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ABSTRACT

This document was developed out of a need for a complete, carefully designed set of evaluation instruments and procedures that might be applied in metric inservice programs across the nation. Components of this package were prepared in such a way as to permit local adaptation to the evaluation of a broad spectrum of metric education activities. The document contains three instruments for measuring content knowledge of The Systeme International d'Unites (SI) (two versions of a multiple-choice test and one form of a laboratory test), an instrument for measuring attitudes toward United States adoption of SI, and an opinionaire for measuring participants' perceptions regarding the effectiveness of a metric education activity. The last of these instruments contains items whose wording is directed to a teacher audience: deletion of selected items would result in a more general instrument. Each instrument is accompanied by information regarding its construction, modification, use, and analysis. With regard to analysis, the package contains listings of computer programs in BASIC specific to the scoring of each instrument and the analysis of the results obtained. (MP)

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**METRIC EDUCATION EVALUATION PACKAGE**



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## PREFACE

The instruments, procedures, and computer programs which comprise this package were developed over a six-year period (1977-80) by Bob Kansky with the assistance of Melried Olson and Robert Morissette. Early work was funded by the Science and Mathematics Teaching Center of the University of Wyoming, The Quadra-State Metric Consortium (USOE Grant #G007603745), and the Utah Metric Education Project (USOE Grant #G00700857). This final package was assembled and published as a project of the Tri-State Metric Consortium (USOE Grant #G0078002).

Formal testing of the instruments discussed in Chapters 2, 3, and 5 made use of 61 metric education classes (with a total enrollment of 1478 persons) in five states: Colorado, Idaho, Montana, Utah, and Wyoming. Informal review of drafts of these instruments involved an additional 221 persons in eight classes. Development of the attitude scale discussed in Chapter 4 engaged 287 undergraduate students at the University of Wyoming.

With the exception of the attitude scale, developmental work has involved only groups of inservice or preservice teachers. While the instruments have potential for use with other groups, there may be a need for some modification of language and/or for the development of new norms.

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## CHAPTER 1

### INTRODUCTION

#### Purpose of This Evaluation Package

Construction of the Metric Education Evaluation Package developed out of a need for a complete ~~carefully designed set~~ of evaluation instruments and procedures that might be applied in metric ~~in-service~~ programs across the nation. Components of the package were prepared in such a way as to permit local adaptation ~~with~~ the evaluation of a broad spectrum of metric education activities.

#### Evaluating "Awareness" Programs

Metric education programs vary in terms of goals and format. Some programs involve ~~short~~ "awareness" activities; the primary goal of such programs often is to create a favorable attitude ~~toward~~ America's adoption of SI,<sup>1</sup> although limited information about metric units of measure and their uses may be included. Such programs have targeted a variety of audiences (e.g., parents of school-age children, the general public, specific professional or social groups, senior citizens) and have been delivered in a variety of settings (e.g., PTA meetings, metric "fairs" conducted by school children, street fairs, newspaper articles, radio programs, television programs and commercials, luncheon meetings of clubs). The informality of such activities generally precludes formal evaluation. When evaluation is included, it generally is the affective domain that is examined. A short, reliable, easy-to-administer instrument is needed -- one which can be used with many audiences. The SI

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<sup>1</sup>The Systeme International d'Unites (or International Metric System).

Attitude Scale included in this package was prepared with such uses ~~in~~ mind.

### Evaluating Programs with Cognitive Goals

A second level of metric education is directed at developing a ~~general~~ understanding of those units of the metric system with which most persons will come in contact. The ~~ultimate~~ level of understanding which is ~~the~~ goal of such a program might be the use of appropriate instruments to ~~find~~ the measures of selected attributes (length, area, volume, mass, temperature) of familiar objects in terms of metric units. The program even might have a goal of having participants be able to make reasonable estimates of those measures without the aid of instruments. Generally speaking, programs having such goals require a carefully-planned sequence of measurement ~~experiences~~ which are spread out over several meetings of the group seeking such knowledge. Such programs have been developed for teachers, precollege students, government groups, agricultural extension agents, home economists, and clerks in large retail stores. Initial measurement of the success of such a program might make use of paper-and-pencil tests or of tests involving simple performances in measuring real objects. The items included on such tests would need to be a function of both (a) the attributes and units studied and (b) the level of understanding expected. The instruments in this package include items for the paper-and-pencil testing of five attributes (length, area, volume, mass, temperature) at eight specific levels of understanding and the items for estimating the measures of those five attributes (without instruments) in a situation involving familiar objects.

It should be noted that the instruments provided were designed to measure limited cognitive goals. They deal only with those attributes and units of

measure with which most ~~circumstances~~ will have contact. They were not designed for programs expecting extreme ~~facility~~ with the use of such units. Finally, they do not include units which ~~are~~ specific to advanced courses in secondary school science or to application ~~within~~ a specific occupation.

### Evaluating Metric Program Activities

In addition to measuring the effects of metric education program activities upon the understanding and attitudes of participants, program leaders may wish to measure the participants' perceptions regarding the value of the program's activities relative to its stated goals. Such participant opinions are useful in program revision. They not only amplify results obtained from cognitive/affective testing but also provide insights into why certain program activities were or were not successful. The opinionnaire included in this package is aimed at obtaining detailed participant reactions to metric programs designed for inservice teachers. It may be shortened and/or reworded for other audiences.

### Overview of the Package

This package contains three instruments for measuring content knowledge of SI (two versions of a multiple-choice test and one form of a laboratory test), an instrument for measuring attitude toward U.S. adoption of SI, and an opinionnaire for measuring participants' perceptions regarding the effectiveness of a metric education activity. Only the last of these instruments contains items whose wording is directed to a teacher audience; deletion of selected items would result in a more general instrument.

Each instrument is accompanied by information regarding its construction, modification, use, and analysis. With regard to analysis, the package contains listings of computer programs (written in BASIC) specific to the scoring of

each instrument and the analysis of the results obtained.

The next two sections are aimed at giving the reader general information about the specific components of the evaluation package. The first section gives a brief description of each component; the second describes the manner in which the information relative to these components is organized in the chapters which follow.

### Components of the Evaluation Package

As was noted earlier, this evaluation package has four principal components.

1. Multiple-Choice Tests of Knowledge About SI

Two equivalent tests were prepared for pretest/posttest use. Items were selected for placement within a matrix defined by six areas of metric content and eight levels of understanding; each test contains 14 subtests. The matrix design also permits deletion/addition of blocks of items where the objectives of a local metric education program deviate from those for which these tests were designed.

2. Laboratory Test of Estimation Skills

This quiz measures the participants' skill at estimating the measures of simple objects. The items make use of a standardized list of common items which are easily obtained locally. An empirically developed three-point scoring scale (0, 1, 2) defines bands of accuracy.

3. SI Attitude Scale

The scale was developed using a 14-cell matrix. The design

divides the object dimension (U.S. adoption of SI) into seven components and the sentiment dimension into two components (attitudes and behaviors). Responses employ a five-point scale.

#### 4. Metric Workshop Opinionnaire

The opinionnaire provides feedback to the designer of a metric education activity with regard to participants' perceptions of the success of that activity. It utilizes four response modes (a five-point scale, a 2-point scale, semantic differential and essay), the first three of which can be output in graphical form using the computer program provided.

#### Organization of the Evaluation Package

Chapter 2 will discuss the development of the instruments and procedures associated with the instruments which comprise the first of the four components. Copies of such things as the instruments themselves, answer keys and directions for administration will be placed in the Appendices. Chapters 3-5 will provide a similar treatment of the other three components. Chapter 6 will discuss the computer programs (also given in the Appendices) provided for compiling and analyzing data obtained from use of the instruments.

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## CHAPTER 2

### COGNITIVE EVALUATION: PART 1

This chapter will deal with the evaluation of certain areas of knowledge about SI (the metric system) which can be measured with multiple-choice tests. It will discuss the design, development, scoring, possible modification and limitations of two equivalent forms of a multiple-choice quiz about SI. The quizzes, answer keys and directions for administration have been placed in appendices for ease of reference.

#### Instrument History

Development of the instruments to be discussed in this chapter began in 1974; final revisions were made in 1980. The final revisions were "cosmetic" (e.g., replacing 'metre' by 'meter'). The last substantive revision was completed in 1978; the work is described in detail in the final report of the USOE project which supported it.<sup>2</sup> Those final substantive changes included an extension of the matrix design of the quizzes in which the earlier matrix was a subset of the new one. Our discussion here will be restricted to the quizzes which were defined by the final matrix.

#### An Attributes-by-Levels Matrix Design

The matrix used in the design of the quizzes has two dimensions: attribute (or content) and level of understanding. The first dimension has six components corresponding to six physical attributes of objects:

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<sup>2</sup>Kansky, R.J. Measurement of the Attainment of Content Goals of the Utah Metric Workshop Teacher Inservice Program. Washington, D.C.: U.S. Office of Education, 1978. (USOE Grant #G007603745)

1. length
2. mass
3. area
4. volume for which measurement in cubic units is appropriate
5. volume for which measurement using division of the liter is appropriate
6. temperature

Due to the range of interests of the potential audience (teachers of Grades K-12, substitute teachers, laypersons, etc.), it was deemed inappropriate to introduce the measures of such attributes as electric current (ampere), amount of substance (mole) or luminous intensity (candela).

The developer's experience in conducting metric education activities led to the identification of twelve levels of understanding regarding the measurement of the attributes. Three of these (Instrument Selection, Instrument Usage, History) were not included in the development of instruments in this package; it was felt the first two should be developed relative to the possible applications of a given group of persons, and the last was considered mostly academic. The levels-of-understanding (or, simply, levels) dimension of the quizzes is comprised of eight of the remaining nine levels. These are named and defined in Table 1. The ninth level (Estimation) is the focus of the laboratory quiz discussed in Chapter 3.

The resulting test-item matrix (eight levels by six attributes) contained 48 cells. Of the eight cells under the attribute of Temperature, only three were filled since it was possible to measure this attribute at the levels of Total Measure, Customary System Referent and Symbol only. (The other five levels make no sense with respect to designing items on Temperature.)

TABLE 1  
Eight Levels of Understanding of SI  
Units of Measure

- 
1. *Gross Unit.* Given the name of a common object, the testee will identify the class of units appropriate for measuring a specified attribute of that object.
  2. *Specific Unit.* Given the numerical portion of the measure of some attribute of a specified common object, the testee will identify the specific appropriate subunit among subunits which pertain to the given attribute.
  3. *Total Measure.* Given some specified attribute of a common object, the testee will identify the approximate measure (number and unit) of the object with respect to that attribute.
  4. *Appropriate Unit.* Given a specific attribute and a specific unit, the testee will identify a common object such that the given unit would be appropriate for measuring the specified attribute of that object.
  5. *Prefix.* Given a specific unit or subunit, the testee will identify an equivalent expression involving a different subunit.
  6. *Customary System Referent.* Given an example from a select set of SI measures (number and unit), the testee will identify the approximate measure in the Customary System which is its counterpart.
  7. *Symbol.* Given the written name of a commonly-used unit, the testee will identify the correct corresponding symbol.
  8. *Intrasystem Conversion.* Given a specific measurement (number and metric unit), the testee will identify an equivalent measurement which employs a different number and metric unit.
-

The cell involving the Customary System Referent level for the attribute Volume in cubic units was also left empty since no items could be found which met the "approximate measure" condition of the Customary System Referent level. (Items for this cell all suggested intersystem conversion using numerical conversion factors, and this measurement concept was explicitly rejected by the designer in accord with recommendations by national groups of educators). Finally, the cell for the Symbol level of the attribute of volume as measured in liters was left blank because of what was at that time (1978) a controversy regarding the symbol for liter (L or ℓ). The inclusion of an item which would force a choice between these symbols was judged to be counterproductive to the overall evaluation process.

Two versions (Versions A and B) of the written test were prepared. Each version consisted of 52 items and was divided into two quizzes (Quiz 1 and Quiz 2) of 5 and 47 items, respectively. Quiz 1 of each version was comprised of the items dealing with Gross Unit; Quiz 2 was comprised of items at the other seven levels of understanding. Because of the definition of Gross Unit (See Table 1), it was necessary to separate the items on Gross Unit from the others. Testees are required to hand in their answers to Quiz 1 before being given Quiz 2.

The two parts of Version A of the quiz are called Quiz 1A and Quiz 2A; the final forms of these two quizzes are in Appendix II. The directions for administering Version A are given in Appendix I; the answer key for Version A is in Appendix III.

The two parts of Version B, Quiz 1B and Quiz 2B, are in Appendix IV; the answer key is in Appendix V. Directions for administration of Version B are the same as for Version A (Appendix I). The classification, by level and

attribute, of the 52 items of each version is given in Table 2.

#### Notes on Instrument Development

A detailed discussion of the development of Versions A and B of the quizzes is given in another report. This section will note major points regarding that development without duplicating the statistical details of the report.<sup>3</sup>

Items for the two versions were prepared by the author in November-December of 1977 and examined for face validity by five persons having extensive experience in metric education. After minor revisions, the items were pilot tested at the University of Wyoming using two groups of experienced teachers: one whose members had participated in a metric education workshop and one whose members had not had such workshop instruction. Following this pilot use (the purposes of which were to identify errors, poor distractors and confusing or ambiguous wording), Versions A and B of the instruments were submitted to tests of reliability and equivalence.

#### Reliability of Versions A and B

Versions A and B of the metric tests were administered to 20 students enrolled in the first course in a two-course mathematics sequence for preservice elementary school teachers at the University of Wyoming. Version A was administered first; Version B was administered five weeks later. There was no discussion of the metric system before or during this five-week interval. (In fact, this topic is not addressed until the second course in the sequence.)

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<sup>3</sup>Ibid, pp. 10-18

Student scores on Version A had a mean of 25.0. The resulting reliability coefficient  $R$  (from the Kuder-Richardson formula 20) was 0.77, which is within the 0.60-0.85 range considered acceptable for teaching decisions.<sup>4</sup> Student scores on Version B had a mean of 25.7 and a standard deviation of 5.20. Again, the reliability coefficient computed from the Kuder-Richardson formula was 0.77.

For each version, the standard error of measurement was computed to provide an estimate of the fluctuation likely to occur in an individual's test score as a result of irrelevant, chance factors. The values of the standard error for Versions A and B were 2.83 and 2.49 respectively. Hence, a student's score may be off from 2 to 3 points on either version due to chance factors.

#### Equivalence of Versions A and B

The provision of a time interval between the administrations of the two forms of the test under the equivalent-forms method provides the most rigorous test of reliability because "it includes all possible sources of variation in the test scores."<sup>5</sup> Since the two versions also met the conditions of "comparable" forms given by Edwards,<sup>6</sup> the equivalent-forms method may be used and reliability measured using the correlation coefficient  $r_{AB}$  (Pearson  $r$ ). Confidence bands for  $r_{AB}$  then can be obtained using Fisher's  $z_r$  distribution.<sup>7</sup>

Computation of  $r_{AB}$  produced a value of 0.72. Under the Fisher  $z_r$  transformation, this value permits assertion with 85 percent confidence that the

<sup>4</sup> N.E. Gronlund, Measurement and Evaluation in Teaching (New York: The Macmillan Company, 1971), p. 119.

<sup>5</sup> Ibid., pp. 105-106.

<sup>6</sup> A.L. Edwards, Statistical Methods for the Behavior Sciences (New York: Rinehart and Company, Inc., 1955), pp. 174-176.

<sup>7</sup> G.A. Ferguson, Statistical Analysis in Psychology and Education (New York: McGraw-Hill Book Company, 1966), pp. 184-186.

population value of  $r_{AB}$  falls between 0.60 and 0.85. Thus, we can have 85 per cent confidence that the population value of  $r_{AB}$  is within the interval which Gronlund considers acceptable for tests which are the bases of teaching decisions.<sup>8</sup>

### Subtest Reliability

Because of the nature of its design, the metric test contained 14 subtests. Specifically, there were six subtests on Attributes (defined by the collections of items in the columns of Table 2) and eight subtests on levels of understanding (defined by the items in the rows of Table 2). Furthermore, there were two supposedly equivalent versions (A and B) of each subtest (again, as defined in Table 2).

The number of items on a subtest ranged from five to eleven. It is well known that, other things being equal, a long test is more reliable than a short one.<sup>9</sup> That is, the smaller the number of items on a test, the smaller will be the reliability coefficient.<sup>10</sup> Also, differences in means or variances of any two such subtest versions are of little real significance due to the small number of items. Nevertheless, means and standard deviations were computed for both versions of each subtest, F-value and t-value were computed to test the hypotheses of equal variances and equal means (necessary to the assertion of comparable forms) and a Pearson  $r$  was obtained for each pair of versions of each subtest.

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<sup>8</sup>Gronlund, op. cit., p. 119.

<sup>9</sup>A. Anastasi. Psychological Testing, fourth edition (New York: The Macmillan Company), 1976, p 115.

<sup>10</sup>Edwards, op. cit., p. 176.

