBM 360-40 is utilized as the main processing unit to update the master files. Upon completion of the daily updating, the output tapes relating to the St. Paul master records are transmitted back over the communications system for further processing and printing on the IBM 1401.

When we began our study, VA maintained three separate master files for the insurance accounts under the jurisdiction of the Philadelphia Center and two separate master files for those under the jurisdiction of the St. Paul Center. These files covered the six major VA administered insurance programs authorized by the Congress.

Prior to the completion of our study, VA implemented a major systems redesign which resulted in consolidating these five master files into one file for the Philadelphia Center and one file for the St. Paul Center. The system's redesign integrated the accounting system and combined a number of daily computer processes into consolidated update programs.

In addition, the insurance award master records for both centers are maintained on one consolidated master file. These records are for the beneficiaries of deceased veterans who are receiving insurance proceeds and for the disabled veterans who are receiving disability insurance payments.

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## DAILY PROCESSING

Daily insurance activities involve processing about 86,000 transactions to update the related master records. Collections of about $1.5 million a day are automatically accounted for, reconciled, and applied to the appropriate individual insurance accounts. Punched cards representing collection items are generated by the system, mailed to policyholders, and returned with premium payments and loan and lien interest payments. Clerically prepared optical character recognition and punched-card input represents file maintenance transactions, such as requests for record printouts, applications for policy loans, cash surrenders, reinstatements, withdrawals of dividend deposits, waivers of premiums, changes to policy contracts, total disability benefits, premium refunds, death notices, accounting transactions, and other miscellaneous transactions.

Magnetic tape input contains pending transactions. These are valid transactions that for some reason could not be processed against the master file. The pending transaction tape is produced as output each day and becomes input the following day.

All tape input is edited and merged in insurance file-number sequence by transaction-type codes into a consolidated transaction input tape. This tape is then processed against the master file where invalid transactions are coded as rejects, transactions that cannot be acted upon are placed on the pending tape for future processing, and valid transactions are processed to update the related master records.

In addition to the updating which results from daily input transactions, the system automatically accomplishes a variety of internal transactions on the basis of a series of call-up dates and call-up codes contained on the individual master records. For example, dividend and interest computations are performed automatically; collection items may be recoded internally and applied to lien and premium or loan and premium accounts; dividend credit amounts are withdrawn when needed and applied to pay premiums and prevent lapse; billing notices, lapse notices, and renewal notices are released automatically; and master record printouts are released automatically under a variety of circumstances to indicate that clerical follow-up actions are necessary.

When a notice of death or disability payment data is entered into the system, the status of the account is determined, general ledger accounts are adjusted, accounting liability is established for settlement of the claim, and an image of the master record is produced on an output tape. This tape is input to the insurance awards system where pertinent information is extracted from the master record and an awards-pending master record is established. When the death or disability claim is approved and appropriate transactions are introduced into the awards system, the pending master record is changed into an awards master record and the system automatically begins to release the disability payment or the insurance proceeds payment on the basis of the particular optional settlement elected by the beneficiary.

Upon completion of the daily updating run, the system produces a series of output tapes which require further processing and printing.

The daily "hard copy" output produced by the system includes:

1. Collection transactions accounting and distribution reports.

2. General ledger account totals.

3. Summary processing control reports.

4. Record printouts for clerical follow-up.

5. Premium notices and loan and lien interest notices.

6. Insurance policies, renewal certificates, insurance status notices, statements of account, lapse notices, and a variety of other forms for mailing to the insureds.

7. Transaction listing for history and record retrieval.

8. Reject lists and a variety of punched control cards for unassociated items, returned checks, pending refunds, cash dividends, etc.

In addition, a daily cash disbursement tape is produced and forwarded to the Philadelphia Regional Disbursing Office of the U.S. Treasury for preparation of checks for payment of dividends, dividend credit-deposit withdrawals, refunds, cash surrenders, and policy loans.

ESTABLISHING TEST FILE

In view of their responsibilities for certifying to the operational status of all computer programs in the insurance system and of all program modifications, the VA systems auditors constructed a test file to assist them in carrying out these responsibilities. The test file consists of (1) a master file of about 14,000 individual master records, (2) a card deck of input transactions, and (3) a complete set of all output data that the system normally produces.

The test master file was obtained by preparing coded input to establish master records and by reproducing other master records from the live master file on another reel of tape. Additional master records are added to the test file as required to represent various conditions and circumstances which did not exist in those records originally established.

The input transactions were obtained by extracting from a consolidated input tape all transactions containing an insurance file number which matched the file numbers of the master records on the test master file. Manually coded input transactions were added to represent different types of transactions which were not contained in the consolidated input tape.

The output was obtained by processing the input transactions against the test master file. This action resulted in updating the individual master records and producing all the output that the system would normally produce under actual processing conditions.

The VA systems auditors then made an extensive review of each master record, to ensure that the updating actions had been proper. Every piece of output was examined, to ensure that it was complete and accurate in every detail. Once this was done, the auditors were satisfied that all the programs in the insurance system were operational.

Subsequent program modifications were tested by adding new input transactions to the input deck and processing them against the test master file by using the modified programs. The new input was designed specifically to test the program or part of the program that had been modified. Also the

auditors determined in advance the effects that the new input should have on the master records and on all the output.

GAO REVIEW OF TEST DECK PROCEDURES

We made a review of a test performed by the VA systems auditors of a program modification which had been implemented during the time of our study. The modification was designed to provide for a computer-generated reply, under certain circumstances, to veterans inquiring about the payment of the 1968 dividend. Under normal procedures dividends are payable on the anniversary date of the policy. It had been the practice over the past several years, in accordance with Executive order, to pay all dividends at the beginning of the calendar year. This practice, however, was not followed in 1968, and VA anticipated an inordinate amount of inquiries from veterans concerning their dividends.

A project for a program modification was established, and instructions were issued that all mail relating to the payment of 1968 dividends be screened in the mail room. Inquiries relating to participating policies were to be forwarded directly to the keypunch section. The number 4 was to be punched in card column 31 of input card VA Form 29-5899--Request for Record Printout (together with file number and name code)--and the card was to be released to DPC. Computor program modifications included:

1. Changes in the daily edit and merge run to place the the input transaction in the proper sequence.

2. Changes in the daily update run to:

   a. Reject transactions involving nonparticipating policies and those not eligible for dividends.

   b. Release to the veteran, where the policy anniversary date had not passed, VA Form 29-5885--Information About Your Insurance--with a computer-printed paragraph explaining that the 1968 dividend would be paid on the policy anniversary date.

c. Release a record printout for clerical follow-up, where the anniversary date had passed to determine whether the veteran already had received the dividend.