TABLE 2  
 Classification of Test Items (Versions A and B)  
 by Level and Attribute

		Attribute					
		Length	Mass	Area	Volume (cubic)	Volume (liter)	Temperature
Gross Unit	A	*2	*1	*5	*3	*4	-
	B	*3	*1	*5	*4	*2	-
Specific Unit	A	1,2,5	4,7	3	8	6	-
	B	3,4,5	1,8	2	7	6	-
Total Measure	A	9	10	12	11	13	25-30
	B	13	9	11	12	10	25-30
Appropriate Unit	A	14	18	16	15	17	-
	B	18	14	16	15	17	-
Prefix	A	21	22,23	19	20	24	-
	B	22	21,24	19	20	23	-
Customary System Referent	A	32,37	36	35	--	33	31,34
	B	32,35,37	36	--	--	33	31,34
Symbol	A	41	40	38	42	--	39
	B	41	40	38	42	--	39
Intrasystem Conversion	A	46	43	45	44	47	--
	B	46	43	45	47	44	--

\*These items appear on Quiz 1 of each version of the test; all other items appear on Quiz 2 of that version.

Level of Understanding

As a result, a few summary observations may be made. The equal-variances and equal-means hypotheses were rejected at the 0.05 level for only one of the 14 subtest comparisons. (This rejection involved the six-item subtest of Prefixes.) Values of the Pearson  $r$  ranged from 0.2 to 0.8; generally speaking, the larger values of  $r$  were obtained on the longer subtests. Overall, the results support a decision not to use test results for statistical analysis of content-goals effectiveness of metric education activities at the subtest level (i.e., specific to a given attribute or level of understanding).

#### Grading of Quizzes 1 and 2

Chapter 6 discusses a set of computer programs provided for the scoring and analysis of the instruments in this package. This section will examine a sample print-out provided by those programs.

It should be noted that Versions A and B of the metric quizzes were designed for use in pretest/posttest analysis of the effectiveness of such metric education activities as inservice workshops for teachers. Since the Pearson  $r$  value obtained (0.72) is sufficient to the assertion that the forms are equivalent, either version may serve as pretest or posttest. In the examples presented in this package, the term 'pretest' refers to Version A; 'posttest' refers to Version B.

Table 3 is a copy of the principal information provided for a group of 20 persons (teachers, in this case) who took both Version A (pretest) and Version B (posttest) of the metric quizzes. The first section of the printout reports that the related metric education activity was a class of 15 sessions, each 180 minutes long, which was conducted in Twin Falls, Idaho. The class began on June 4, 1979.

TABLE 3

Sample Scoring Printout  
Quizzes 1 and 2

INSTRUCTOR: HENRY-ID  
 CLASS LOCATION: TWIN FALLS, IDAHO  
 DATE CLASS BEGAN: 1979-6-4  
 TOTAL NUMBER OF SESSIONS: 15  
 LENGTH OF EACH SESSION (MINUTES): 180  
 \*\*\*\*\*  
 NUMBER OF PRETESTS GRADED: 20  
 CLASS PRETEST AVERAGE: 32 (OUT OF A POSSIBLE 52)

#### LEVEL-OF-KNOWLEDGE SUBTEST AVERAGES ####  
 GROSS UNIT: 3.9 (OUT OF A POSSIBLE 5)  
 SPECIFIC UNIT: 5.65 (OUT OF A POSSIBLE 8)  
 TOTAL MEASURE: 5.2 (OUT OF A POSSIBLE 11)  
 APPROPRIATE UNIT: 3.45 (OUT OF A POSSIBLE 5)  
 PREFIX: 3.5 (OUT OF A POSSIBLE 6)  
 CUSTOMARY SYSTEM REFERENT: 4.85 (OUT OF A POSSIBLE 7)  
 SYMBOLS: 2.75 (OUT OF A POSSIBLE 5)  
 INTRASYSTEM CONVERSION: 2.7 (OUT OF A POSSIBLE 5)

#### ATTRIBUTE SUBTEST AVERAGES ####  
 LENGTH: 8.75 (OUT OF A POSSIBLE 11)  
 AREA: 5.1 (OUT OF A POSSIBLE 8)  
 MASS: 5.5 (OUT OF A POSSIBLE 10)  
 VOLUME (LITRE): 4.35 (OUT OF A POSSIBLE 7)  
 VOLUME (CUBIC): 3.35 (OUT OF A POSSIBLE 7)  
 TEMPERATURE: 4.95 (OUT OF A POSSIBLE 9)

\*\*\*\*\*  
 NUMBER OF POSTTESTS GRADED: 20  
 CLASS POSTTEST AVERAGE: 45.7 (OUT OF A POSSIBLE 52)

#### LEVEL-OF-KNOWLEDGE SUBTEST AVERAGES ####  
 GROSS UNIT: 4.55 (OUT OF A POSSIBLE 5)  
 SPECIFIC UNIT: 7.3 (OUT OF A POSSIBLE 8)  
 TOTAL MEASURE: 9.05 (OUT OF A POSSIBLE 11)  
 APPROPRIATE UNIT: 5 (OUT OF A POSSIBLE 5)  
 PREFIX: 5.1 (OUT OF A POSSIBLE 6)  
 CUSTOMARY SYSTEM REFERENT: 6.15 (OUT OF A POSSIBLE 7)  
 SYMBOLS: 4.9 (OUT OF A POSSIBLE 5)  
 INTRASYSTEM CONVERSION: 3.65 (OUT OF A POSSIBLE 5)

#### ATTRIBUTE SUBTEST AVERAGES ####  
 LENGTH: 10.95 (OUT OF A POSSIBLE 12)  
 AREA: 5.65 (OUT OF A POSSIBLE 7)  
 MASS: 9.25 (OUT OF A POSSIBLE 10)  
 VOLUME (LITRE): 5.95 (OUT OF A POSSIBLE 7)  
 VOLUME (CUBIC): 5.65 (OUT OF A POSSIBLE 7)  
 TEMPERATURE: 8.25 (OUT OF A POSSIBLE 9)

The second section of the printout reports class performance on the pretest (Version A). In addition to giving the mean score (32), it presents scores for each of the 14 subtests. Although, as has been discussed, subtest scores cannot be used for formal analysis, they provide the instructor with informal information regarding specific weak or strong points, backgrounds of the class and suggest a tailoring of the metric activities planned.

The final section of Table 3 gives details of class performance on the posttest (Version B). While the posttest mean (45.7) might be compared with the pretest mean (32), changes in the subtest means are but informally suggestive of the success of the class activities relative to growth in subtest knowledge.

Also provided by the scoring program, but not shown in Table 3, is a listing of the pretest and posttest scores of individuals in the class. The matched pretest/posttest scores of individuals are used in the analysis which follows.

#### Analysis of Pretest/Posttest Scores

Provision has been made to apply analysis of covariance (ANCOVA) to pretest/posttest scores. A sample printout is presented in Table 4.

The ANCOVA involved makes use of pretest (Version A) scores as the single covariate and posttest (Version B) scores as the dependent variable. The analysis of Table 4 utilizes a control group of 20 preservice elementary teachers. Control group scores are stored in a data file separate from the main analysis program; they easily could be replaced by scores of a new control group.

#### Use of the Metric Quizzes: Limitations

Use of quizzes in Appendices II and IV assumes that the 14 components (Attributes and Levels) which defined its construction are understood by the

TABLE 4

Sample Analysis of Covariance Printout  
Pretest/Posttest

INSTRUCTOR: HENRY-ID  
CLASS LOCATION: TWIN FALLS, IDAHO  
DATE CLASS BEGAN: 1979-6-4

NUMBER OF SESSIONS: 15  
LENGTH OF A SESSION (MINUTES): 180

	BETWEEN	WITHIN	TOTAL
SUM OF SQUARES (PRETEST)	390.625	1953.75	2344.375
SUM OF SQUARES (POSTTEST)	4202.5	999.4	5201.9
SUM OF PRODUCTS	1281.25	1132	2413.25
DEGREES OF FREEDOM	1	38	39
ADJUSTED SUM OF SQUARES	2374.2307	343.52079	2717.7515
ADJUSTED DEGREES OF FREEDOM	1	37	38

	CONTROL GROUP		EXPERIMENTAL GROUP	
	MEAN	STD. DEV.	MEAN	STD. DEV.
PRETEST	25.75	5.1490929	32	8.7358909
POSTTEST	25.2	5.2875226	45.7	4.9640815
ADJ. MEANS	27.010621		43.889379	

NUMBER IN CONTROL GROUP: 20  
NUMBER IN EXPERIMENTAL GROUP: 20

F-STATISTIC: 255.72407

user and are the focus of instruction in the metric education activity planned. Components could be added to (or deleted from) the matrix to meet the user's wishes, but new reliability/equivalence studies should precede use of the resulting quizzes in a pretest/posttest analysis.

At present, subtest scores provide informal information only. If any subtest score is viewed by the user as being important, the matrix could be used to increase systematically the number of items in that pretest. Reliability of the new instrument (and subtest) would require testing.

Either version of the quizzes requires from 35-50 minutes to administer. Addition of items for any purpose should keep this in mind.

All statistical analysis has used groups of teachers, both preservice and inservice. Scores obtained during reliability/equivalence studies (in which no instruction intervened between pretest and posttest) used inservice teachers in 1976<sup>11</sup> and preservice teachers in 1978.<sup>12</sup> Moreover, the 1978 study involved the addition of 16 items to the earlier versions of Quiz 2. While there is reason to believe that the instruments are appropriate for both groups, further testing is needed. Certainly, use with other groups makes such studies mandatory. What the present metric quizzes provide is a structured design and a pool of carefully constructed items keyed to that design.

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<sup>11</sup>Kansky, R. J. Project Evaluation for the Quadra-State Metric Consortium. Washington, D.C.: U.S. Office of Education, 1978. (USOE Grant #G007603745).

<sup>12</sup>Kansky, op. cit.

## CHAPTER 3

### COGNITIVE EVALUATION: PART 2

#### Instrument History

The multiple-choice quizzes discussed in Chapter 2 were designed to evaluate knowledge about SI along two dimensions: attribute and level of understanding. Specifically, they attended to six physical attributes (length, area, mass, cubic volume, "liter" volume, temperature) and the eight levels of understanding given in Table 1. A ninth level of understanding also was the object of testing but could not be assessed using a multiple-choice format. That level, Estimation, is defined as follows:

*Estimation.* Given an object, a specified attribute and a specific unit of SI measure, the testee will give a "reasonable" numerical measure of the given attribute of the object in terms of the specified unit.

Testing of the level of Estimation across the six attributes is the task of the laboratory-type instrument discussed in this chapter. It is called the Metric Labtest.

Labtest development took place in 1976-77 and is described in another report.<sup>13</sup> The current version of the Labtest and its variable-score answer key differ from the form reported there only with respect to the spelling conventions.

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<sup>13</sup>Kansky, 1978, op. cit., pp. 24-29.

Notes on Instrument Development

The Labtest (Appendix VI) is comprised of thirteen items. Essentially a subtest of a single level of understanding across the six physical attributes identified for the written tests, its length was not unlike the length of the subtests of the multiple-choice metric quizzes. The overall length also was suggested by time and space considerations and the desire to include specific units of measure. The classification of labtest items by physical attributes is given in Table 5.

TABLE 5  
Classification of Labtest Items  
by Attribute

Attribute	Labtest Item Number(s)
Length	1, 2, 3
Area	4, 5
Mass	6, 7
Volume (liter)	8, 9
Volume (cubic)	10
Temperature	11, 12, 13

The instrument was developed in association with a "standardized" set of simple, familiar objects comprising a Labtest Materials Kit (Appendix VII). These objects were selected with an eye to availability. The objects are accompanied by Memorandum #1 (Appendix VIII) which gives detailed directions on how to use the Labtest Kit to set up the 13 testing stations of the Labtest. Memorandum #2 (Appendix VIII) serves as a reminder to the instructor to record the

mass of the person who is the object of the estimation exercise at Station 7 of the Labtest.

To be realistic, the test must allow open responses. Since it is unreasonable to expect participants to "estimate" the exact measures (to the nearest centimeter, gram, milliliter or degree Celsius) of the objects, the Labtest Scoring Key (Appendix IX) presents numerical bounds for an acceptable response.

During initial development, each Labtest answer was assigned 0, 1 or 2 points depending upon its "closeness" to the true measure of the object with a score of 0 being assigned to an unacceptable estimate. The numerical bounds of estimates to be assigned a score of 2 were obtained by recording the estimates of persons experienced in conducting metric education workshops for teachers. Initial numerical bounds for estimates to be assigned a score of 1 were "best guesses" of those workshop instructors.

The draft version of the Labtest, accompanied by the specified set of physical objects, then was subjected to trial use by a metric education class for teachers in Rawlins, Wyoming. Although the author was present as an observer, the setting up of the Labtest was done by the instructor using written directions. This was done in order to test the clarity of the directions. The Labtests were then scored using the trial scoring key.

Of the thirteen items, only six had mean scores that fell within the ~~numerical bounds that had been assigned a score of one; no mean fell within the~~ bounds that had been assigned a score of two. Discussion of the Labtest with participants in the Rawlins group identified a need to clarify instructions to the testees (e.g., permission to pick up the objects was intended but was not

written on the trial version of the test) and to emphasize (by capitals or under-scoring) the unit of measure in which the estimate was to be given. Given these changes, the participants agreed that the numerical bounds of the scoring key were reasonable.

Based upon the results obtained in the first trial, the Labtest, Labtest directions and Labtest Scoring Key were revised and then used with a metric education class for teachers in Denver, Colorado. These revised documents, with very minor format revisions, are those included in this package.

#### Grading of the Labtest

The Labtest Scoring Key (Appendix IX) can be used to hand-score the Labtest; it also is imbedded in the computerized scoring program discussed in Chapter 6. Its use requires inputting the mass (to the nearest kilogram) of the person used at Station 7 of the test.

Obviously, the small number of items will not permit subtest scores for the six attributes. Only a total score (ranging from 0 to 26) is considered. Uses of the test with 27 classes of teachers (648 persons) during 1977-79 produced an average score of 11.52, slightly below the target score of 13. The persons recording these scores had completed from 15 to 60 clock-hours of instruction in SI.

Table 6 shows a sample printout from the computer program of Chapter 6 which may be used to score the Labtests. (This class of 20 persons is the same as that reported in Tables 3 and 4.) The output notes that the mass of the person used at Station 7 was, in this case, 84 kilograms. The program then reports the mean Labtest score for the group and mean score for each of the thirteen items on the Labtest. Although the latter information was not used in any

TABLE 6

Sample Scoring Printout  
Metric Labtest

---

NUMBER OF LABTESTS GRADED: 20  
CLASS LABTEST AVERAGE: 10.25 (OUT OF A POSSIBLE 26)  
=== MASS OF THE PERSON USED IN ITEM #7 WAS 84 KILOGRAMS ===

AVERAGE SCORE (MAXIMUM = 2) ON EACH LABTEST ITEM:

ITEM 1:	.75
ITEM 2:	.9
ITEM 3:	.8
ITEM 4:	.75
ITEM 5:	.7
ITEM 6:	.85
ITEM 7:	1.2
ITEM 8:	.8
ITEM 9:	.85
ITEM 10:	.35
ITEM 11:	.45
ITEM 12:	.95
ITEM 13:	.9

---

formal analysis, it can be useful to the directors of metric inservice activities in helping them identify attributes for which experiences in estimation would appear to have been inadequate. The scoring program also provides a listing of pretest (Version A)/Labtest scores for each individual. These matched scores may be used in the analysis described in the next section.

#### Analysis of Pretest/Labtest Scores

The analysis of covariance (ANCOVA) program described in Chapter 6 may be used in a Pretest/Labtest comparison. A sample computer printout is given in Table 7. The comparison uses the pretest (Version A) scores as the single covariate and Labtest scores as the dependent variable. Control group scores

(stored in a data file) are from a class of 20 preservice teachers.

TABLE 7

Sample Analysis of Covariance Printout  
Pretest/Labtest

INSTRUCTOR: HENRY-ID  
CLASS LOCATION: TWIN FALLS, IDAHO  
DATE CLASS BEGAN: 1979-6-4

NUMBER OF SESSIONS: 15  
LENGTH OF A SESSION (MINUTES): 180

	BETWEEN	WITHIN	TOTAL
SUM OF SQUARES (PRETEST)	390.625	1953.75	2344.375
SUM OF SQUARES (LABTEST)	511.225	273.55	784.775
SUM OF PRODUCTS	446.875	179.5	626.375
DEGREES OF FREEDOM	1	38	39
ADJUSTED SUM OF SQUARES	360.36031	257.05851	617.41882
ADJUSTED DEGREES OF FREEDOM	1	37	38

	CONTROL GROUP		EXPERIMENTAL GROUP	
	MEAN	STD. DEV.	MEAN	STD. DEV.
PRETEST	25.75	5.1490929	32	8.7358909
LABTEST	3.1	1.8890265	10.25	3.2907365
ADJ. MEANS	3.3871081		9.962892	

NUMBER IN CONTROL GROUP: 20  
NUMBER IN EXPERIMENTAL GROUP: 20

F-STATISTIC: 51.868858

Use of the Labtest: Limitations

The Labtest has never been subjected to a reliability study. This should be done with a group appropriate to the user's intent.

Although a given person can complete the Labtest in about 15 minutes, it requires about 90 minutes and a large space to set up. The directions of Appendix VII should be read carefully at least one full day in advance of test administration.

The test presents what amounts to "impossible" tasks for someone who has had little or no specific instruction in SI. Practically speaking, then, it is humane to administer it only after the participants have had a reasonable number of planned experiences in estimating the measures of the attributes involved.

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## CHAPTER 4

### AFFECTIVE EVALUATION

#### Instrument Design

The design of the instrument discussed in this chapter is based upon the work of Morissette and was done with his consultation.<sup>14</sup> It was constructed within a matrix having two dimensions: Affective Domain and Metric Adoption Domain.

The Affective Domain is, by definition, comprised of two categories:

1. Attitudes. Attitudes are expressions of feelings toward some particular or general element of a focal group of persons, objects, ideas, theories, concepts or formulas. A verbal statement of attitude often contains an expression of feeling through the use of terms such as 'love', 'hate', 'like', 'dislike', 'enjoy', or 'relish'. It also may express that feeling by asserting an anticipated result (positive or negative) of the actions of that focal group.
2. Behaviors. Behaviors are expressions of involvement with the focal group. A behavior statement often contains a form of an action word such as 'support', 'use', 'work', 'promote', 'encourage', 'buy', or 'study'. It also may be expressed in language which implies support of or interference with actions of that focal group.

Loosely speaking, statements of attitudes are expressions of feelings whereas statements of behavior are assertions of action.

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<sup>14</sup>Morissette, Robert L., "Development and Comparison of Two Science Sentiment/Attitude Inventories by Item and Factor Analysis" (unpublished Ph.D. dissertation, Department of Curriculum and Instruction, University of Wyoming, 1975).

The Metric Adoption Domain consists of seven focal groups which are the objects of attitude or behavior with respect to American adoption of SI. The seven groups are as follows.

1. Mathematicians and Scientists
2. Government (state, local and national)
3. Business and Industry
4. Social Change (as related to self, the media, religion and national lifestyle)
5. Educators
6. Personal Use (as related to specific interaction with the individual's life)
7. Systems Comparison (as related to the comparative advantages or disadvantages inherent to the design of the measurement system: SI or Customary)

The Cartesian product of the two dimensions defined 14 cells. From nine to fourteen items were generated for each cell.

From the outset, it was intended that the wording and length of the instrument be acceptable for use with a variety of audiences. Specifically, it was decided that an average of four items per cell was a maximum and that an average of three or fewer items was preferred. Since this would result in a maximum of eight items in any one of the seven categories of the Metric Adoption Domain, there was no intent that scores from these categories be used for pretest/posttest comparisons. The seven categories were identified to ensure adequate development of the Attitude and Behavior categories by giving explicit item-writing attention to a comprehensive list of focal groups which would serve as the objects of a person's attitudes and behaviors regarding adoption of SI.

#### Instrument Development

From a pool of 160 items, 105 were selected for the construction of a pilot

version of the SI Attitude Scale. Each of the 14 cells of the test-design matrix contained at least six items. The pilot instrument was administered to 236 undergraduates at the University of Wyoming. The test group included 51 students enrolled in a remedial mathematics course, 46 students enrolled in a mathematics course for preservice elementary school teachers, 52 students enrolled in an introductory (general education) course in geology, 38 students enrolled in precalculus algebra, 31 students enrolled in precalculus trigonometry, and 18 students enrolled in a methods course for preservice secondary school science teachers. Directions and format for the 105-item pilot version were essentially those shown on the final version of the Scale (Appendix X).

Scoring of the pilot tests was done with a computer program similar to the one in Chapter 6. The numeric value of responses to "negative" items (i.e., items for which a response of '5' indicates strong disapproval of American adoption of SI) were reversed; hence, support of adoption of SI corresponds to a high score on each item for the purpose of test analysis.

The method of item analysis employed with the SI Attitude Scale was that described by Morissette.<sup>15</sup> In brief, analysis consisted of obtaining Nunnally's modified Pearson product-moment correlation<sup>16</sup> between the average score for each item and the average score for the cell to which the item belongs. Stepwise reductions of items with lower correlations continued until only four items remained in each cell. Coefficient alpha was then computed using the formula given

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<sup>15</sup>Ibid., pp. 56-59.

<sup>16</sup>Nunnally, J.C., Psychometric Theory (New York: McGraw-Hill, 1967), p. 262.

by Nunnally.<sup>17</sup>

Large values of coefficient alpha for the total test (0.9725), the Attitude category (0.9505), and the Behavior category (0.9602) led to the decision to further reduce the number of items per cell. The stepwise process was continued until only two items remained in each cell.

Table 8 shows the rank order of the 28 selected items along with the corresponding correlation coefficient between each item and the total test score. The item numbers correspond to those on the SI Attitude Scale in Appendix X.

The 14 items of the Attitude category of the Affective Domain give a coefficient alpha of 0.9123; the 14 items of the Behavior category, a coefficient alpha of 0.9484. The coefficient alpha for the 28-item instrument is 0.9617. Based on Nunnally's assertion that the "square root of coefficient alpha is the estimated correlation of a test with errorless true scores,"<sup>18</sup> the total score on the SI Attitude scale would correlate 0.98 with a true score on overall sentiment (where sentiment is the sum of attitude and behavior) toward American adoption of SI. The correlations for the categories of Attitude and Behavior are 0.96 and 0.97, respectively.

Despite the small number of items in each of the seven categories of the Metric Opinion Domain, the following coefficients alpha were obtained: Mathematicians and Scientists, 0.8326; Government, 0.7987; Business and Industry, 0.7113; Social Change, 0.8827; Educators, 0.6686; Personal Use, 0.8794; Systems Comparison, 0.8510. The corresponding estimated correlations of a test with errorless

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<sup>17</sup>Ibid., p. 196.

<sup>18</sup>Ibid.

TABLE 8

## Rank Order of Selected Items by Correlation Coefficients

		Metric Adoption Domain													
		Mathematicians and Scientists		Government		Business and Industry		Social Change		Educators		Personal Use		Systems Comparison	
		<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>	<u>Item</u>	<u>r</u>
Affiliative Domain	Attitudes	1	0.75	2	0.68	3	0.50	4	0.76	5	0.42	6	0.87	7	0.68
		15	0.63	16	0.62	17	0.37	18	0.72	19	0.61	20	0.76	21	0.68
	Behaviors	8	0.87	9	0.74	10	0.73	11	0.83	12	0.60	13	0.83	14	0.76
		22	0.68	23	0.72	24	0.73	25	0.82	26	0.73	27	0.64	28	0.83

scores are 0.91, 0.89, 0.84, 0.94, 0.82, 0.94 and 0.92. Nunnally also has noted that instruments with a reliability greater than 0.50 will suffice at early stages of research. The SI Attitude Scale and each of its nine categorical subscales far exceed this minimal expectation. Thus, the instrument would appear to be reliable for evaluations using total score or those summing across one of the nine subscales.

#### Scoring and Summarizing the Attitude Scale

A computer program is provided (Chapter 6) for the scoring and summarizing of individual and group responses to the SI Attitude Scale. Table 9 shows a sample printout for a class of 20 students. For each person in the class, the program reports three scores: the Attitude subscale, the Behavior subscale, the Total scale. It also reports the mean and standard deviation of each of these scores for the entire class.

#### Interpreting Scores from the Attitude Scale

If the Scale is used in a pretest/posttest design, the means and standard deviations provided by the scoring program can be employed to test for any change in attitude that might be attributed to the metric education activity. Significant increases in any one of the three scores would indicate a more positive disposition toward American adoption of SI for the scale (Attitude, Behavior, Total) involved. Such pretest/posttest analysis should make use of scores from an appropriate control group.

A second approach would use a single administration of the Scale to classify a group (or each individual within the group) as having one of three "general positions" with regard to adoption of SI: generally opposed, neutral, generally in favor. In this case, scores of the experimental group should be

TABLE 9

## Sample SI Attitude Scale Printout

\*\*\*\*\*

INSTRUCTOR: HENRY-ID.  
 CLASS LOCATION: TWIN FALLS, IDAHO  
 DATE CLASS BEGAN: 1979-6-4

\*\*\*\*\*

PERSON NUMBER	ATTITUDE SCORE	BEHAVIOR SCORE	TOTAL SCORE
------------------	-------------------	-------------------	----------------

\*\*\*\*\*

1	31	27	58
2	28	36	64
3	35	34	69
4	30	31	61
5	51	50	101
6	25	28	53
7	53	51	104
8	49	47	96
9	56	51	107
10	49	43	92
11	45	39	84
12	44	39	83
13	46	41	87
14	55	58	113
15	54	51	105
16	55	48	103
17	66	58	124
18	62	66	128
19	56	55	111
20	47	44	91

\*\*\*\*\*

CLASS STATISTICS  
 (N = 20)

ATTITUDE	BEHAVIOR	TOTAL
AVE. S.D.	AVE. S.D.	AVE. S.D.
46 11.5	44 10.6	91 21.8

\*\*\*\*\*

compared with those obtained from an appropriate control group which, in addition to completing the Scale, has responded to the item:

Circle the number of the statement below which best describes your general position with regard to the adoption of the metric system by the United States.

1. I am opposed to America's adopting the metric system.
2. I have no strong feelings one way or the other regarding America's adopting the metric system.
3. I favor America's adopting the metric system.

For instance, by administering the Scale (augmented by the item above) to a mixed group of 169 undergraduates in college mathematics courses, the scores in Table 10 were obtained. Thus, for similar groups, a Total Scale score of about 113 (an Attitude Subscale score of about 72 or a Behavior Subscale score of about 96) would be interpreted as indicating a position which is generally in favor of adoption of SI. Such statements could be assessed with a t-test.

TABLE 10  
SI Attitude Scale Scores Corresponding  
to General Positions on Adoption of SI  
(University of Wyoming Undergraduate Mix, n = 169)

<u>General Position</u>	<u>n</u>	<u>Scale</u>					
		<u>Attitude</u>		<u>Behavior</u>		<u>Total</u>	
		<u>ave.</u>	<u>s.d.</u>	<u>ave.</u>	<u>s.d.</u>	<u>ave.</u>	<u>s.d.</u>
Opposed	29	37.3	6.5	48.9	6.6	57.6	8.1
Neutral	66	34.8	8.2	47.3	7.6	55.8	7.2
In Favor	74	72.1	14.4	96.2	12.9	113.4	15.0
Combined	169	50.7	10.3	48.9	10.6	99.6	18.9

Data from such a "control" group could be used to characterize the general position of a comparable group (or to identify members of three subgroups within that group).

In summary, interpretation of scores on the SI Attitude Scale requires data from an appropriate control group. Pretest/posttest comparisons require pretest/posttest data from the control group and can be done using the scoring program of Chapter 6. The "categorical analysis" requires adding the general position item to the test given to the control groups; figures such as those in Table 10 may then be obtained by running the scoring program on the three subgroups identified by that item.

## CHAPTER 5

### EVALUATING METRIC PROGRAM ACTIVITIES

The instrument discussed in this chapter was designed specifically for providing the leaders of metric workshops for experienced teachers with the opinions of workshop participants relative to (a) the effectiveness of the workshop in meeting its stated goals of increasing the participants' knowledge of SI and (b) the perceived usefulness of workshop activities as examples of classroom activities for students of Grades K-12. However, changing the wording of the items of the instrument may make it of use in many other metric programs.

#### Development of the Opinionnaire

The Metric Workshop Opinionnaire (Appendix XI) used in this study is a modification of a more general workshop questionnaire long used by the Science and Mathematics Teaching Center of the University of Wyoming. This modification was done in 1977 by the author of this evaluation package and was reviewed by metric education leaders in eight universities in Idaho, Montana, and Utah.

The first 31 items of the Metric Opinionnaire provide feedback regarding participants' perceptions with respect to seven categories: physical arrangements (Items 1, 3), instructors (Items 7, 8, 14, 25, 26), materials, activities, and methods (Items 2, 6, 11, 13, 17, 24), communication (Items 4, 5, 15, 22), purposes, goals, and content (Items 9, 10, 16, 21), usefulness in teaching (Items 12, 18, 20), and personal satisfaction (Items 19, 23, 27, 28, 29, 30, 31).

Numerical values were assigned to an individual's responses to Items 1-26 as indicated on the Opinionnaire. The values 5 through 1 were assigned to the blanks of Items 27-31 with the value 5 being assigned to the most positive response.

While Items 32 and 35 also deal with the "usefulness of teaching" category, the block of Items 32-37 was included to measure the participants' intent to share workshop materials and ideas with teachers or students. Items 38-40 call for essay responses; they permit the participants to emphasize what they perceive to be major success or failures of a workshop and to list successes or failures which are (a) not touched upon in other items or (b) peculiar to a particular workshop.

#### Scoring and Summarizing the Opinionnaires

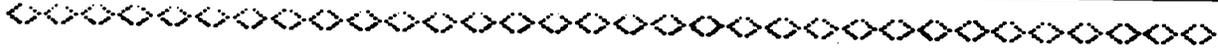
A computer program discussed in Chapter 6 is used to summarize responses to Opinionnaire Items 1-37 in graphical form which permit a three-way comparison. A sample printout of the graphical report is shown in the four pages of Table 10.

As noted in the key presented in Table 11, each item is represented by three bars: each bar indicates the average numerical response of a given population of workshop participants. In the example shown, the three populations (and their corresponding graphical symbols) are:

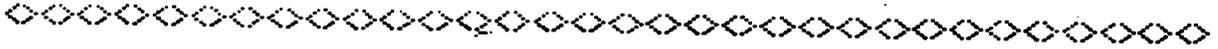
- \*: The 20 persons enrolled in a particular metric workshop, this one being in Twin Falls, Idaho);
- +: The 167 persons within an entire state (Idaho) that were enrolled in a metric workshop like the one at Twin Falls;
- §: The 523 persons within a consortium of states (Idaho, Montana, Wyoming) enrolled in a metric workshop like the one at Twin Falls.

TABLE 11

Sample Metric Workshop Opinionnaire Printout



INSTRUCTOR: HENRY-ID -  
WORKSHOP LOCATION: TWIN FALLS, IDAHO



KEY TO THE BAR GRAPH

- \* : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS OPINIONNAIRE ITEM BY THE 20 PERSONS IN THIS PARTICULAR METRIC WORKSHOP.
- + : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS OPINIONNAIRE ITEM BY THE 167 PERSONS FROM IDAHO WHO HAVE TAKEN A METRIC WORKSHOP.
- \$ : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS OPINIONNAIRE ITEM BYE THE 523 PERSONS IN THE ENTIRE CONSORTIUM WHO HAVE TAKEN A METRIC WORKSHOP.