Our review of the test made by the VA systems auditors consisted of determining (1) what input the auditors had prepared to test the modification and (2) how the output had been effected. It is significant to note that, although the modification had involved only one punch to one input card, the audit staff prepared 43 pieces of input to test the modification. The input represented different types of conditions that could appear on master records, for example, type plan, number of policies, amount of insurance, call-up codes, and different optional segments. The variety of input was prepared to ensure that the program modification would process the transaction properly regardless of the status of the master record.

It is also significant to note that, although the modification had been designed to effect a change on a form notice to veterans under one set of circumstances and to release a printout of a master record under other circumstances, the auditors were required to review prints of four different magnetic tapes, two listings, and 14 different types of form notices to veterans, to ensure that the modification would properly produce only that output that was intended.

The VA audit staff prepared the input which was inserted into the test deck of input transactions and converted to magnetic tape. The tape imput was processed through the modified edit and merge program and then processed against the test master file by using the modified update program. The output tapes were processed through the dispersal program and then further processed through the 1401 print-punch programs to produce the test output.

The output was then reviewed to ensure that (1) master records had not been altered, (2) printouts of master records had been released in those cases where the policy anniversary date had passed, (3) general ledger totals had not changed, (4) the transaction listing had not been altered, (5) the various form notices to veterans (except VA Form 29-5885) had not been affected and (6) the reports and controls listing had reflected the additional pieces of input and output.

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Subsequent to our review the VA ADP systems auditors adopted the technique of using tape-compare programs in conjunction with the test file. The programs were developed by VA systems employees and were tested and accepted for use by the auditors. The purpose of the programs is to use the computer to compare output tapes before and after modifications to operating programs. This technique greatly reduces the amount of hard copy output the auditors have to review. For example, a transaction tape may be generated before and after a modification to the operating program which produces the tape. The tape-compare program is used to compare the transaction date on both tapes and to printout only those transactions which differ. The auditors are required to manually review only a few hundred pieces of output, instead of the thousands that had to be reviewed prior to adopting the use of tape-compare programs.

## CONCLUSION

On the basis of our review, we concluded that the extensive use of test decks in conjunction with ADP systems of even moderate complexity required an intimate knowledge of the system on the part of the auditor. It is also apparent that technical assistance would be required in conducting a test.

The construction of a test deck may require special programs. In the VA case special programs had to be prepared to select master records from the live master file and to extract the matching input transactions for the consolidated input tape. Also the system redesign which VA had implemented to consolidate the master files of the various insurance programs had necessitated the same redesign to the auditor's test deck. The conversion programs that had been prepared to accomplish the redesign were used initially to consolidate the test master files. After review and certification by the system auditors, the conversion programs were then used to convert the live master files.

The construction and use of a test deck for comprehensive and recurring audits is a large undertaking that involves a considerable expenditure of time and requires a thorough knowledge of the system. The proper use of a test deck, however, is an effective auditing technique, and it should be considered by the auditor.

APPENDIX IX

# REVIEW GUIDE
# FOR EVALUATING INTERNAL CONTROLS IN AUTOMATIC DATA PROCESSING SYSTEMS

UNITED STATES
GENERAL ACCOUNTING OFFICE
1968
(WITH 1970 REVISIONS)

## FOREWORD

*This guide has been designed for use by GAO staffs in evaluating internal controls in ADP systems in Federal agencies or other organizations whose operations are being reviewed.*

*The guide contains background information on controls used in ADP systems and a questionnaire for use in reviewing them.*

*As more experience is gained in the review and evaluation of ADP systems in operation, the guide will be revised as necessary.*

E.H. Morse, Jr.

**E.H. Morse, Jr.**
**Director, Office of Policy and Special Studies**

APPENDIX IX

# REVIEW GUIDE FOR EVALUATING INTERNAL CONTROLS IN AUTOMATIC DATA PROCESSING SYSTEMS

APPENDIX IX

## SECTION I

## BACKGROUND MATERIAL ON CONTROLS USED IN ADP SYSTEMS

### INTRODUCTION

The installation of an ADP system will often alter the functions and responsibilities of various groups in an organization. For example, it may alter the requirements for original source data to be furnished by operating departments. It may change the group processing the information and it may alter the processing since functions previously performed by the operating, service, and accounting departments may be transferred to the data processing group in order to make fuller use of the computer's capability. The conversion to ADP may result in the elimination of intermediate records and controls that were present in the previous system.

The objectives of controls in an ADP system are to insure that the system accepts and processes only valid data, that it processes such data completely and accurately, and that it produces the information, records, and reports that are needed. These are necessary and important objectives. Systems that are designed with these control objectives will not only possess a high degree of reliability, but the accuracy and orderliness which result will lead to greater processing efficiency by reducing the number of errors that require manual intervention and reprocessing.

### NATURE OF INTERNAL CONTROLS

For many years, internal control has been identified with such characteristics as the division of duties, a network of authorizations and approvals, arithmetical verifications, and lines of responsibility. However, with the ever-increasing centralization of data processing through the use of large-scale electronic computers, there has been a tendency to consolidate many of these functions. Even

with this consolidation, the basic concept of the division of duties and responsibilities as a measure of internal control is still valid. However, there is a change in the manner in which the basic concept is applied.

The following changes are involved as functions are transferred from people to machines. First, the need for internal control over these people disappears. Second, a series of needs arise for control over such elements of the system as:

1. The machines.

2. The machine programs that run the machines.

3. The people who operate the machines.

4. The data entering the machines or systems.

5. The processing of the data in the machine's system.

6. The output products that are produced by the machines.

In a manual, as well as in an automatic data processing system, data must be introduced into the system (input), processed, and the resultant information (output) communicated to management and other interested parties. A sound functional internal control system is equally important in either system.

GAO staff members must be aware of the characteristics of internal control which have changed or which have experienced a change in emphasis with the advent of ADP. Information systems, including accounting systems, using ADP can neither be designed nor audited properly unless the effect of ADP upon internal control is thoroughly understood.