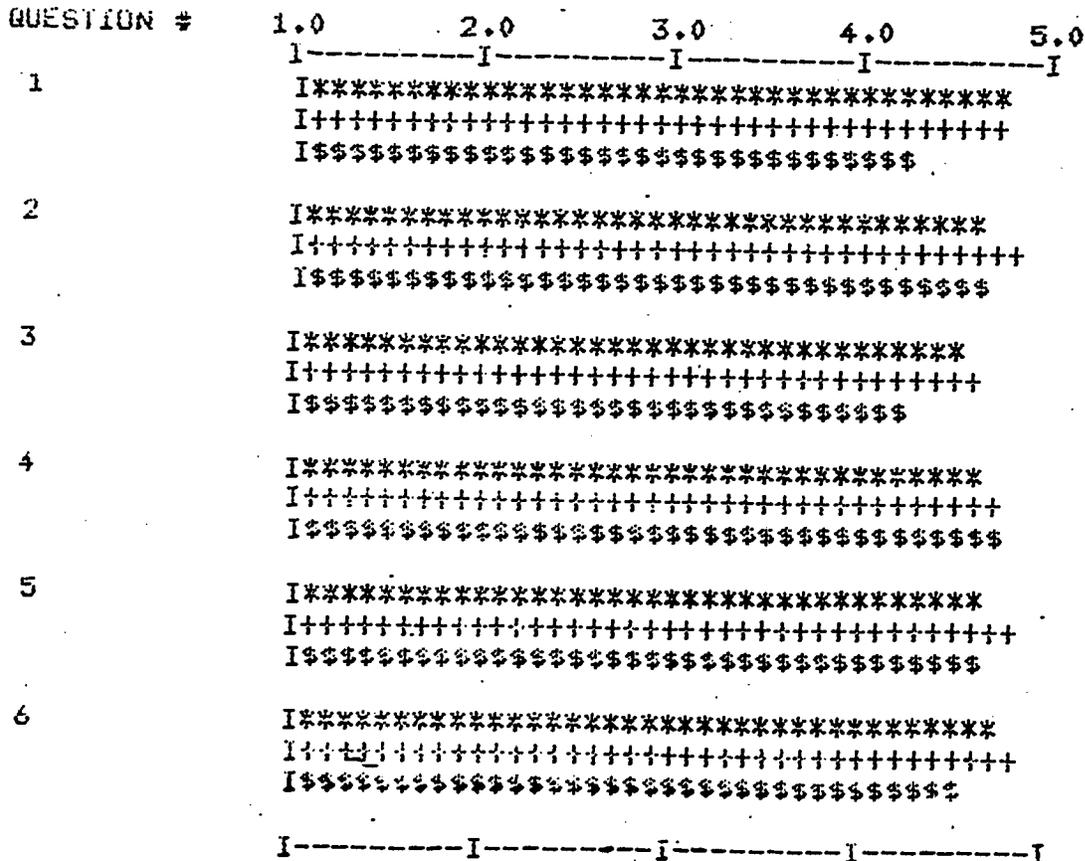
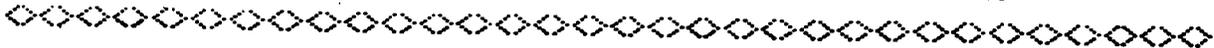


TABLE 11 (Continued)

QUESTION #	1.0	2.0	3.0	4.0	5.0
	I-----	I-----	I-----	I-----	I-----
7	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
8	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
9	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
10	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
11	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
12	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
13	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
14	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
15	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
16	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
17	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
18	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####
19	I*****	I*****	I*****	I*****	I*****
	I+++++	I+++++	I+++++	I+++++	I+++++
	I#####	I#####	I#####	I#####	I#####



QUESTION #	1.0	2.0	3.0	4.0	5.0
	I-----I	I-----I	I-----I	I-----I	I-----I
20	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
21	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
22	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
23	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
24	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
25	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
26	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
27	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
28	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
29	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
30	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
31	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$	I***** I+++++ I\$\$\$\$\$
	I-----I	I-----I	I-----I	I-----I	I-----I

TABLE 11 (Concluded)

	1.0	1.5	2.0
32	I-----I-----I		
	I*****I*****I		
	I+++++I+++++I		
	I\$\$\$\$\$I\$\$\$\$\$I		
33		I*****I*****I	
		I+++++I+++++I	
		I\$\$\$\$\$I\$\$\$\$\$I	
34		I*****I*****I	
		I+++++I+++++I	
		I\$\$\$	
35		I*****I*****I	
		I+++++I+++++I	
		I\$\$\$\$\$I\$\$\$\$\$I	
36		I*****I*****I	
		I+++++I+++++I	
		I\$\$\$\$\$I\$\$\$\$\$I	
37		I	
		I+++++I+++++I	
		I\$\$\$\$\$	
	I-----I-----I		



# OF PEOPLE WHO HAVE ANSWERED THIS OPINIONNAIRE

IDAHO	MUNT	WYO	CONSORTIUM
167	103	253	523



The bars for Items 1-31 are based upon a response scale which ranges from 1 to 5; the bars for Items 32-37 range from 1 to 2 where a '1' corresponds to a response of 'no' and '2' corresponds to a response of 'yes.'

The bar graphs of Table 11 were intended to provide formative (rather than summative) evaluation data. The relative lengths of the bars on a given item, when interpreted against a backdrop of information regarding the conditions of a given workshop or group of workshops, suggest points for revision of future workshop activities. For example, consider the three-bar graph for Item 10. The graphs suggest that the workshop participants in Idaho feel that the workshop objectives are quite realistic, an opinion supported to a somewhat lesser degree by participants throughout the consortium of states. Participants in this particular class were less certain that the workshop objectives were realistic. In interpreting these responses, however, it is useful to know that the population of this particular class was rather special. It consisted of teachers who were being trained to conduct metric workshops for other teachers. Whereas the objectives of most metric workshops were confined to the cognitive and affective goals measured by the instruments of Chapters 2-4, objectives for this workshop were augmented to deal with the task of having the participants develop plans for the replication of the workshop for other groups of teachers. In short, this was an atypical workshop.

Items 35-37 provide another example of the need for careful interpretation of the graphs. In Items 35 and 36, participants in the Twin Falls workshop firmly assert their intent to use the workshop activities in their own classes; Item 37 indicates that, unlike other workshop participants, the Twin Falls participants have not yet actually done so. This conflicting evidence of intent and action is explained by the fact that the workshop was conducted during the

summer; the participants as yet had no opportunity to use the materials in their classes.

Table II concludes with a tabulation of the group enrollments. At the time at which this printout was generated, the bar-graph comparisons were based upon Opinionnaire responses from 167 persons in Idaho, 103 persons in Montana, and 253 persons in Wyoming. Thus, the average response for a person in the three-state consortium was the composite of 523 opinions.

### Adapting the Opinionnaire

Modifications of the Opinionnaire can take place along two dimensions. First, the instrument might be altered by adding, deleting, replacing or modifying the items. Secondly, the nature of the bar-graph comparisons might be changed to include more or fewer groups. (The three groups used here -- class, state, consortium of states -- are simply an example of one set of groups that has been used.)

### Modifying the Instrument

The wording of many of the items restricts the use of the instrument in Appendix XI to metric workshops involving teachers. By replacing the phrase 'this workshop' by 'this metric education program' (or, simply, 'program'), 24 of the items (Items 1-16, 23, 25-31) could be used with other audiences; the remaining items would require substantive revision, replacement or deletion. The order of items within Items 1-26 or Items 27-31 could be changed to produce subgroups of consecutive items dealing with specific categories of information about the program (e.g., physical arrangements, instructors, goals). Open-response Items 38-40 could be modified, augmented or deleted. The resulting instrument could be summarized by the existing computer program of

Chapter 6 so long as two conditions remain unchanged:

1. Items 1-31 ask for responses on an integral scale from 1 to 5;
2. Items 32-37 ask for responses of '1' or '2.'

Chapter 6 discusses procedures for adapting the computer program should either of those two conditions be altered.

#### Changing the Comparison Groups

The computer program used to score and summarize Opinionnaire responses was designed to provide feedback at three instructional levels: class, state, and consortium. Adaptation to other structures requires some understanding of the purposes which defined its present form.

In 1976, representatives from seven universities in three states (Idaho, Montana, Wyoming) designed a common program in metric education for inservice teachers. The three-state project (later called the Tri-State Metric Consortium) was aimed at training selected teachers (called "portal school leaders") to conduct metric workshops for other teachers. The eight project co-directors adopted (a) a common set of instructional goals for the workshops conducted to train the portal school leaders, (b) a common time-allocation chart for five types of activities (laboratory, lecture/discussion, leadership planning, evaluation, local needs) which would constitute the 60-clock-hour workshop for portal school leaders, (c) a common basic set of materials and equipment to be provided for use by each portal school leader who subsequently conducted a metric workshop for teachers, and (d) a common set of evaluation instruments. These agreements assured sufficient standardization of leadership training and inservice workshop design to permit the three-way comparisons of responses to the Metric Workshop Opinionnaire.

The computer program used to score and summarize Opinionnaires stores each person's responses in three data files:

1. A Class File. This file contains the Opinionnaire responses for the persons enrolled in a particular metric activity (i.e., a specific workshop).
2. A State File. This file contains the Opinionnaire responses for all persons with one of three states (Idaho, Montana, Wyoming) who were involved in a metric activity similar to that experienced by the people in the Class File.
3. A Consortium File. This file contains Opinionnaire responses for all persons within the three-state consortium who were involved in a metric activity similar to the one experienced by the persons in the Class File.

The bar graphs for each item would then support formative evaluation at three levels.

1. The portal school leader of a particular class may view the responses of his students both in an absolute sense and in comparison with the responses of persons in his state who took workshops from the portal school leaders with whom he trained. (Comparisons with the Consortium graph would seem to be of little value at this level.) Since a given portal leader often conducted more than one inservice class for teachers, the information provided by this informal analysis could be used in the planning/redesign of future workshops.
2. University personnel who conducted the portal school leadership training activities have use for all three bars of the graph. Responses

FROM the class of a particular portal school leader serve as a reminder to make personal contact with that leader. While that contact might involve efforts to resolve an apparent problem suggested by Opinionnaire responses, it is also made to thank the leader for his work and to encourage his continued participation. Any large differences found in comparing State and Consortium graphs were meant to trigger a contact between state leaders and the Consortium Director.

3. A Consortium Director was appointed to coordinate the three-state activities. (He was not a member of any one of the seven participating universities.) The Director used the State and Consortium graphs to monitor interstate adherence to the agreements upon which the Consortium was based.

The current computer program can be used almost as is by any metric project having three major subdivisions (corresponding to the states), more than one "class" associated with each subdivision, and a common set of metric education goals and procedures. For instance, a district-wide project with similar metric inservice activities designed for teachers at three instructional levels (K-6, 7-9, 10-12) could redesignate the three data files as follows.

1. Class File
2. Level File (K-6, 7-9, or 10-12)
3. District Files

The only required change in the computer program would involve the changing of PRINT-statement references to the groups (e.g., references to 'Idaho' would be replaced by references to 'Level K-6') and the changing of the names of related data files.

It should be noted that the reduction of the number of state-level groups from three to two requires no alteration of the computer program. One state-level file simply would go unused. However, any increase in the number of state-level groups would require alterations in the computer program to accommodate the additional files. Such alterations are discussed in Chapter 6.

## CHAPTER 6

### COMPUTER PROGRAMS

#### Introduction

The seven computer programs of Appendix XII were prepared over a four-year period by a self-taught programmer. As a result, some programs (e.g., ROUTER) are written in a structured style whereas others (e.g., GRADER) lack that style. In the latter cases, the programs have been augmented by numerous REM-statements.

The programs are lengthy as a result of the many REM-statements and of an assumption that the users of the programs would not be experienced programmers. Hence, there are copious directions and special routines to insure against unintended aborts. These features have grown through experience in having the programs executed by nonprogrammers.

#### Hardware and Language Considerations

All programs were written for a 48K Northstar Horizon II microcomputer with dual disk drives. The language is Version 5.1 Microsoft BASIC. The system used a Lear-Siegler ADM-1A terminal and an Integral Data Systems friction-drive dot-matrix printer.

While space does not permit detailed comments on the special characteristics of the system, five peculiarities should be noted. The first is a function of the printer's character set; the other four are features of the BASIC used.

1. The zero character. The printer used for the program listings of Appendix XII did not have the symbol 'Ø' for zero. The symbol for zero used by the printer is distinguished from the letter 'O' by the fact that the symbol for zero is smaller and more pointed than that for the

letter '0'. The following lines show the two symbols.

```
THIS IS THE SYMBOL FOR ZERO: 0 .
THIS IS THE LETTER '0': 0 .
```

2. Multiple statements on a line. The BASIC used is one which permits more than one statement per programming line. The statements are separated by the Symbol '\'.
3. Clearing the screen. The BASIC has no simple clear-screen command. Clearing the screen is accomplished by the statement:

```
PRINT CHR$(27), "*"
```

Generally speaking, this statement has been placed in a subroutine for easy, repeated use.

4. Chaining between programs. The CHAIN-statement does not have the chaining-with-variables feature. To carry the value of selected variables from one program to another, those values must first be stored in a data file; the data file must then be read immediately after chaining to the new program. A data file called 'DUMBFIL' is used for this purpose in the programs listed.
5. Directing PRINT-statements to the screen or printer. The BASIC statement 'PRINT' or its abbreviation '!' sends text to the screen.

The statement:

```
PRINT #01
```

or its abbreviation (!#01) permits the option of printing on the screen or the printer depending upon the numerical value assigned to the alphanumeric variable '01'. If preceded by the assignment statement '01=1', the PRINT-statement 'PRINT#01' will send text to the printer; if preceded by '01=0', the text will go to the screen.

### Program Names and Purposes

Of the seven programs listed in Appendix XII, six are linked by CHAIN-statements to form a package. The other program (CONLOAD) simply loads a data file to be used by one of the programs in the package. The name and a general description of each program follows.

ROUTER (Appendix XII(a)) routes the user to the five other programs of the package.

FILEMGR (Appendix XII(b)) is used by ROUTER to help a nonprogrammer to create or destroy the class data files needed by other programs in the package.

GRADER (Appendix XII(c)) is used to score, summarize, and store in data files the multiple-choice pretest (Appendix II), the multiple-choice posttest (Appendix IV) and the labtest (Appendix VI).

ANCOVA (Appendix XII(d)) uses analysis of covariance to do pretest/posttest and pretest/labtest comparisons. The test data for the control group used in these comparisons is stored in the data file CONTROL.

CONLOAD (Appendix XII(e)) is separate from the other programs in the package. It is used to load test scores (pretest/posttest/labtest) of the ANCOVA control group into the data file CONTROL.

SIAScore (Appendix XII(f)) scores and summarizes responses to the SI Attitude Scale (Appendix X).

OPINION (Appendix XII(g)) scores and graphically summarizes responses to the Metric Workshop Opinionnaire (Appendix XI).

### Documentation of Computer Programs

Full documentation of the seven computer programs probably is unnecessary. The liberal use of REM-statements (especially at the beginning of each program) was done with the intent of placing much documentation within the programs. Further documentation will be confined to the comments in the sections which follow.

### Comments on ROUTER

This program gives the user access to the scoring/analysis programs called GRADER, ANCOVA, SIAScore, and OPINION. It accesses FILEMGR to allow the user to name and create the class data files needed by those scoring/analysis programs. Use of ROUTER assumes the existence of a small (256 byte) data file called DUMBFIL which is used to store the name and location (drive number) of the class data file created.

### Comments on FILEMGR

This program creates two data files of 2048 bytes each for a given class. One file (Lines 1970-80) will be used to store data gathered by the scoring routines of GRADER; the other (Lines 1990-2000) will store data from OPINION.

Files of size 2048 bytes are sufficient for classes of up to about 80 persons. In general, the files should have 750 bytes for general (class) information plus 15 bytes for each person in the class. The size can be changed by changing the number of 256-byte disk sectors indicated in Line 910.

### Comments on GRADER

This program is used to score and summarize responses to the two multiple-choice tests of Chapter 2 and the labtest of Chapter 3. It also prints pretest/posttest/labtest-triples for each person in a given class and saves that information in a class data file (Lines 4060-4290) for future use by ANCOVA.

The scoring of any one of the tests may be interrupted without loss of data. Lines 980-1040 permit the user to pick up scoring at the end of the last whole test entered.

The keyed responses for the metric pretest (Appendix II) and posttest (Appendix IV) are stored in Lines 4390-4440. They are read into arrays by

Lines 1470-1500 (pretest) and Lines 2300-2330 (posttest). The four boundary scores required for scoring 12 of the 13 labtest items (see Appendix IX) are stored as ordered quadruples in Lines 4450-4490. The boundary scores for Item 7 of the labtest are a function of the mass of the person serving as a "test object" for that item. That person's mass is requested by Lines 3130-3150; the four boundary scores are computed in Line 3210 as part of the routine (Lines 3170-3240) which reads the labtest key into an array.

Responses to the multiple-choice items must be sorted according to the 14 main categories defined by Table 2. This is done for the pretest by Lines 1760-2160 and for the posttest by Lines 2580-2990.

Both individual and (categorized) class results of the three tests are stored in a class data file, C\$, by Lines 4060-4290. The information stored includes descriptive data about the class (Line 4100), the pretest/posttest/labtest-triple of scores for each person in the class (Line 4120), the eight level-of-knowledge class subtest scores for the pretest (Line 4150) and posttest (Line 4210), the six attribute class subtest scores for the pretest (Line 4180) and posttest (Line 4240), and the total class score on each labtest item (Line 4270).

A printed summary of the class scores -- including the triple of test scores for each individual -- is generated by Lines 4630-5710. The option of hardcopy (shown in Tables 3 and 6) or of printing on the screen is provided by Lines 4520-4620.

#### Comments on ANCOVA

This program uses the data files prepared by GRADER and CONLOAD to conduct either a pretest/posttest or a pretest/labtest analysis of covariance for a

given class. It prints the relevant charts (see Tables 4 and 7) for either comparison. Lines 2400-2570 permit the option of printing on the screen or with a printer.

The memory requirement (Line 170) of 15500 bytes is not altogether correct. This size is based upon class sizes (both experimental and control) of 20. This requirement depends upon the arrays dimensioned in Lines 2290-2330, where N is the size of the experimental group and M is the size of the control group.

#### Comments on CONLOAD

The use of ANCOVA requires pretest, posttest, and labtest scores from an appropriate control group. These scores are placed in a data file called CONTROL by this program (CONLOAD). The size of control is  $(15*M)+5$  bytes, where M is the number of persons in the control group.

This program can be used with a new control group by changing the DATA-statements in Lines 480-550. The figure in Line 490 would be replaced by the number of persons in the new control group; Lines 520-550 (and beyond, if necessary) would hold the pretest/posttest/labtest-triple of scores for each person in the control group.

The ANCOVA program requires that a score be recorded on all three tests for each member of the control group; the scores must be entered into CONTROL by CONLOAD in the ordered triples described. If the posttest or labtest is not administered to the control group, scores of zero must be entered.

#### Comments on SIASCORE

This program scores and summarizes class responses to the SI Attitude Scale. The printing of the results is divided into three subroutines to permit the chart heading (Lines 2290-2380), the scores of an individual (Lines 2410-2460),

and the class averages and standard deviations (Lines 2490-2680). These sub-routines are designed to produce hardcopy such as seen in Table 9.

Use of the data file SI-DATA described in Lines 630-680 is required by Choice 2 in Lines 860-900. If SI-DATA is created, it could be used to retrieve the data at some future date. The reading routine would need to be integrated with Lines 2350-2680.

The file SI-DATA is opened by Lines 1920-1930; individual triplets of scores are added to it by Lines 1840-1860; Lines 1960-2010 enter the class statistics and close the file. Data is stored using the random-access feature of Microsoft BASIC. Hence, the WRITE-statements in Lines 1850-1860 and 1980-2000 use the '%' symbol to indicate random-access addressing within the file. The address of the byte at which storing is to begin is given by the number or numerical expression immediately following the '%'. (This is the only random-access addressing done in any of the programs.)

The 28 items of the Scale have been ordered to fit the read-in routine of Lines 1390-1540. The routine expects four groups of seven items each which are taken from the test design matrix in the following order:

1. Seven Attribute items taken from seven adjacent cells of the Metric Adoption Domain as shown in Table 7.
2. Seven Behavior items taken from seven adjacent cells of the Metric Adoption Domain as shown in Table 7.
3. (Repeat #1 above.)
4. (Repeat #2 above.)

This systematic placement of items on the Scale also is assumed in Lines 1600-1700 where responses to the 28 items are sorted into the Attitude and Behavior subscale totals. Hence, any redesign of the Scale should keep this grouping

process (as noted in 1-4 above) in mind as it will simplify the modification of SIASCORE.

#### Comments on OPINION

This program assumes that the class whose opinionnaires are about to be scored has had pretests, posttests, or labtests scored by the GRADER program. The descriptive data about the class (whose name is stored in DUMBFILE) is sought in a data file, 01\$, previously created when using GRADER (Lines 1000-1060). The existence of such a file is assured by questions raised in ROUTER before OPINION is accessed.

The scoring of a particular set of opinionnaires can be interrupted without loss of data. Lines 1300-1340 permit the user to pick up wherever the interruption occurred.

Opinionnaire responses for a given class are stored in a class opinionnaire data file, 0\$, by Lines 3850-3920. They are also added to the total opinionnaire data from a particular state (Lines 3790-3810) and a three-state consortium by Lines 2360-2720. Both state and consortium data are kept in the single data file CONSORT (which is a file of 1500 bytes).

The printed output generated by the subroutine in Lines 2810-3660 was designed for the continuous display illustrated by Table 11 and requires a printer. It could be segmented for display on a screen.

A P P E N D I C E S

59/60

APPENDIX I

Directions for Quiz Administration  
Quizzes 1 and 2, Version A or B

1. Pass out Quiz 1 and its Response Sheet.
2. Say: "Please PRINT your name on the Response Sheet to Quiz 1."

When participants have done this, say:

"Please read the directions, and complete the five items of Quiz 1. Record your answers on the Response Sheet provided."

"I'll collect both the questions and the Response Sheet as soon as everyone is finished."

- \*3. Collect both questions and Response Sheets from Quiz 1.
4. Pass out Quiz 2 and its Response Sheet.
5. Say: "Please PRINT your name on the Response Sheet to Quiz 2."

When participants have done this, say:

"Again, record your answers on the Response Sheet. Turn in both the questions and the Response Sheet when you are finished."

---

\* Note to Instructor: To prevent inter-item cuing, the answer sheet to Quiz 1 must be turned in before Quiz 2 is distributed.

61/62 8d

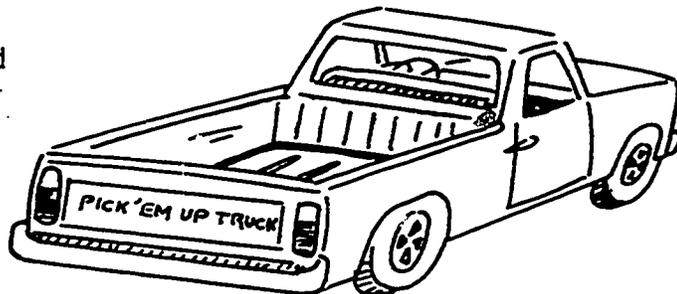
A P P E N D I X   I I

Quizzes 1 and 2: Version A

- Directions:
1. Please write your name on the separate response sheet provided.
  2. Each of the items on this quiz has exactly one correct response. On the separate response sheet, circle the number which corresponds to that choice.
  3. You will turn in the separate response sheet only. Hence, you may wish to record your responses on this test booklet for your own information.
  4. As soon as you have completed this quiz, turn in your response sheet and ask for a copy of Metric Quiz 2, Version A.

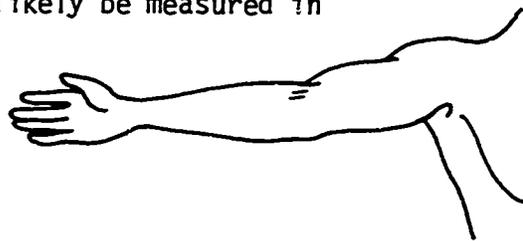
1. The mass of a pick-up truck would most likely be measured in

- (1) kilograms
- (2) square decimeters
- (3) liters
- (4) meters



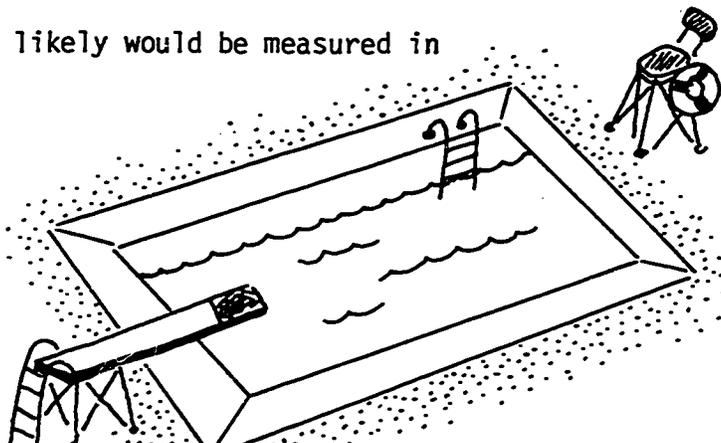
2. The length of an adult man's arm would most likely be measured in

- (1) liters
- (2) centimeters
- (3) kilograms
- (4) square decimeters



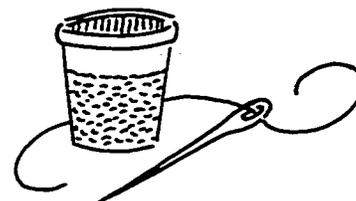
3. The volume of a public swimming pool likely would be measured in

- (1) tonnes
- (2) cubic meters
- (3) kilometers
- (4) square meters



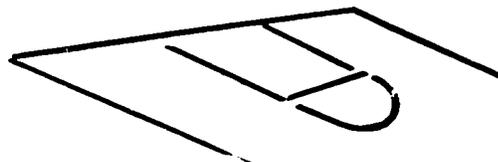
4. The volume of a thimble likely would be measured in

- (1) square centimeters
- (2) grams
- (3) milliliters
- (4) millimeters



5. The area of a basketball court would most likely be measured in

- (1) liters
- (2) centimeters
- (3) kilograms
- (4) square meters



- Directions:
1. Please write your name on the separate response sheet provided.
  2. Each of the items on this quiz has exactly one correct response. On the separate response sheet, circle the number which corresponds to that choice.
  3. You will turn in the separate response sheet only. Hence, you may wish to record your responses on this test booklet for your own information.

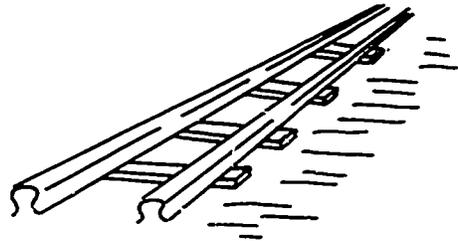
1. Abraham Lincoln had a height of about 2

- (1) meters
- (2) kilometers
- (3) centimeters
- (4) decimeters



2. The distance between the rails on the Union Pacific Railroad track is about 140

- (1) centimeters
- (2) decimeters
- (3) kilometers
- (4) millimeters



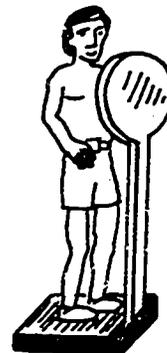
3. The area of the rectangle below is about 20

- (1) square centimeters
- (2) square millimeters
- (3) square decimeters
- (4) square meters



4. The mass of an average adult man (American) is about 75

- (1) grams
- (2) milligrams
- (3) kilograms
- (4) centigrams

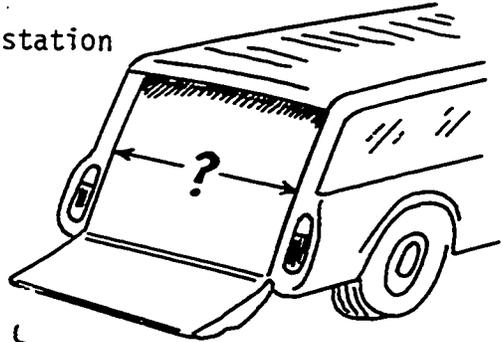


**Please Go To**  
**Page 3**

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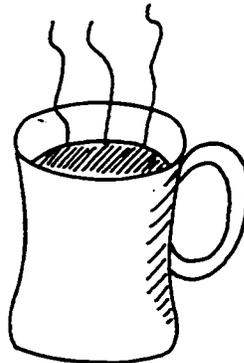
5. The width of the inside of a full-sized American station wagon automobile is about 15

- (1) centimeters
- (2) kilometers
- (3) decimeters
- (4) millimeters



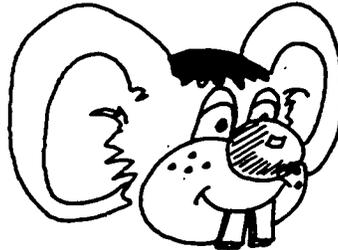
6. The volume of a coffee cup is about 200

- (1) liters
- (2) deciliters
- (3) milliliters
- (4) centiliters



7. A mouse has a mass of about 20

- (1) centigrams
- (2) milligrams
- (3) kilograms
- (4) grams



8. A telephone booth has a volume of about 2

- (1) cubic kilometers
- (2) cubic centimeters
- (3) cubic milliliters
- (4) cubic meters



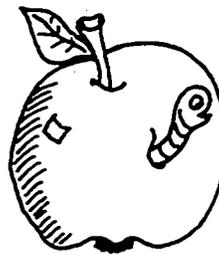
9. A tall basketball player has a height of about

- (1) 10 decimeters
- (2) 200 centimeters
- (3) 6 meters
- (4) 7.5 meters



10. An average apple has a mass of about

- (1) 10 grams
- (2) 150 grams
- (3) 500 grams
- (4) 1000 grams



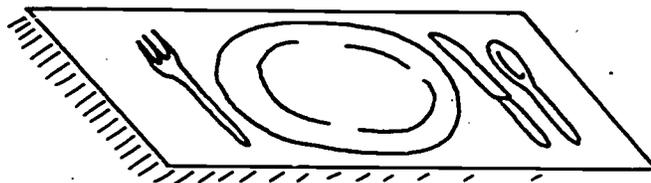
11. The volume of a standard desk telephone is about

- (1) 300 cubic centimeters
- (2) 2 cubic decimeters
- (3) 100 cubic millimeters
- (4) 1000 cubic millimeters



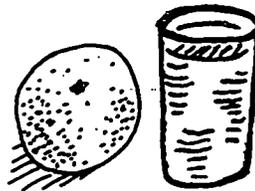
12. The area of an average dinner plate is about

- (1) 500 square millimeters
- (2) 0.5 square meter
- (3) 50 square centimeters
- (4) 5 square decimeters



13. An average breakfast serving of fruit juice has a volume of about

- (1) 5 milliliters
- (2) 0.5 liter
- (3) 150 milliliters
- (4) 10 liters



14. The meter would be a good unit to use to measure the length of

- (1) a bridge over the Mississippi River
- (2) a ladybug
- (3) a man's foot
- (4) the State of California

15. The cubic centimeter is a good unit to use when measuring the volume of

- (1) Lake Superior
- (2) a standard sized light bulb
- (3) a footlocker
- (4) the trunk of a full-sized American car

16. The square meter would be an appropriate unit to use in measuring the area of

- (1) a postage stamp
- (2) a football field
- (3) a letter-sized envelope
- (4) the State of Wyoming

17. The liter would be a good unit to use if you had to measure the volume of

- (1) a soup spoon
- (2) a gymnasium
- (3) a basketball
- (4) the Pacific Ocean

18. The kilogram is a good unit to measure the mass of

- (1) a ping-pong ball
- (2) a golf ball
- (3) the Statue of Liberty
- (4) a teacher's desk

19. One square decimeter is the same area as
- (1) 10 square meters
  - (2) 0.1 square meter
  - (3) 0.01 square meter
  - (4) 100 square meters
20. One cubic dekameter is the same volume as
- (1) 1000 cubic meters
  - (2) 0.01 cubic meter
  - (3) 100 cubic meters
  - (4) 0.001 cubic meter
21. One centimeter is the same length as
- (1) 1000 meters
  - (2) 10 meters
  - (3) 0.01 meter
  - (4) 0.001 meter
22. One dekagram is the same mass as
- (1) 0.01 gram
  - (2) 0.1 gram
  - (3) 100 grams
  - (4) 10 grams
23. One kilogram is the same mass as
- (1) 0.001 grams
  - (2) 0.01 gram
  - (3) 10 grams
  - (4) 100 grams
24. One kiloliter is the same volume as
- (1) 0.001 liter
  - (2) 0.01 liter
  - (3) 100 liters
  - (4) 1000 liters

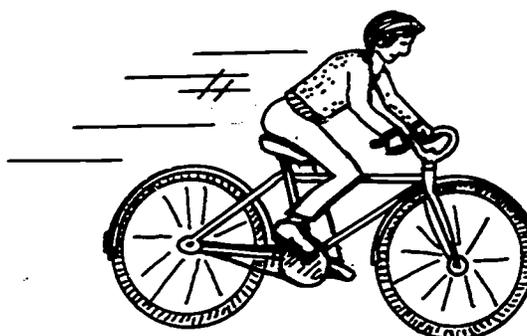
25. On a hot day, it would be refreshing to drink a glass of lemonade which has a temperature of

- (1) 35 degrees Celsius
- (2) 30 degrees Celsius
- (3) 5 degrees Celsius
- (4) -35 degrees Celsius



26. It would be comfortable to go bike riding wearing a light sweater when the air temperature is

- (1) 15 degrees Celsius
- (2) 45 degrees Celsius
- (3) 60 degrees Celsius
- (4) 80 degrees Celsius

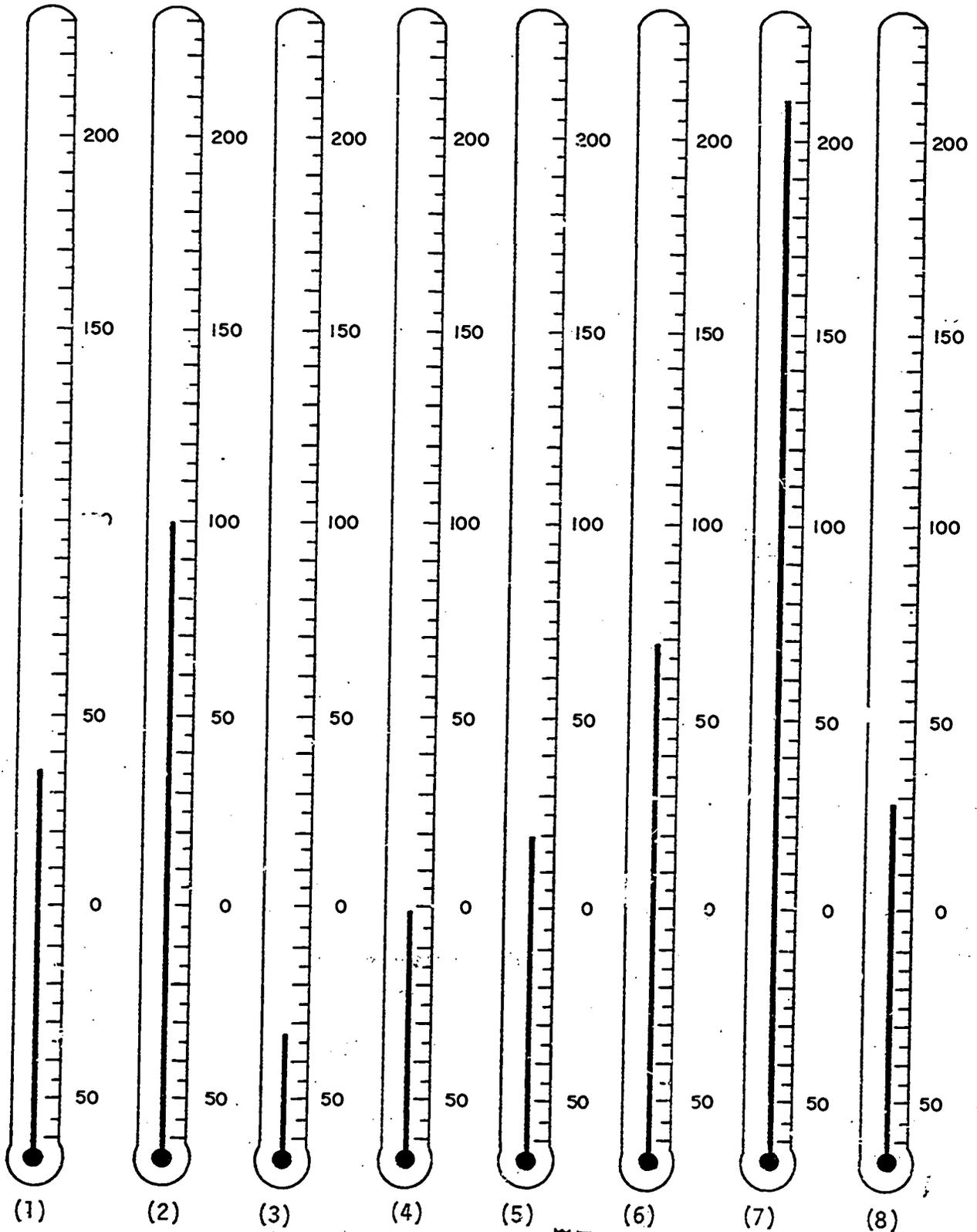


27. A reasonable body temperature for a snowman is about

- (1) 20 degrees Celsius
- (2) -10 degrees Celsius
- (3) 10 degrees Celsius
- (4) 32 degrees Celsius



### CELSIUS THERMOMETERS



Instructions for Items 28 - 30

Several Celsius thermometers are pictured at your left. For each of the following four events, give the number of the thermometer which most nearly indicates the temperature of that event. (A thermometer may be used more than once.)