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## INTERNAL CONTROL IN AUTOMATIC DATA PROCESSING SYSTEMS

Internal controls in a data processing system vary widely, depending upon the type of application and its complexity. The actual techniques to be employed by an organization depend upon individual conditions and requirements. In the final analysis, the adequacy of the network of internal control present in a system is the key element to be depended upon in determining the reliance to be placed upon the accuracy of the data processing system.

Some of the internal controls most commonly used in mechanized information handling systems are described below.

### Input controls

Input controls are those controls established to verify the accuracy of the process of transferring data from an external document into a machine-readable document. The exactness with which computers follow instructions requires that data entering the system be converted into machine-readable media in correct form and content.

The auditor should become familiar with:

1. The types and quantities of source documents.

2. The methods for converting this data to processing-machine language.

3. The procedures for introducing the input into the processing equipment.

4. The methods of recording information in coded forms on paper tapes, punched cards, or tags that can be used over and over again to produce other records without rewriting (source data automation).

5. The recording devices used to feed transaction data directly from the point of transaction into the computer (direct recording).

6. The various controls and checks designed to insure that all source data will reach the equipment without loss, addition, or error.

This review should also cover the procedures and facilities for retaining source documents, including safeguards imposed and the manner, methods, and authority for the disposition of such records.

Separation of duties

Separation of duties involves a plan of organization within an automatic data processing facility whereby those functions concerned with systems planning and implementation are segregated from those concerned with the day-to-day operation of the system. This separation provides an effective cross-check of the accuracy and propriety of changes which are introduced into the system; it avoids the undesirable situation in which operating personnel can implement revisions without prior approval and thorough checking; and it eliminates access to the equipment by nonoperating personnel.

As a practical matter, the implementation of the separation principle becomes difficult with an ADP system because there is a tendency to have loose organizational relationships between system analysts and programmers, computer operators, key punch personnel, the control group, and the program and tape library. In addition to loose organization, the trend toward integrated processing further obscures the separation of duties. In the face of these trends, it becomes difficult for the auditor to expect to find the traditional separation of duties. However, he can reasonably expect to find some form of separation of duties. Several general points for consideration are listed below:

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1. Many data processing operations are carried on by a data processing center which functions as a service organization for the various activities which collect and use the data processed. The establishment of such an independent service-type organization which handles all of the actual data processing provides, in itself, a division of duties and responsibilities and, under the proper circumstances, might constitute an acceptable measure of internal control.

2. A control unit or group may be established for the purpose of monitoring and controlling data, both entering and leaving the data processing center. These control units, when they are organizationally independent of both the processing activity and the using activities, also represent an effective internal control through the division of duties and responsibilities.

3. Many important types of transactions affecting financial files must come fron authorized personnel on signed documents. Furthermore, procedures are established to insure that input of this nature is made only from the appropriately validated document.

4. Controls over the approval and implementation of computer program changes may be instituted.

5. At least two qualified people must be on duty in the machine room during all processing as a check against unauthorized use of the computer.

6. A copy of the console typewriter printout may be retained as a log of computer operations.

Document controls

Consideration should be given to the control of documents by log or other means.

Prenumbered source document--Serial numbers are printed or stamped on each document. This technique is particularly adaptable to documents, such as checks, vouchers, or sensitive documents, where each document must be accounted for. Input data so identified may be checked either mechanically or electronically to insure proper sequence or to reveal missing numbers.

Document register--A record on which each document is listed at the point of receipt or origin or at some critical intermediate control point during processing. This record not only discloses missing or misplaced documents, but it also can indicate delays in processing. If a document is lost or misplaced during processing, the document register can be referred to in order to locate the missing document.

Transmittal slips--A printed form utilized as a cover letter describing a group or batch of source documents being transferred from one department or location to another.

Batching--Accumulating documents into an economic processing unit indicating the number of documents in the group, the serial numbers of the documents included, and perhaps a control total of some data field that is common to all documents. Control totals on the batch are accumulated before source data is converted to input form. After data conversion is made to a machine-readable language, the batch totals previously taken may be compared to the totals on the input data. Batch totals may also be used as a check on the processing unit through a comparison of input totals developed during processing and the totals previously developed prior to the input of the data into the system.

Manual editing--The physical inspection of the contents of the source document, that is not in a machine-processable medium, to insure that the information contained on the document is complete and accurate before it is entered into the ADP system.

For example, to insure the accurate conversion of input data to a machine-processable medium (e.g., punched cards), it is often desirable to manually edit the source document and transfer the appropriate data to a coding sheet from which the key punching can be directly performed. This technique is especially valuable when the source document is either extremely complex--where much of the information on the source document is extraneous to the requirements of the machine-processable medium--or else where the source document is prepared by third parties who cannot be controlled in the accuracy of their preparation of the source document. The type of data that would be appropriately checked would include identification or descriptive information such as controlling codes, customer names, extensions, and footings.

Control totals

A control total is an effective method of controlling both the number of records processed and the accuracy of the processing itself. It involves the development of various control totals through the addition of specific data elements taken from each record processed. These may be either "hash" totals or actual data footings which have some significance in the system. These totals and their comparison from time to time throughout the processing generally furnish an excellent means of detecting errors.

A "hash" total is the sum of certain specified numerical factors in the records being processed which has no accounting significance other than as a control. For example, the sum of stock numbers, employee numbers, account codes, department numbers, voucher numbers, or work order numbers are "hash" totals since they

provide the controls without providing any significant accounting information.

Actual footings or significant control totals familiar to the auditor in manual accounting systems are utilized extensively in mechanized systems. These include totals and subtotals of dollar amounts or quantity amounts and they can be made to serve a number of useful purposes in addition to their controlling function. The capability of automatic data processing equipment to derive and, in some cases, compare these totals rapidly and economically has supported the use of the control total device in many more instances than would have been possible in manual systems.

Control group

A group usually organized independently of both the using activity and data processing center for the purpose of monitoring and directing data, both entering and leaving the data processing center. Such a control group has the responsibility of insuring that information flows through the data processing center in the manner outlined in procedure manuals and computer programs. In some instances, this control group also schedules the work of the data processing center and acts as liaison between the center and those departments originating input or receiving final reports. The control group may also follow up and reconcile discrepancies in order to insure correct processing and proper disposal of rejected or incorrect transactions.

For example, source documents are received by the control group to be checked for proper authentication and completeness. They are then batched and control totals developed for each batch. These control totals are entered on a document log. Erroneous source documents are returned to the control group for investigation, correction, and reentry into the system. Printed output, reflecting machine-developed control totals, are forwarded

to the control group for comparison against totals developed on the document log.

Program documentation

Complete and comprehensive documentation is essary to the continued efficient operation and succes any data processing system. Operating personnel sho have formal written procedures to follow. It, of course, is good practice to keep documentation current.

Adequate program documentation is necessary to permit management, auditors, or outside agencies to examine and understand the operations. Management has a broad need for good documentation. For example, in the absence of the original programmer, management must rely on documentation for making program changes, reprogramming to improve machine efficiency, converting to another computer, or interchanging information with another installation. Documentation is also of value to the auditor. System flow charts and associated operator instructions, for example, assist the auditor in determining how data flows through the system and the types of errors the computer has been programmed to detect.

Adequate documentation varies according to the circumstances involved. One method of judging the adequacy of documentation is to determine whether a typical programmer could read his way to an understanding of the system without supplementary information and discussion.

Documentation of a system of average complexity might include the following:

1. A general written description of the overall system, including a statement of its objectives, a description of the basic flow of information through the system, and a broad description of the separate processing steps and interrelationships between computer runs.

2. A system flow chart to accompany and illustrate the description.

3. For each computer program, a description of the functions performed by the program and a general description of how the program accomplishes these functions.

4. Block diagrams showing the sequence of operations performed by the programs.

5. Record descriptions showing the form and content of all inputs and outputs and memory locations.

6. Program listing in source language and in object code (a copy of a computer program used can replace the need for object code listing).

7. Program operating instructions for loading control cards, switch settings, halt procedures, sources of input, and disposition of output.

Output controls

Output controls assure that data processing results are reliable and that no unauthorized alterations have been made to transactions and records while in the custody of the automatic data processing unit. The basic objective is to provide the user a reliable record without slow and costly visual reviews of each individual output record or document.

Output controls include, for example, the use of record counts and control totals. To the extent feasible, output record counts or amounts should be predetermined or established as controls at the earliest practicable point in the data processing operations. Provisions should also

be made for control counts of error or reject as well as "good" output records.

The output control data should be produced automatically in such format that the data cannot be altered to conform with predetermined counts or amounts. Also, control data output should be reviewed or reconciled outside the data processing unit. For example, a continuous form computer console typeout, printed control totals on the last page or form, or punched summary cards picked up by a shift supervisor and transmitted to a separate control unit for verification would provide maximum assurance or specified output without operating alteration.

Samples of all end products, especially in those data fields not subject to output count or other controls, should be visually inspected or reviewed for quality. For obvious reasons, this inspection is particularly important for those end products sent to customers or other persons outside the agency.

Programmed controls

The computer's ability to make simple decisions and perform arithmetical calculations makes it possible to program control procedures directly into an ADP system. These programmed controls represent checks capable of being incorporated into the computer by means of coded instructions or programs. For example, the computer can be programmed to test input data against predetermined standards, count records, and develop control totals. Programmed controls should be made a part of every computer program.

Hardware controls

Hardware controls are defined as those data protection and validation devices that are built into the equipment by the manufacturer. Their primary function is to verify the accuracy of information transmitted, manipulated, or stored and to to insure that the computer is

performing properly. The electronic nature of the computer and the checking circuits and procedures (parity bits, dual reading, echo checks, etc.) engineered into the equipment make possible an operational reliability surpassing by far the standards attainable in mechancial equipment or manual operations.

Conversion controls

The conversion of a conventional paperwork or electrical accounting machine system to an ADP system should be controlled in such a manner as to insure a smooth transition from the old to the new system. Critical emphasis should be placed on the correction of discrepancies prior to conversion to the ADP system. Some basic techniques have been developed to facilitate the auditor's coverage of important conversion areas. These techniques include:

1. Procuring time schedules, training, and planned conversion procedures.

2. Determining the necessity for parallel operations.

3. Becoming familiar with conversion routines.

4. Reviewing document retention procedures.

5. Reviewing site preparation.

6. Reviewing system failure and related emergency procedures.

7. Analyzing file purification process.

8. Monitoring cutoff procedures as to their compatibility with old versus new system operations.

9. Reviewing conversion controls as to their adequacy in preventing losses on transfer of information from the old system to the new.

PREAUDIT OF ADP SYSTEMS

An audit of a new ADP system before its use is a practice often followed. The audit may be performed by either the external or internal auditor. It usually consists of a review of the system plan and evaluation of the controls designed into the system. Specifically, the objective is to evaluate the adequacy of system design and internal controls to see if the system will provide processing results that will be accurate and reliable and to determine whether the data system, as designed, will permit effective and economical audits of the system and its products. Other matters to which the auditor's review may extend include the adequacy of the system documentation, conversion procedures, and content and frequency of reports.

SECTION II

## QUESTIONNAIRE FOR USE IN REVIEW OF INTERNAL CONTROLS IN ADP SYSTEMS

### INTRODUCTION

This questionnaire is to be used in the evaluation of internal controls incorporated in automatic data processing systems. It is designed to provide the auditor with certain audit guidelines and to provide a framework around which an informed decision can be reached regarding the adequacy of internal controls. Obviously, in reviewing the total ADP system, the auditor will obtain general background information and perform a review in sufficient depth to understand the basic purpose of the system, the general flow of information into the system, and the products coming out.

This questionnaire emphasizes the methods of internal control rather than specific procedures of auditing. It should, therefore, be used as an aid in identifying and evaluating internal controls. It is not intended that the auditor restrict his efforts to obtaining superficial answers to a list of questions. Instead, an in-depth analysis and evaluation of specific controls should be performed as called for by the circumstances.

Since internal controls in a data processing system vary widely, depending upon the type of application and complexity, a questionnaire or checklist obviously cannot provide a standard approach which will apply to all applications. Furthermore, it is not possible to list the specific number or types of controls a system should have before it is considered to have adequate internal controls. It is possible, however, to provide the auditor with certain review guidelines.

APPENDIX IX

## INTERNAL CONTROL IN AUTOMATIC DATA PROCESSING SYSTEMS

Properly designed ADP internal controls can operate as a substitute for detailed checking and, at the same time, provide a mechanism for control.