28. nationally recommended room temperature (during cold weather)
29. normal human body temperature
30. temperature at which tap water boils
  
31. A temperature of 0 degrees Celsius is closest to which of the following?
  - (1) 50 degrees Fahrenheit
  - (2) 30 degrees Fahrenheit
  - (3) 0 degrees Fahrenheit
  - (4) -30 degrees Fahrenheit
  
32. A centimeter is closest to which one of the following?
  - (1) half an inch
  - (2) 3 inches
  - (3) 12 inches
  - (4) 36 inches
  
33. Forty liters is closest to which of the following?
  - (1) 10 gallons
  - (2) 80 gallons
  - (3) 20 gallons
  - (4) 160 gallons
  
34. An oven temperature of 200 degrees Celsius is closest to which of the following?
  - (1) 100 degrees Fahrenheit
  - (2) 400 degrees Fahrenheit
  - (3) 200 degrees Fahrenheit
  - (4) 300 degrees Fahrenheit

35. A square meter is closest to which of the following?
- (1) a square foot
  - (2) a square inch
  - (3) a square mile
  - (4) a square yard
36. A kilogram is closest to which one of the following?
- (1) half a pound
  - (2) a pound
  - (3) 2 pounds
  - (4) 100 pounds
37. A speed of 90 kilometers per hour is closest to which of the following?
- (1) 45 miles per hour
  - (2) 55 miles per hour
  - (3) 135 miles per hour
  - (4) 160 miles per hour

38. Which of the following is the correct symbol for 50 square centimeters?
- (1) 50 sq. cm.
  - (2)  $50 \text{ cm}^2$
  - (3)  $(50 \text{ cm})^2$
  - (4)  $50 \text{ CM}^2$
39. Which of the following is the correct symbol for 33 degrees Celsius?
- (1) 33 deg. C
  - (2) 33 C
  - (3)  $33 ^\circ\text{C}$
  - (4)  $33 ^\circ \text{C}$
40. Which of the following is the correct symbol for 47 milligrams?
- (1) 47 mgs
  - (2) 47 mg
  - (3) 47 mgs.
  - (4) 47 mg.
41. Which of the following is the correct symbol for 25 decimeters?
- (1) 25 dm.
  - (2) 25 dms.
  - (3) 25 dam
  - (4) 25 dm
42. Which of the following is the correct symbol for 58 cubic meters?
- (1) 58 cu m
  - (2) 58 cu. m.
  - (3)  $58 \text{ M}^3$
  - (4)  $58 \text{ m}^3$

43. A mass of 2.5 kilograms is the same as a mass of
- (1) 2500 grams
  - (2) 0.0025 gram
  - (3) 250 grams
  - (4) 25 grams
44. A volume of 20 cubic centimeters is the same as a volume of
- (1) 2000 milliliters
  - (2) 20 milliliters
  - (3) 2 milliliters
  - (4) 200 milliliters
45. An area of 30 square decimeters is the same as an area of
- (1) 9 square meters
  - (2) 0.09 square meter
  - (3) 0.3 square meter
  - (4) 300 square meters
46. A length of 40 centimeters is the same as a length of
- (1) 0.4 decimeter
  - (2) 4 decimeters
  - (3) 40 000 decimeters
  - (4) 400 decimeters
47. A volume of 5200 milliliters is the same as a volume of
- (1) 5 200 000 liters
  - (2) 52 liter
  - (3) 5.2 liter
  - (4) 52 liters

APPENDIX III

Answer Key

Version A, Quizzes 1 and 2

Quiz 1	Quiz 2
(1) 1	(1) 1
(2) 2	(2) 1
(3) 2	(3) 1
(4) 3	(4) 3
(5) 4	(5) 3
	(6) 3
	(7) 4
	(8) 4
	(9) 2
	(10) 2
	(11) 2
	(12) 4
	(13) 3
	(14) 1
	(15) 2
	(16) 2
	(17) 3
	(18) 4
	(19) 3
	(20) 1
	(21) 3
	(22) 4
	(23) 4
	(24) 4
	(25) 3
	(26) 1
	(27) 2
	(28) 5
	(29) 1
	(30) 2
	(31) 2
	(32) 1
	(33) 1
	(34) 2
	(35) 4
	(36) 3
	(37) 2
	(38) 2
	(39) 3
	(40) 2
	(41) 4
	(42) 4
	(43) 1
	(44) 2
	(45) 3
	(46) 2
	(47) 3

80<sub>79</sub>/80

A P P E N D I X I V

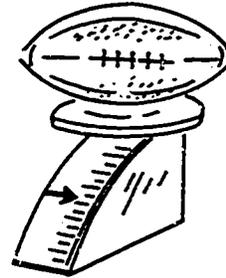
Quizzes 1 and 2: Version B

81/82 81

- Directions:
1. Please write your name on the separate response sheet provided.
  2. Each of the items on this quiz has exactly one correct response. On the separate response sheet, circle the number which corresponds to that choice.
  3. You will turn in the separate response sheet only. Hence, you may wish to record your responses on this test booklet for your own information.
  4. As soon as you have completed this quiz, turn in your response sheet and ask for a copy of Metric Quiz 2, Version B.

1. The mass of a football would probably be measured in

- (1) grams
- (2) milliliters
- (3) square centimeters
- (4) decimeters



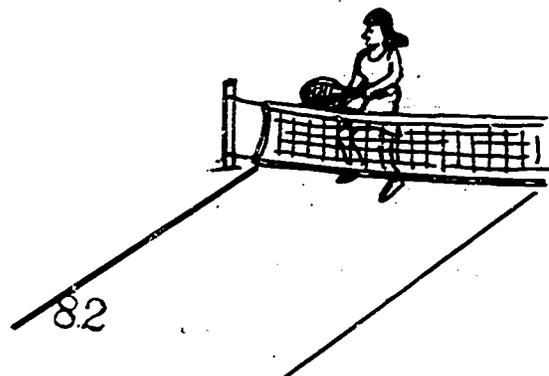
2. The volume of a coffee can would likely be measured in

- (1) liters
- (2) milligrams
- (3) square decimeters
- (4) centimeters



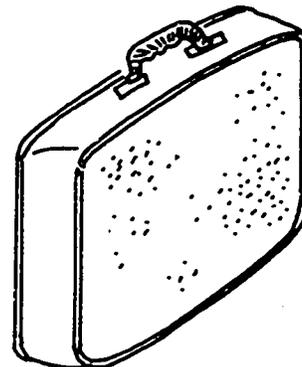
3. The length of a tennis court would probably be measured in

- (1) tonnes
- (2) meters
- (3) square decimeters
- (4) kiloliters



4. The volume of a suitcase would probably be measured in

- (1) centimeters
- (2) kilograms
- (3) cubic decimeters
- (4) square millimeters



5. The area of the face of a pocket watch would probably be measured in

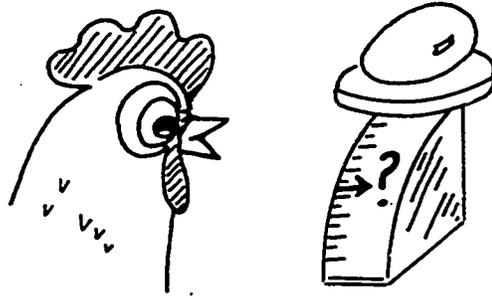
- (1) centimeters
- (2) decimeters
- (3) grams
- (4) square millimeters



- Directions:
1. Please write your name on the separate response sheet provided.
  2. Each of the items on this quiz has exactly one correct response. On the separate response sheet, circle the number which corresponds to that choice.
  3. You will turn in the separate response sheet only. Hence, you may wish to record your answers on this test booklet for your own information.

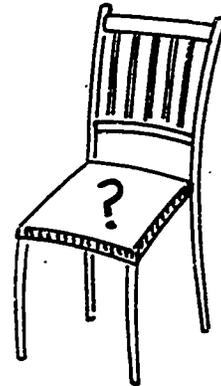
1. The mass of an average chicken egg is about 35

- (1) grams
- (2) milligrams
- (3) centigrams
- (4) kilograms



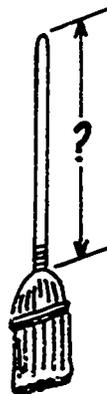
2. The seat on a dining room chair has an area of about 16

- (1) square meters
- (2) square decimeters
- (3) square millimeters
- (4) square centimeters



3. The length of the handle on a household broom is about 140

- (1) kilometers
- (2) centimeters
- (3) millimeters
- (4) decimeters

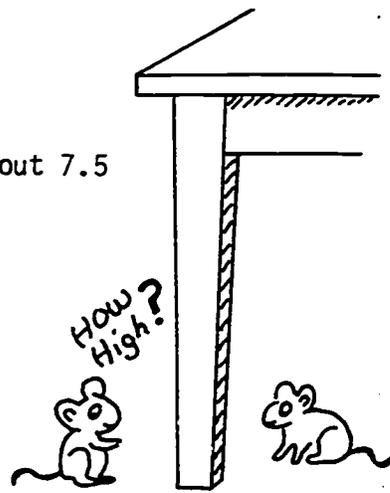


**Please Go To  
Page 3**

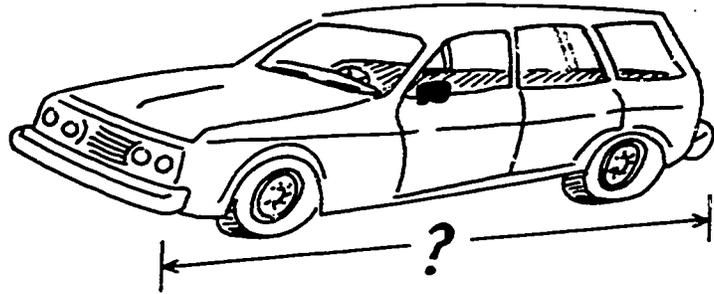
85

86

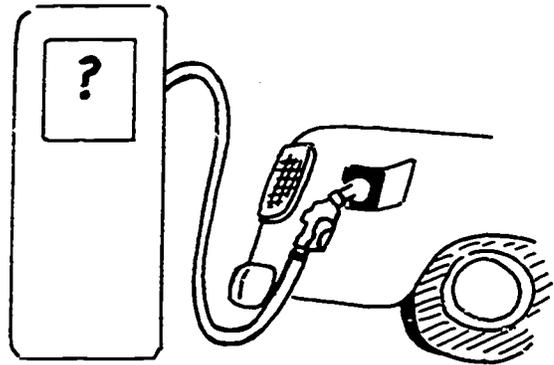
4. The height of a dining room table is about 7.5
- (1) millimeters
  - (2) decimeters
  - (3) kilometers
  - (4) centimeters



5. The length of a full-sized American station wagon (automobile) is about 4
- (1) millimeters
  - (2) kilometers
  - (3) meters
  - (4) centimeters



6. The gas tank of a full-sized American car has a volume of about 80
- (1) deciliters
  - (2) milliliters
  - (3) liters
  - (4) centiliters



7. The volume of a sugar cube is about 2
- (1) cubic meters
  - (2) cubic millimeters
  - (3) cubic centimeters
  - (4) cubic decimeters

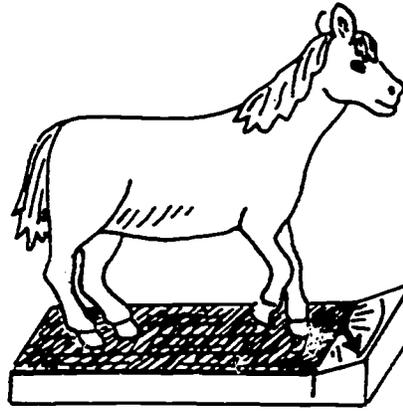


8. A large dog would have a mass of about 40
- (1) grams
  - (2) centigrams
  - (3) milligrams
  - (4) kilograms



9. The mass of an average horse (full grown) is about

- (1) 800 kilograms
- (2) 1 kilogram
- (3) 5000 grams
- (4) 1000 milligrams



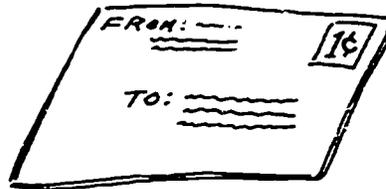
10. A metal trash can, if filled to the top with rain water, would hold about

- (1) 15-20 liters
- (2) 75-80 liters
- (3) 150-200 milliliters
- (4) 500-600 milliliters



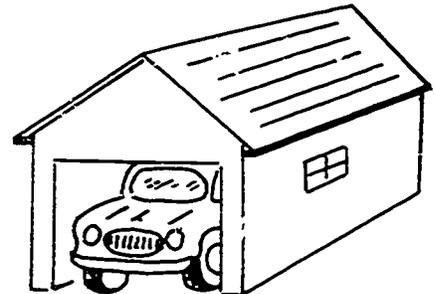
11. The area of a standard postcard (as purchased from the U.S. Post Office) is approximately

- (1) 100 square millimeters
- (2) 0.1 square meter
- (3) 1 square decimeter
- (4) 15 square centimeters



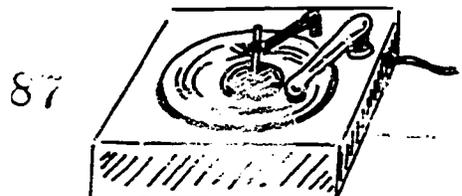
12. A one-car garage has a volume of about

- (1) 100 cubic decimeters
- (2) 500 cubic decimeters
- (3) 70 cubic meters
- (4) 1000 cubic meters



13. A distance across a long-playing phonograph record is about

- (1) 33 millimeters
- (2) 12 centimeters
- (3) 1 meter
- (4) 3 decimeters



14. It is appropriate to use the milligram as a unit when measuring the mass of
- (1) a gold ring
  - (2) an elephant
  - (3) a dog
  - (4) a bicycle
15. The cubic decimeter is a good unit to use when measuring the volume of
- (1) a volleyball
  - (2) a thimble
  - (3) a two-car garage
  - (4) the Atlantic Ocean
16. The square centimeter would be an appropriate unit to use in measuring the area of
- (1) a head of a common straight pin
  - (2) a sheet of standard typing paper
  - (3) a baseball diamond
  - (4) the State of Texas
17. A milliliter would be a good unit to use when measuring the volume of
- (1) a clothes closet
  - (2) a bathtub
  - (3) the juice in a lemon
  - (4) a grain silo
18. The centimeter is a good unit to use to measure the length of
- (1) a swimming pool
  - (2) a telephone pole
  - (3) the eye of a sewing needle
  - (4) a person's index finger
19. One square dekameter is the same area as
- (1) 0.01 square meter
  - (2) 100 square meters
  - (3) 10 square meters
  - (4) 0.1 square meter

20. One cubic decimeter is the same volume as

- (1) 0.001 cubic meter
- (2) 0.1 cubic meter
- (3) 100 cubic meters
- (4) 1000 cubic meters

21. One centigram is the same mass as

- (1) 0.01 gram
- (2) 0.1 gram
- (3) 10 grams
- (4) 100 grams

22. One dekameter is the same length as

- (1) 1000 meters
- (2) 0.001 meter
- (3) 10 meters
- (4) 0.1 meter

23. One milliliter is the same volume as

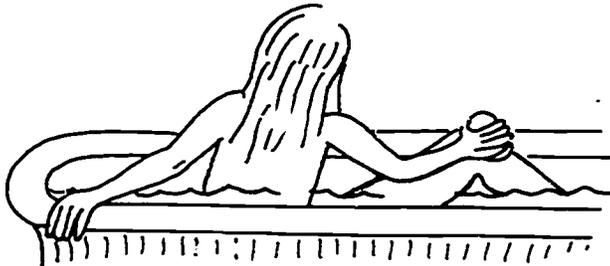
- (1) 1000 liters
- (2) 0.001 liter
- (3) 0.01 liter
- (4) 10 liters