The conversion to a computerized system requires major changes in audit approach and techniques. The accessibility of information, the disappearance of man-readable records, and the manipulation of data by the computer are significant problems to which the auditor will have to adjust his audit approach.

In reviewing internal controls, the auditor seeks to find out whether prescribed procedures are actually being followed. The traditional audit approach of working backwards from summary records is not adequate in many mechanized systems. This could cause the auditor to shift his approach to a procedures or systems audit whereby, instead of testing procedures for detailed transaction recording, he would emphasize ADP systems documentation and internal controls.

In an audit of a mechanized system, the auditor should be aware of the controls built into the system which greatly increase the accuracy and validity of data processed. Some of these controls are discussed below. It is not a complete list of all controls available, but a list of those most commonly used in mechanized information systems.

## AUDIT GUIDELINES

General elements to be considered when evaluating the adequacy of the system or network of internal controls are the (1) internal audit organization, (2) controls outside the computer, (3) hardware controls, and (4) programmed controls. The auditor must determine whether these controls exist, whether they are adequate in the specific situation, whether they are being followed, and how they can be checked.

### INTERNAL AUDIT ORGANIZATION

An ADP function is usually of sufficient significance to an agency to warrant attention by the internal auditors or other internal groups.

#### Questions

1. Have any reviews been made? Obtain and review copies of available reports.

2. Did internal auditors aid in designing or providing an auditability survey of the ADP system? If so, the internal auditor should have detailed knowledge of the internal controls.

3. Are reviews of the effectiveness of controls within the ADP center periodically made?

If no reviews of any kind are made, we should consider developing an appropriate recommendation.

### CONTROLS OUTSIDE THE COMPUTER

#### Input controls

Input controls are those controls established to verify the accuracy of the process of transferring data from an external document into a machine-readable document. The exactness with which computers follow instructions requires that data entering the system be converted into machine-readable media in correct form and content.

The importance of this area of data input cannot be stressed too strongly. No data processing system can produce accurate and worthwhile results if the basic data upon which it works is unreliable, incomplete, or inaccurate.

The techniques used to review the input portion of most automatic data processing systems are similar to those used for conventional systems since these are generally clerical operations. The auditor should become familiar with (1) the types and quantities of source documents, (2) the methods for converting this data to processing-machine language, (3) the procedures for introducing the input into the processing equipment, and (4) the various controls and checks designed to insure that all source data will reach the equipment without loss, addition, or error. This review should also cover the procedures and facilities for retaining source documents, including safeguards imposed, and the manner, methods, and authority for the disposition of such records.

Questions

1. What forms of input are used in the ADP system? (Punched cards, magnetic tape, paper tape, optical scanners, magnetic ink, magnetic cards)

2. Are adequate verification procedures in effect to check the accuracy of input information being conventionally key punched into card and paper tape?

   a. Are all important data fields subject to mechanical verification by operators using verifier machines?

   b. If only some (or none) of the important data fields are verified, is an adequate

alternative verification technique, such as sight or "mass" verification, being effectively employed?

3. Is adequate verification made of punched card or paper tape information that is not conventionally key punched?

   a. If mark sense, porta-punch, or other similar procedures are used, is an adequate sight verification, batch total, or other control technique being used effectively to verify the accuracy of the mark sensing and the automatic card-punching process?

   b. If punched cards or paper tape are being created by a punch intercoupled with electromechanical equipment (adding machine, bookkeeping machine, etc.), are all important data fields adequately verified?

   c. If prepunched cards or tape are used, does the system make adequate provision for verifying the accuracy of their original punching and their subsequent reentry into the machine system?

4. If media other than punched card or tape is being utilized, does adequate control of media accuracy exist?

5. If information is received over communication facilities, are checks made to see that information was transmitted and received correctly?

6. Are provisions made in the system for timely reentry of rejected or corrected input data?

7. Are source documents stored in such a manner to safeguard against misuse or inadvertent handling and fire hazards?

8. Are source documents retained for a sufficient length of time to reconstruct the file in the event the master file is destroyed?

Separation of duties

The basic concept of the division of duties and responsibilities as a measure of internal control is still valid. No one group should have direct and complete access to the recordkeeping system.

Questions

1. Is formal separation of duties between systems analysts and programmers, computer operators, keypunch operators, and record librarian practical at present? Although desirable and recommended by most literature, formal separation of duties is not widely nor consistently practiced at present. Other solutions currently being used are:

   a. Important types of transactions affecting financial files must come from authorized personnel on signed documents. Examples are new hires, pay raises, and overtime work.

   b. Controls over approval and implementation of computer program changes are being used.

   c. At least two qualified people must be on duty in the machine room during all processing.

   d. Companies using computers with a console typewriter usually require that a copy of the typewriter printout be retained as a log of computer operations.

Control group

A control group is usually organized independently of both the using activity and data processing center for the purpose of monitoring and directing data both entering and leaving the data processing center. Such a control group has the responsibility of insuring that information flows through the data processing center in the manner outlined in procedure manuals and computer programs. In some instances, this control group also schedules the work of the data processing center and acts as liaison between the center and those departments originating input or receiving final reports. The control group may also follow up and reconcile discrepancies in order to insure correct processing and proper disposal of rejected or incorrect transactions.

Questions

1. Has a separate control group been set up independent of the ADP area?

2. Have adequate procedures been established within the control group to (1) assure that all source data is introduced into the computer and (2) provide a positive control over output products to insure that all such products are accounted for and received by the designated agency or activity? Consider the following controls:

   a. Prenumbered source documents.

   b. Document control registers.

   c. Document transmittal slips.

   d. Batching techniques.

   e. Control totals.

3. If no separate control group has been established, are procedures in effect adequate to provide a positive control over data entering and leaving the data processing center?

Program documentation and operating controls

Program documentation is needed to convey an understanding of what the ADP system does and how it does it. In addition, it is essential that standardized instructions for operators be competently planned and comprehensively documented to minimize operator errors.

Questions

1. Is an adequate description of the ADP system available? The description, including statements and illustrations, should be sufficiently detailed to indicate (1) the application being performed, (2) the procedures employed in each application, and (3) the controls used to insure accurate and reliable processing. Consider the following documentation:

   a. Overall system flow charts.

   b. Narrative or written description of the flow of information in the system.

   c. Description of how each program accomplishes its functions.

   d. Block diagrams showing the sequence of operations performed by the programs.

   e. Record descriptions showing the form and content of all inputs and outputs and memory locations.

f. Program listing in source language and in object code (a copy of a computer program used can replace the need for object code listing).

g. Program operating instructions.

2. Are current standardized operator and run descriptions adequately documented for each computer run? These instructions are generally incorporated into "run books." Do "run books" contain the following:

   a. Identification of all machine system components used and the purpose thereof?

   b. Identification of all input and output forms and media with data content layouts?

   c. Explanation of the purpose and character of each run?

   d. Detailed set-up and end-of-run operator instructions, including all manual switch settings required?

   e. Identification of all possible programmed and machine halts and specifically prescribed restart instructions for each?

3. Are logs of machine time maintained? These records can be used to check operator efficiency, equipment reliability, and to guard against unauthorized use of the computer.

4. Is a record (console record) maintained for all interventions made by the computer console operator?

   a. Are records of intervention audited?

   b. Is operator intervention kept to a minimum?

5. Is access to the computer available to unauthorized persons?

6. Are computer operators rotated?

7. Is adequate supervision provided on all operating shifts? Special attention should be given to extra shifts run at odd hours.

Control over program changes

Computers are capable of operating only through a set of instructions referred to as a program which is prepared by a person technically trained to logically arrange a series of steps or instructions to work on the data and arrive at a desired result. Therefore, one of the most important controls necessary in an EDP environment is the control over program changes.

Any and all changes to machine programs should be made in a formalized manner and should be approved by persons responsible for the efficient operation of the system. Quite often a change or modification is far-reaching and could have an effect on more than one application.

Questions

1. Are program changes approved by a person of authority in addition to the programmer and system analyst?

2. Is some management official responsible for approving program changes?

3. Is each change in writing?

4. Is each change well documented as to:

   a. Reason for change?

   b. Effect of change?

5. Are periodic checks made to insure that no unauthorized program changes have been made?

Output controls

Output controls assure that results of the data processing are reliable and that no unauthorized alterations have been made to transactions and records while in the custody of the data processing unit.

Questions

1. Is there a system in effect that provides positive control over output products to insure that all such products are accounted for and received by the designated agency or activity?

2. Are exception reports of unusual transactions or abnormal processing results furnished to the appropriate level of management for necessary action?

3. Do output products provide for a comparison of operating results with data which is independent of the computer processing? For example, does the system provide for comparison of operating results with physical inventories or confirmations of accounts receivable?

4. Does the system provide for recording, controlling, and retention of all interventions made by the console operator?

5. Are persons responsible for input transactions prohibited from controlling the resultant output products?

Magnetic tape

Magnetic tape is today the most common type of input and output used in medium and large-scale computer

installations. Under proper storage and handling conditions, the service life of magnetic tape is almost unlimited.

Questions

1. Is there a procedure for removing error-causing tapes and having them rehabilitated or replaced as necessary?

2. Are there formal procedures for preventing premature reuse of tapes?

3. Are there physical controls to prevent inadvertent erasure of tapes?

Librarian

An individual who has the responsibility for the custody of all data processing files is the librarian. The purpose for a record librarian is to assure that only authorized changes can be introduced into the computer programs or historical records.

Questions

1. Are the data processing files (magnetic tape and disk) controlled by a librarian?

2. Is the librarian completely independent of the planners and programmers?

3. Are copies of computer programs and their supporting documents maintained in the library and issued to interested parties only on written authorization?

4. Is an external label affixed to all files indicating content, data created, retention date, etc.?

## HARDWARE CONTROLS

Hardware controls are defined as those data protection and validation devices that are built into the equipment by the manufacturer. The primary function is to verify the accuracy of information transmitted, manipulated, or stored and to insure that the computer is performing properly.

One of the most critical areas is the handling of error conditions located and defined by the controls built into the machines. It is of primary concern that errors detected are properly corrected and that the corrected data is reentered into the system.

Some of the hardware controls commonly used in mechanized systems are listed below.

Parity checking--The parity bit is a binary digit (bit) which may be added in the parity bit channel when required to provide the proper number of bits to make the coded data either an odd or an even number of bits. This bit, called a redundancy or parity bit, is added so as to make the total number of bits in each valid character even (or in some machines odd) so that, if a single bit is added or dropped, an invalid character results.

Duplicate circuitry--Some computers duplicate the more essential circuitry of their main arithmetic unit. Calculations are carried out twice to insure accuracy.

Dual arithmetic--The computer automatically performs every computation twice, using the same circuitry. The results are then compared.

Echo checking--A check of accuracy of transmission in which the information which was transmitted to an output device is returned to the information source and compared with the original information to insure accuracy of output.

Read-after-write check--A built-in control feature that reads information back from the storage medium after it has been recorded and checks to see that the recording agrees with the original information.

Hole count--The total number of holes read in each column of a punched card at one station is compared with the total number of holes read from the same column of the same card as it passes through another station.

Reverse arithmetic--A method by which a computer verifies a calculation by using the same circuitry and by using a different method of calculation.

Although the auditor has little control over the presence or absence of built-in equipment controls, he should know of their existence and the effect that they can have on internal control.

Questions

1. What hardware controls are included in the equipment?

2. What corrective action is taken when the built-in machine check detects an error?

3. Is corrected data properly controlled to assure that the corrected record is subsequently returned to the system for processing?

4. Are preventive maintenance procedures in effect to minimize potential machine failure?

## PROGRAMMED CONTROLS

Programmed controls represent checks capable of being incorporated into the computer by means of coded instructions or programs. These controls can be separated into two types: (1) those controls planned for controlling and validating the input after it has entered the system

but prior to actual processing and (2) those controls designed to protect the data until processing is completed.

Essentially, the purpose of reviewing programmed controls is twofold. First, it is to determine whether or not the design and arrangement of the machine operations provide adequate assurance that the data processing will be performed accurately and reliably. Second, it is to ascertain what provisions have been made in the system for the detection of erroneous data. Because of the various branches within a computer routine, the location of a control check is often as important as the control itself. Therefore, the auditor should not only identify and evaluate the adequacy of programmed controls but also appraise the points of application.

Some of the more common checks which can be made an integral part of the computer's stored program are listed below.