24. One milligram is the same mass as

- (1) 0.001 gram
- (2) 0.01 gram
- (3) 10 grams
- (4) 1000 grams

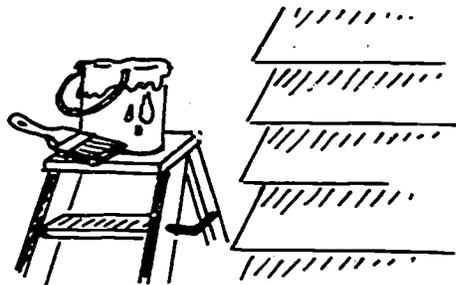
25. It would be reasonable to take a bath in water which has a temperature of

- (1) 40 degrees Celsius
- (2) 100 degrees Celsius
- (3) 70 degrees Celsius
- (4) 20 degrees Celsius



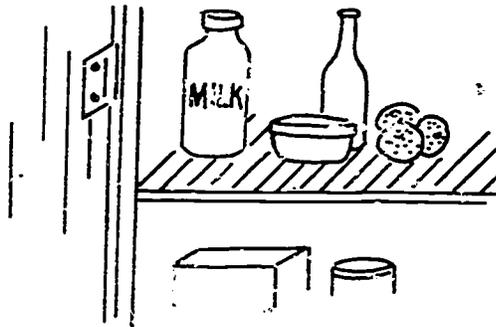
26. It would be reasonable to paint the outside of your house when the air temperature is

- (1) 95 degrees Celsius
- (2) 80 degrees Celsius
- (3) 70 degrees Celsius
- (4) 20 degrees Celsius

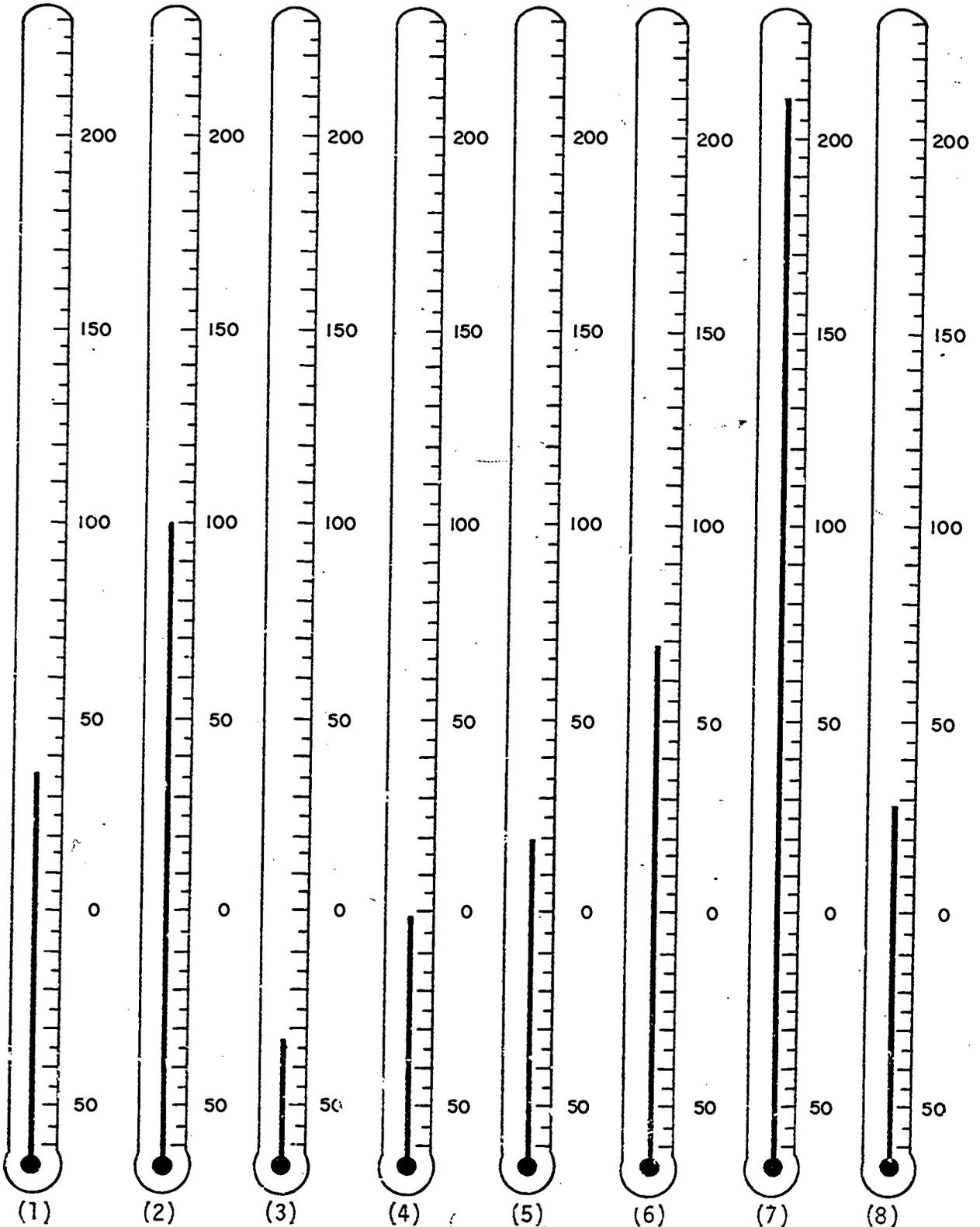


27. A reasonable temperature for the inside of a refrigerator is about

- (1) -10 degrees Celsius
- (2) 20 degrees Celsius
- (3) 5 degrees Celsius
- (4) 32 degrees Celsius



### CELSIUS THERMOMETERS



Instructions for Items 28 - 30

Several Celsius thermometers are pictured at your left. For each of the following four events, give the number of the thermometer which most nearly indicates the temperature of that event. (A thermometer may be used more than once.)

28. normal human body temperature
29. temperature at which tap water freezes
30. nationally recommended room temperature (on a cold day)
  
31. A temperature of 100 degrees Celsius is closest to which of the following?
  - (1) 50 degrees Fahrenheit
  - (2) 150 degrees Fahrenheit
  - (3) 200 degrees Fahrenheit
  - (4) 100 degrees Fahrenheit
  
32. A kilometer is closest to which one of the following?
  - (1) 2 miles
  - (2) 100 miles
  - (3) half a mile
  - (4) a mile
  
33. A liter is closest to which of the following?
  - (1) a cup
  - (2) a pint
  - (3) a quart
  - (4) a gallon
  
34. An oven temperature of 150 degrees Celsius is closest to which of the following?
  - (1) 75 degrees Fahrenheit
  - (2) 150 degrees Fahrenheit
  - (3) 225 degrees Fahrenheit
  - (4) 300 degrees Fahrenheit

35. A meter is closest to which of the following?

- (1) a yard
- (2) a foot
- (3) a mile
- (4) an inch

36. A tonne (metric ton) is closest to which one of the following?

- (1) 100 pounds
- (2) 500 pounds
- (3) 1000 pounds
- (4) 2000 pounds

37. A speed of 40 kilometers per hour is closest to which of the following?

- (1) 80 miles per hour
- (2) 60 miles per hour
- (3) 25 miles per hour
- (4) 20 miles per hour

38. Which of the following is the correct symbol for 40 square millimeters?
- (1) 40 MM<sup>2</sup>
  - (2) 40 sq. mm.
  - (3) 40 mm<sup>2</sup>
  - (4) (40 mm)<sup>2</sup>
39. Which of the following is the correct symbol for 57 degrees Celsius?
- (1) 57<sup>o</sup> Celsius
  - (2) 57<sup>o</sup>C
  - (3) 57 °C
  - (4) 57 deg. Cel.
40. Which of the following is the correct symbol for 75 kilograms?
- (1) 75 Kg
  - (2) 75 kg
  - (3) 75 kg.
  - (4) 75 kgs.
41. Which of the following is the correct symbol for 65 decimeters?
- (1) 65 dms.
  - (2) 65 dm
  - (3) 65 dam
  - (4) 65 dm.
42. Which of the following is the correct symbol for 35 cubic centimeters?
- (1) 35 cm<sup>3</sup>
  - (2) (35 cm)<sup>3</sup>
  - (3) 35 cu cm
  - (4) 35 cc

43. A mass of 640 grams is the same as a mass of
- (1) 0.64 kilogram
  - (2) 6.4 kilograms
  - (3) 640 000 kilograms
  - (4) 64 000 kilograms
44. A volume of 400 milliliters is the same as a volume of
- (1) 400 cubic centimeters
  - (2) 40 cubic centimeters
  - (3) 4000 cubic centimeters
  - (4) 4 cubic centimeters
45. An area of 4 square decimeters is the same as an area of
- (1) 400 square centimeters
  - (2) 1600 square centimeters
  - (3) 40 square centimeters
  - (4) 0.16 square centimeter
46. A length of 25 millimeters is the same as a length of
- (1) 2.5 decimeters
  - (2) 0.025 decimeter
  - (3) 0.25 decimeter
  - (4) 2500 decimeters
47. A volume of 30 cubic centimeters is the same as a volume of
- (1) 3 cubic decimeters
  - (2) 0.3 cubic decimeter
  - (3) 30 cubic decimeters
  - (4) 0.03 cubic decimeter

APPENDIX V

Answer Key

Version B, Quizzes 1 and 2

Quiz 1		Quiz 2	
(1) 1	(1) 1	(17) 3	(33) 3
(2) 1	(2) 2	(18) 4	(34) 4
(3) 2	(3) 2	(19) 2	(35) 1
(4) 3	(4) 2	(20) 1	(36) 4
(5) 4	(5) 3	(21) 1	(37) 3
	(6) 3	(22) 3	(38) 3
	(7) 3	(23) 2	(39) 2
	(8) 4	(24) 1	(40) 2
	(9) 1	(25) 1	(41) 2
	(10) 2	(26) 4	(42) 1
	(11) 3	(27) 3	(43) 1
	(12) 3	(28) 1	(44) 1
	(13) 4	(29) 4	(45) 1
	(14) 1	(30) 5	(46) 3
	(15) 1	(31) 3	(47) 4
	(16) 2	(32) 3	

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APPENDIX VI  
Metric Labtest

Name: \_\_\_\_\_

The purpose of this quiz is to find out how well you can estimate measures of length, area, mass, volume and temperature in appropriate metric units. Your estimates are to be based upon the measurement experiences that you've had; hence, no formal measuring instruments (commercial or homemade) are to be used in doing this quiz.

Thirteen laboratory stations have been set up. The number at a given station corresponds to the number of a task given below.

For each task, make as accurate an estimate of the measure requested as you can. Make your estimate in terms of the unit of measure indicated.

For each task you will receive a score of 0, 1 or 2 points according to where your estimate falls with respect to preset bounds.

You may start the quiz at any station. You may handle the objects at the stations (remembering, please, to replace them before moving on to another station).

- \_\_\_\_\_ 1. Estimate, in decimeters, the length of the piece of rope at this station.
- \_\_\_\_\_ 2. Estimate, in centimeters, the length of the line drawn on the egg-shaped object at this station.
- \_\_\_\_\_ 3. Estimate, in meters, the perimeter of the triangle made with tape on the floor.
- \_\_\_\_\_ 4. Estimate, in square centimeters, the area of the front cover of the journal (ARITHMETIC TEACHER) at this station.
- \_\_\_\_\_ 5. Estimate, in square decimeters, the area of the piece of cloth at this station.
- \_\_\_\_\_ 6. Estimate, in grams, the mass of the bag of salt at this station.
- \_\_\_\_\_ 7. Estimate, in kilograms, the mass of the person standing at this station.
- \_\_\_\_\_ 8. Estimate, in milliliters, the volume of colored water in the bottle at this station.
- \_\_\_\_\_ 9. Estimate, in liters, the volume of the large box at this station.
- \_\_\_\_\_ 10. Estimate, in cubic centimeters, the volume of the small box at this station.
- \_\_\_\_\_ 11. Estimate, in degrees Celsius, the temperature of the water in the bucket at this station. (PLEASE DON'T TOUCH THE THERMOMETER THAT'S IN THE BUCKET.)
- \_\_\_\_\_ 12. Estimate, in degrees Celsius, the temperature of the water in the bucket at this station. (PLEASE DON'T TOUCH THE THERMOMETER THAT'S IN THE BUCKET.)
- \_\_\_\_\_ 13. Estimate, in degrees Celsius, the temperature of the water in the bucket at this station. (PLEASE DON'T TOUCH THE THERMOMETER THAT'S IN THE BUCKET.)

## APPENDIX VII

### Metric Labtest Materials Kit

A QUIZ KIT has been provided. It contains most of the materials needed to set up the 13 Labtest stations; you'll need to supply a few additional things. Specifically, you will need to obtain:

- 1 graduated cylinder (to measure 400 milliliters of water)
- 1 roll masking tape
- 1 meter stick (calibrated in centimeters)
- 1 pair scissors
- several paper towels
- source of both hot (over 50°C) and cool (20°C or below) tap water

The kit sent provides the following items:

- 13 index cards (numbered from 1 through 13)
- 1 piece of clothesline (17 decimeters long)
- 1 L'eggs container (panty hose container) with line drawn around its long circumference with an indelible felt-tipped pen. (Line is about 27 cm long.)
- 1 copy Mathematics Teacher
- 1 plastic bag containing salt (mass of 700 grams)
- 1 rectangular piece of cloth (74 cm by 43 cm)
- 1 clear (or translucent) plastic bottle with cap that will hold about one liter of water
- 3 Celsius thermometers with an upper range of at least 50°C
- 3 small styrofoam bait buckets (each having a volume of about 2 liters) with lids
- 1 small box (17 cm by 11 cm by 6 cm)
- \*1 large box (44 cm by 29 cm by 29 cm)
- 1 small bottle food coloring
- 1 roll of string

- 
- \* A box which holds 10 reams of spirit duplicator paper works well. The box is used both as the object of a Labtest question and as a container for packing the other materials listed above. Please use this box to return the objects of the kit.

1102

APPENDIX VIII

Memorandum #1: ~~Setting~~ in the ~~Metric~~ Labtest

Memorandum #2: Labtest ~~Reporting~~ ~~Form~~

MEMORANDUM #1

TO: All Metric Instructors

RE: ~~Setting Up the Metric Labtest~~

Equipment Used in the Labtest

You have been provided with a box of objects to use for the items of this quiz. Check that collection of objects in that kit using the

Materials List: Metric Labtest Kit

attached to this ~~memorandum~~.

Note that the "object" used in Item 7 is a person. Try to find a person who meets the specifications given on the back of this sheet. Use the form provided by Memorandum #4 to report the name of the person used in Item 7.

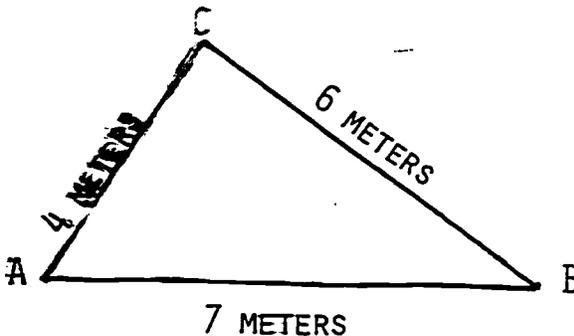
Setting Up the Labtest

- A. Each station should be physically separate from each other station in order to avoid confusion.
- B. Each station should be numbered. Use the enclosed index cards; tape them down.
- C. The set-up for each station is described below.

Station 1: Use the rope provided. It should be about 17 meters long. If it isn't, please replace it with one that is.

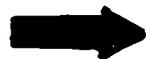
Station 2: Use the egg-shaped object provided. If the line has faded, please trace it with a pen to make it darker.

Station 3: Find a place on the floor where you can make the triangle described below. A roll of masking tape has been enclosed so that each side can be drawn completely. (You may have to place the triangle in a hallway or another room and leave directions at Station 3 on where to find it.) When completed, the triangle should look like this



except, of course, ~~that~~ it will be much larger and it will not be labeled.

OVER



You can construct the triangle as follows:

- (a) Make two marks on the floor which are 7 meters apart. Connect them with tape.
- (b) Using the string provided, cut one piece which is 4 meters long and another that is 6 meters long.
- (c) Using a small piece of tape, tape one end of the 4-meter string at A and tape one end of the 6-meter string at B.
- (d) Gently pull the two strings until their ends just meet. This point is C. Mark point C with a piece of tape.
- (e) Using tape, connect point C to point A and point B. The triangle should now look like the one on the other side of this sheet.

Station 4: Use the journal provided.

Station 5: Use the piece of cloth provided. Unfold it and tape its corners to the table.

Station 6: The plastic bag of salt provided should have a mass of 700 grams. Please check it and correct it if necessary.