Record count--The computer can be programmed to count the number of records it processes and compare the result with a predetermined total.

Sequence check--This program control permits master records to be checked for sequence while being read for processing.

Limit check--Amounts or quantities developed or taken directly from the records are compared with predetermined limits or quantities.

Crossfooting--Crossfooting balance checks are used to check the accuracy of individual postings.

Checkpoint and restart--A technique that permits the computer to continue processing from the last checkpoint, rather than from the beginning of a run, in case of an error or an interruption in the program.

Machine editing--Processed data is validated by comparing it against predetermined standards or tables.

Error routine--If a programmed check signifies an error in reading or writing, a programmed error routine should cause the operation to be performed once again. If an error still exists, certain predetermined formal procedures should be made available to the operator outlining the action to be taken.

Self-checking digits--A special check digit or number attached to either end of a significant identification number such as a stock number or employee number. It is used to check data transmission and transcription of these numbers within a processing system.

Tape labels--Certain identifying information written on the tape.

Hash totals--A sum of numbers in a specified field of record or of a group of records used for checking purposes.

Zero balancing--An operation that subtracts from an overall total the quantities comprising that total. The result should be zero.

Questions

1. What programmed controls have been built into the operating system? For example, do the programs:

   a. Include routines for checking the console switches, tape units, and disk storage units before processing the data?

   b. Include routines for checking tape or disk labels before processing such files?

c. Provide for maintaining and proving batch totals, hash totals, or record counts of input data, master files, and processing runs?

d. Include appropriate editing routines to insure the accuracy and completeness of the input data?

e. Provide for writing a record of each programmed halt and intervention by the operator?

f. Include procedures for reviewing the reasonableness of the processed data and for providing a record of all unreasonable or unusual amounts?

2. What corrective action is taken when the programmed control detects an error?

3. Is corrected data properly controlled to assure that the corrected record is subsequently returned to the system for processing?

DISASTER SAFEGUARDS

The installation should have an adequate reconstruction plan in the event of partial or complete destruction of the ADP center and current files.

1. Does the plan include duplicates of essential files, programs, and documentation?

2. Are duplicate files and records stored in a safe place where it is unlikely that the same disaster would destroy both duplicate and original files?

3. Is back-up hardware provided for?

APPENDIX IX

## OVERALL EVALUATION

It is important to recognize that the integrity of data in the system depends substantially upon a variety of controls upon the equipment, the system, and the operators. In the final analysis, the adequacy of the network of internal controls present in the system is the key element to be depended upon the determining the reliance to be placed upon the accuracy of the data processing system.

Specifically, the auditor must give full consideration to the controls previously evaluated and tie together the total system of internal controls. The auditor must satisfy himself that the system design and internal controls assure reasonably accurate data processing results. It must be remembered that most individual controls are expensive and accomplish limited objectives. The tendency on the part of the auditor to overcontrol a system must be avoided and a cost versus significance evaluation should be applied before recommending the addition of an ADPS control.

SECTION III

## TRENDS IN AUTOMATIC DATA PROCESSING AND THE AUDITOR

### NEW SYSTEM TECHNIQUES

During the early period of automatic data processing, it was common practice to mechanize only a small portion of the data system. The resultant systems were often simple adaptations of the manual system they replaced and thus presented no problem to the auditor. Visible audit trails were adequate, supporting documents were usually available for examination, and it was possible to trace input data directly to output and vice versa. This early approach to ADP was commonly referred to as auditing "Around the Machine" and was widely used because of its relative simplicity.

With the advent of more sophisticated and complex systems, particularly integrated and real-time data processing systems, it becomes increasingly difficult to perform a satisfactory audit without considering data manipulation by the computer. This method, auditing "Through the Machine," concentrates on the actual machine processing rather than the end products of the system.

The use of on-line, real-time systems, random access memories, transaction recorders, and wire transmission all make auditing "around" the computer more difficult and auditing "through" the computer more desirable.

On-line, real-time systems--Real-time processing involves processing information or data in a sufficiently rapid manner so that the results of the processing are available in time to influence the process being monitored or controlled. When a transaction and its response are simultaneous, the program checks and controls which are

separate in other systems are combined in one program. Testing the effectiveness of controls is more complex and the design of test decks is more difficult than in batch-type systems.

Random access memories--In contrast to magnetic-tape files, some random access files contain only the current generation of the file because updating destroys the old record. To retain the ability to reconstruct a file, provisions must be made to retain the file containing transactions that have intervened since a previous memory-content record was made.

Transaction recorders--There is a growing use of transaction-recording devices for feeding transaction data directly from the point of transaction into the computer. Many types of these devices do not prepare a printed copy of the transaction. Accordingly, provisions must be made to reconstruct a file. The computer can be programmed to print the necessary listing of transactions.

Transaction recorders can malfunction; therefore, the auditor will need measures to obtain assurance that erroneous messages do not contaminate real data in the system. With programmed checks, the computer can detect invalid messages and signal for retransmission. Retention of erroneous messages can be useful to the auditor in checking controls on input.

Wire transmission--The use of wire transmission complicates the audit problem since source documents, if they exist at all, will usually be stored at the remote locations from which they were transmitted. Careful consideration of both audit-trail and internal-control requirements is required where wire transmission is used.

Haskins & Sells Auditape System--The auditape system represents one of the newer techniques developed that uses data processing efficiently for auditing purposes. The system is a set of generalized computer programs or routines that can be useful for a variety of audit and management purposes.

Basically, there are two parts to the auditape system. One part is permanent and is contained on a reel of magnetic tape. The other part is the adaptable portion that is fed into the computer by means of punched specification cards. The auditor learns how to prepare these cards after a brief training period.

Auditape was developed by Haskins & Sells, one of the large public accounting firms, for use in its audit practice. The system was designed to fill the need for computer programs that could be used (1) by persons having no specialized knowledge of computers or programming languages and having only a nominal amount of simple instruction and (2) on a wide variety of records interchangeably without any need for preparation of special programs for each type of application to be processed. The program routines can be linked together to perform a variety of functions such as agings, extensions of inventory values, extraction of items meeting specific criteria, and computation of optimum sample size and random selection of sample items.

The present auditape system is designed for IBM 1400 series tape-system computers and the system 360 with 1401 emulator. The emulator permits the system 360 to function as a model 1401 computer. The present system represents a beginning; work is currently underway to adapt auditape for other types of equipment.

Flexible Audit Selection Technique (FAST)--The U.S. Air Force Auditor General developed the Flexible Audit Selection Technique (FAST) for use with the USAF Standard Base Level Supply System (UNIVAC 1050 II). The FAST program routine utilizes the processing capability of the computer to select data for audit purposes, either by the random sampling method or by the selection of specific types of data.

The FAST program is stored internally on the magnetic drum of the UNIVAC 1050 II system and is integrated with the program routines that comprise the supply

data processing system. Input required to activate the program consists of a single program select card along with one trailer card when required. If the essential data has been punched into the cards, the program will proceed to either select a sample or select only those records or data that are specified by the program select card or the trailer card. Data that meets the selection criteria can be printed out or punched on a card for use by the auditor.

Selecting Audit Transactions Electronically (SATE)--The procedure for Selecting Audit Transactions Electronically (SATE) was developed by the USAF Auditor General for use with the USAF Standard Base Level Supply System (UNIVAC 1050 II). The SATE program uses the computer to select transactions for audit purposes. Three types of selections are available:

1. Random Start-Fixed Interval Sample: This selection will produce a specific sample of the transactions processed during the day that the SATE program is run.

2. Reverse Post Selection: All reverse post transactions processed will be selected.

3. Data Element: Transactions are selected on the basis of specified data elements.

The SATE program is an integral part of the USAF Standard Base Level Supply System. Input cards required to activate the program include a program select card; parameter cards A, B, and 1 through 8; and a sentinel card. Output products can be either printed listings or punched cards.

Utility Program for Selecting Data--The Utility Program for Selecting Data is another program that was developed by the USAF Auditor General. This program is not oriented to a particular system or to a specific computer. Instead, it is punched card oriented and can be used on several computers in the Air Force. Basically, it is an

ADP program designed to select data from any file of punched cards regardless of which ADP equipment they were prepared from, their data format, or the size of the file.

Input required to use the Utility Program for Selecting Data consists of two types of control cards. An "object program" then translates the control cards into a user oriented computer program designed to isolate and extract desired information from a file of source data cards. Output can be in either printed listing or punched card form.

Time-shared Computer Applications in Contract Audits--The Defense Contract Audit Agency (DCAA) has entered into a contract with CEIR, Inc., for use of its time-shared computer system. The computers are located at the CEIR computer complex in Bethesda, Maryland. Communication with the computers is through teletype machines that are available to DCAA personnel at more than 40 contractor locations throughout the country.

Programs to perform most of the time-consuming computational and clerical work required for use of statistical sampling, correlation analysis, and improvement-curve techniques have already been developed and stored in the computer system. These programs are immediately available to DCAA personnel with access to any of the teletype machines which have been authorized to use the service. In June 1967, 12 computer programs were available in the DCAA library, including those designed for the following purposes:

1. Generate and sort random numbers.

2. Generate and sort sequences of random numbers.

3. Appraise the results of sampling for variables.

4. Determine sample sizes from preliminary sample data.

5. Fit an improvement curve to unit hours or cost.

6. Fit an improvement curve to average-lot hours or cost.

7. Simple linear fit--with confidence intervals.

8. Fit two variables to six different curves.

9. Multiple linear fit--with transformations.

Communication between a teletype machine and the computer is essentially the same as between two telephones. Dialing the telephone number of the computer activates the system. The computer answers with a confirmation tone. In response to a short series of questions from the computer, the auditor identifies the teletype machine, indicates the name of the programming language, and provides the name of the program. When the computer is set to work, it types "READY." When the word "RUN" is typed on the teletype machine, the computer solves the problem and prints out the answer in a matter of seconds.

## AUDITING STANDARDS AND TECHNICAL TRAINING

Even though ADP systems have imposed a complex new technology, the high quality of the work which the auditor performs must remain unchanged. The standards by which the quality of the audit function is measured have not been affected by the advent of ADP.

With the widespread growth of ADP, there is an implied necessity for the auditor to achieve and maintain adequate technical training and proficiency in ADP systems if he is to render opinions or issue reports relating to accounting systems involving extensive use of ADP equipment. The auditor, therefore, should continuously strive to increase his knowledge and understanding of automatic data processing through formal training, actual experience, and informal study on his own time. While it is difficult

to define precisely just how much knowledge of ADP the auditor needs as a minimum, the following topics provide an approximate guide:

1. A thorough knowledge of punched-card code or language.

2. A working knowledge of computer languages and binary mode of operation.

3. A general understanding of how ADP equipment reads, punches, compares, calculates, branches, and switches.

4. A general understanding of the basics of programming.

5. A thorough understanding of the wide variety of controls used in ADP systems and the methods for detecting, handling, and correcting errors.

6. A detailed knowledge of the means of communication between the equipment and its operator through the various input and output components, including the machine console or operating station.

7. A working vocabulary of the names of machine components, operations, and related items.

8. A sufficient knowledge of flow charts and logic diagrams to enable the auditor to make reference to them in identifying program checks and evaluating the method of internal control.

The trend to more completely integrated data processing and decisionmaking within the ADP system with less printout of data may necessitate greater reliance on programmed control procedures. These trends suggest that the auditor may have to become technically proficient in ADP control techniques that have not been much used to date:

1. Developing audit test decks. Test transactions could be included in each processing operation. The processing accorded the test transactions, when compared with predetermined results, will indicate whether the programs are performing as intended and whether the control procedures are still in effect.

2. Developing special audit programs for the computer. Special programs can be designed to provide in usable form most of the information required to make an examination of the records.

3. A more sophisticated application of random sampling techniques. Mechanized statistical sampling programs provide an effective means of selecting, analyzing, and testing the voluminous data processed by the ADP system.

4. Assisting in the design of the ADP internal control system. The auditor's logical role is to guide the development of the internal control policy. He can indicate what types of controls should be used in the various major segments of the data processing system.

A thorough understanding of systems analysis and design will be required by certain auditors charged with responsibility to evaluate (1) new systems during the development stages, (2) major changes to operational systems, and (3) advanced techniques to perform mechanized audits. The audit of some exceptional data processing systems may require a more extensive knowledge of machine technology, but the levels of understanding indicated above will provide the auditor with the minimum information normally required.

## SECTION IV

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