Station 7: Find a "stranger" -- someone whose mass should be unknown to the people in your class. Try to find someone with a mass in the range from 75 to 85 kilograms. REPORT THE MASS (TO THE NEAREST KILOGRAM) OF THAT PERSON BY USING MEMORANDUM #2.

Station 8: Put 400 milliliters of tap water into the plastic bottle and add 2-3 drops of the food coloring provided. Cap the bottle and shake gently.

Station 9: Use the box in which the lab test materials were shipped. Tuck in the flaps.

Station 10: Use the small box provided.

Station 11: Using hot and cool tap water, fill one of the styrofoam containers about 2/3 full of water with a temperature of 50°C; place the thermometer face down in the bottom of the bucket and put the lid on the bucket. Provide paper towels. (Check thermometer before test begins to make certain the water is at the specified temperature.) Check about every 5 minutes to make sure temperature remains same; if not, please adjust by using ice water or boiling water.

Station 12: Like Station 11, but water should be 35°C. Check temperature every 5 minutes.

Station 13: Like Station 11, but water should be 20°C. Check temperature every 5 minutes.

D. When the quiz is over, please return all materials (buckets, rope, empty plastic bottle, etc.) using the box in which the equipment was sent to you.

To make our assessment possible, complete Memorandum #4 now and include it with the answer sheets.

MEMORANDUM # 2

Labtest Reporting Form

~~\*\*\*Please complete this form and return it in the package with the answer sheets to the Metric Labtest.\*\*\*~~

From: \_\_\_\_\_ (your name)

RE: The Metric Labtest

1. The mass (to the nearest whole kilogram) of the person used at Station 7 of the Labtest was \_\_\_\_\_ kilograms.
2. Testing conditions which may have had an influence on student responses to the Labtest were as follows (if any):

107 / 108 102

APPENDIX IX

Metric Labtest Scoring Key

Each ~~test~~ should be scored 0, 1, or 2; the score in each case depending upon how close your estimate is to the exact ~~measure~~ of the object. Column I of the chart below shows the "exact" numerical measure ~~for the appropriate unit, refer to the quiz~~; in Column II it indicates those estimates which are good enough to be worth two points. Columns III and IV indicate the ~~underestimates~~ (Column III) and overestimates (Column IV) which are worth one point. If your estimate is farther from the exact measure than those indicated in Columns III and IV, it is worth 0 points.

Labtest Item No.	I Exact Measure	II Estimates worth 2 points	III Underestimates worth 1 point	IV Overestimates worth 1 point
1	17	<del>16.25</del> - 17.75	15 - 16.2	17.8 - 19
2	27	<del>26</del> - 28	24 - 25.9	28.1 - 30
3	17	<del>16.3</del> - 17.75	15.5 - 16.25	17.8 - 18.5
4	<del>455</del>	<del>413</del> - 500	375 - 412	501 - 546
5	31.8	26 - 33.75	24 - 25.9	33.8 - 35
6	700	600 - 800	500 - 599	801 - 1000
7*	<input type="checkbox"/>	<input type="checkbox"/> -5 to <input type="checkbox"/> +5	<input type="checkbox"/> -7.5 to <input type="checkbox"/> -5.1	<input type="checkbox"/> +5.1 to <input type="checkbox"/> +7.5
8	400	350 - 450	300 - 349	451 - 500
9	35.75	30 - 37.5	20 - 29.9	37.6 - 45
10	<del>950</del>	900 - 1020	750 - 899	1021 - 1125
11	<del>50</del>	48 - 52	45 - 47.5	52.5 - 55
12	<del>35</del>	32 - 37	30 - 31.5	37.5 - 40
13	20	18 - 22	15 - 17.5	22.5 - 25

\* The answers here depend upon the person chosen. Your instructor will tell you what to write in the .

APPENDIX X

SI Attitude Scale

Name: \_\_\_\_\_

The purpose of this instrument is to measure your attitude toward American adoption of the metric system (also called the Le Systeme International, unites and abbreviated 'SI' in all languages).

Directions

1. If asked to do so by the person administering this instrument, please write your name in the blank at the top of this sheet.
2. Please respond to each item on the instrument.
3. In responding to an item, respond on the basis of your first impression. Please do not "ponder" any item.
4. For each of the 28 items on the other side of this sheet, respond by circling the number (from 1 to 5) which best indicates your level of agreement with the statement. For example, given the statement:

The metric system is easy to learn.

you should

- \*Circle '1' if you strongly disagree (SD) with the statement,
- \*Circle '2' if you disagree (D) with the statement,
- \*Circle '3' if you are undecided (U) or have no opinion regarding the statement,
- \*Circle '4' if you agree (A) with the statement, or
- \*Circle '5' if you strongly agree (SA) with the statement.

Please turn the page to begin.



## SI Attitude Scale

(Directions on Other Side of This Sheet)

- | SD | D | U | A | SA |  |
|----|---|---|---|----|--|
| 1  | 2 | 3 | 4 | 5  | (1) No scientist or mathematician can convince me that the metric system is better than our present system of measurement.   |
| 1  | 2 | 3 | 4 | 5  | (2) Adoption of the metric system would constitute another example of bureaucratic government control.   |
| 1  | 2 | 3 | 4 | 5  | (3) Adoption of the metric system will force substantial increases in consumer costs.  |
| 1  | 2 | 3 | 4 | 5  | (4) Major changes such as the adoption of the metric system are a necessary part of the growth of our nation.  |
| 1  | 2 | 3 | 4 | 5  | (5) Educators, looking for something new to do, are responsible for the big push to adopt the metric system.   |
| 1  | 2 | 3 | 4 | 5  | (6) It pleases me to see America convert to the metric system.   |
| 1  | 2 | 3 | 4 | 5  | (7) The metric system is cumbersome since it makes it necessary to worry about decimal places.   |
| 1  | 2 | 3 | 4 | 5  | (8) I'm in support of scientists and mathematicians who have spoken in favor of implementing the metric system.  |
| 1  | 2 | 3 | 4 | 5  | (9) Government (national, state and local) should begin preparing the public for metric road signs and weather reporting.  |
| 1  | 2 | 3 | 4 | 5  | (10) I would encourage local businesses to carry items that pertain to home use of the metric system (e.g., metric measuring tapes, tools, kitchen items, thermometers, etc.). |
| 1  | 2 | 3 | 4 | 5  | (11) I am willing to change to the metric system.  |
| 1  | 2 | 3 | 4 | 5  | (12) I would work on a school textbook selection committee to ensure that new textbooks in subjects such as history and industrial arts use metric units.                      |
| 1  | 2 | 3 | 4 | 5  | (13) Given the opportunity, I would vote against America's conversion to the metric system.  |
| 1  | 2 | 3 | 4 | 5  | (14) I prefer the metric system because it is based upon multiples of ten.   |
| 1  | 2 | 3 | 4 | 5  | (15) I'm glad that scientists and mathematicians developed the metric system.  |
| 1  | 2 | 3 | 4 | 5  | (16) Adoption of the metric system is essentially the idea of a small group of federal bureaucrats.  |
| 1  | 2 | 3 | 4 | 5  | (17) Conversion to the metric system will increase the price of automobiles.   |
| 1  | 2 | 3 | 4 | 5  | (18) Changing to the metric system will be worth the effort since it will provide an "international language" of measurement.  |
| 1  | 2 | 3 | 4 | 5  | (19) The metric system, like the "new math," is just a fad promoted by educators.  |
| 1  | 2 | 3 | 4 | 5  | (20) The metric system will be easy to use in my personal life.  |
| 1  | 2 | 3 | 4 | 5  | (21) Conversion among metric units is easy because it involves multiplying or dividing by ten.   |
| 1  | 2 | 3 | 4 | 5  | (22) Our present system of measurement is very systematic and orderly.   |
| 1  | 2 | 3 | 4 | 5  | (23) America should maintain a "wait-and-see" attitude toward the metric system for at least the next ten years.   |
| 1  | 2 | 3 | 4 | 5  | (24) Food stores should use metric scales to weigh meats and produce.  |
| 1  | 2 | 3 | 4 | 5  | (25) Conversion to the metric system would benefit all Americans.  |
| 1  | 2 | 3 | 4 | 5  | (26) I favor requiring that all new school textbooks make predominant use of metric units.   |
| 1  | 2 | 3 | 4 | 5  | (27) I'm willing to buy metric tools or metric measuring utensils for the kitchen.   |
| 1  | 2 | 3 | 4 | 5  | (28) We should adopt the metric system because its units of length, area, volume and mass are interrelated in simple ways.   |

APPENDIX XI

Metric Workshop Opinionnaire

The purpose of this ~~opinionnaire~~ is to provide the feedback necessary to identify specific strengths or weaknesses ~~of the~~ metric workshop program. Your opinions will be compiled and summarized; these ~~summaries~~ will be returned to the workshop leaders and will be a major component in workshop ~~revision~~.

\*\*\*\*\*

For each of Items 1-~~26~~ of this opinionnaire, please circle the response which best describes your immediate feeling. Don't puzzle over or worry about any item. If you wish to write a comment beside any item, please do so. The meaning of each of the five numerical responses is as follows:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Undecided or No Opinion
- 4 = Agree
- 5 = Strongly Agree

- |   |   |   |   |   |      |   |
|---|---|---|---|---|------|---|
| 1 | 2 | 3 | 4 | 5 | (1)  | The physical facilities in which the workshop was held were conducive to learning.  |
| 1 | 2 | 3 | 4 | 5 | (2)  | The materials displayed and used in the workshop were effective.  |
| 1 | 2 | 3 | 4 | 5 | (3)  | The length of time allotted for the workshop was appropriate.   |
| 1 | 2 | 3 | 4 | 5 | (4)  | There was good rapport among the workshop participants.   |
| 1 | 2 | 3 | 4 | 5 | (5)  | The workshop sessions provided opportunities for expressing and sharing ideas.  |
| 1 | 2 | 3 | 4 | 5 | (6)  | Participants spent class time involved in worthwhile activity.  |
| 1 | 2 | 3 | 4 | 5 | (7)  | Help and encouragement were readily available from the instructional staff.   |
| 1 | 2 | 3 | 4 | 5 | (8)  | Formal presentations by instructional staff were stimulating.   |
| 1 | 2 | 3 | 4 | 5 | (9)  | The objectives of the workshop were clear.  |
| 1 | 2 | 3 | 4 | 5 | (10) | The objectives of the workshop were realistic.  |
| 1 | 2 | 3 | 4 | 5 | (11) | The topics and activities were appropriate to the workshop objectives.  |
| 1 | 2 | 3 | 4 | 5 | (12) | The information provided by the workshop is usable.   |
| 1 | 2 | 3 | 4 | 5 | (13) | The workshop design facilitated participant involvement.  |
| 1 | 2 | 3 | 4 | 5 | (14) | Participants were encouraged to implement new ideas.  |
| 1 | 2 | 3 | 4 | 5 | (15) | The workshop stimulated participant interest.   |
| 1 | 2 | 3 | 4 | 5 | (16) | The workshop has helped me to understand the metric system (SI).  |
| 1 | 2 | 3 | 4 | 5 | (17) | The instructional methods employed in the workshop have helped me to understand instructional concepts associated with teaching about the metric system (SI). |
| 1 | 2 | 3 | 4 | 5 | (18) | The workshop has increased my awareness of instructional alternatives.  |
| 1 | 2 | 3 | 4 | 5 | (19) | The workshop has helped me toward the achievement of the objectives I have as a teacher.  |
| 1 | 2 | 3 | 4 | 5 | (20) | The workshop has given me new ideas on how to improve instruction in my classroom.  |
| 1 | 2 | 3 | 4 | 5 | (21) | The workshop has introduced me to equipment, materials and methods that I haven't used before in teaching.  |
| 1 | 2 | 3 | 4 | 5 | (22) | The workshop has enhanced my understanding of instruction across grade levels.  |
| 1 | 2 | 3 | 4 | 5 | (23) | The workshop satisfactorily met my expectations.  |
| 1 | 2 | 3 | 4 | 5 | (24) | I approve of the grading policy employed in this workshop.  |
| 1 | 2 | 3 | 4 | 5 | (25) | I would recommend this workshop to my colleagues should the same instructional staff offer it again.  |
| 1 | 2 | 3 | 4 | 5 | (26) | I would attend another workshop conducted by the staff who planned this workshop (if the topic interested me).  |

-- PLEASE TURN TO ITEMS ON OTHER SIDE --

In Items 27-31, place an 'X' in that blank between the word pair which comes closest to expressing your feelings about the workshop.

- (27) effective:\_\_:\_\_:\_\_:\_\_:ineffective  
(28) pleasant:\_\_:\_\_:\_\_:\_\_:unpleasant  
(29) valuable:\_\_:\_\_:\_\_:\_\_:worthless  
(30) interesting:\_\_:\_\_:\_\_:\_\_:boring  
(31) important:\_\_:\_\_:\_\_:\_\_:unimportant

---

In Items 32-37, respond YES by circling '2' or NO by circling '1'.

NO YES

- 1 2 (32) Do you feel that it is feasible for you to share the materials and/or ideas developed during the workshop with fellow teachers who did not attend the workshop?
- 1 2 (33) Do you intend to do so?
- 1 2 (34) Have you done so already?
- 1 2 (35) Do you feel that it is feasible for you to incorporate the activities, strategies, and/or materials investigated in this workshop into your instructional setting?
- 1 2 (36) Do you intend to do so?
- 1 2 (37) Have you done so already?

---

(38) What was the one best thing about this workshop? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(39) What was most in need of improvement in this workshop? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(40) Please use the space below to make specific suggestions or comments which might help us to improve our workshops.

APPENDIX XII

Computer Programs

- (a) ROUTER
- (b) FILEMGR
- (c) GRADER
- (d) ANCOVA
- (e) CONLOAD
- (f) SIASCORE
- (g) OPINION

## APPENDIX XII(a)

## ROUTER

```

10 REM*****PROGRAM NAME
20 REM          ROUTER
30 REM
40 REM*****DATE OF LAST REVISION
50 REM          1980-8-30
60 REM
70 REM*****AUTHOR(S)
80 REM          BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER
90 REM          BOX 3992 UNIVERSITY STATION, LARAMIE, WY 82071
100 REM          PHONE\ 307/766-6381
110 REM
120 REM*****PROGRAM DESCRIPTION
130 REM          THIS PROGRAM ROUTES THE USER OF THE METRIC GRADING/ANALYSIS
140 REM          PROGRAM AMONG THE INITIAL OPTIONS OF CREATING OR DESTROYING
150 REM          DATA FILES, OF SCORING TESTS, ATTITUDE SCALES OR OPINIONNAIRES,
160 REM          AND OF CONDUCTING ANALYSES OF THE RESULTS OBTAINED IN THE
170 REM          SCORING.
180 REM
190 REM          IN FACT, THE PROGRAM CREATES/DESTROYS PAIRS OF FILES.
200 REM          EACH PAIR CONTAINS A DATA FILE FOR STORING PRE-, POST-
210 REM          AND LABTEST RESULTS AND A SECOND FILE TO HOLD THE
220 REM          METRIC OPINIONNAIRE DATA FOR THE SAME CLASS. THE LATTER
230 REM          IS ALWAYS FORMED BY AFFIXING A '9' TO THE NAME OF THE
240 REM          FORMER FILE. (THIS IS THE REASON THAT THE USER IS
250 REM          PERMITTED ONLY 7 CHARACTERS IN THE NAME OF A DATA FILE.)
260 REM
270 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
280 REM          8400 BYTES
290 REM
300 REM*****HARDWARE CONSIDERATIONS
310 REM          WRITTEN FOR A NORTHSTAR HORIZION II (48K) WITH DUAL DISK
320 REM          DRIVES AND USING VERSION 5.1 MICROSOFT BASIC.
330 REM
340 REM*****LIST OF NUMERIC VARIABLES
350 REM          R1 = FLAG (WHEN = 1) THAT NO SPECIFIC CLASS DATA IS INVOLVED
360 REM          R3 = FLAG TO SELECT 'GRADER', 'OPINION' OR 'ANCOVA'
370 REM          R4 = FLAG (WHEN = 1) TO CHAIN TO THE 'FILEMGR' PROGRAM
380 REM
390 REM*****DIMENSIONS OF NUMERIC ARRAYS
400 REM          NONE NEEDED
410 REM
420 REM*****LIST OF STRING VARIABLES
430 REM          N$ = NAME OF DATA FILE
440 REM          D$ = STRING VALUE OF THE DISK DRIVE NUMBER OF N$.
450 REM          C$ = COMPLETE FILE REFERENCE (NAME + FILE NUMBER)
460 REM
470 REM*****DIMENSIONS OF STRING ARRAYS
480 REM          DIM N$(20)
490 REM

```

ROUTER (Continued)

```

500 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
501 REM      FILEMGR = PROGRAM TO PERMIT THE NONPROGRAMMER TO CREATE
502 REM      OR DESTROY DATA FILES
510 REM      DUMBFIL = DUMMY FILE TO HOLD INFO ABOUT DATA FILE
520 REM      GRADER  = PROGRAM TO GRADE PRETESTS, POSTTESTS AND LABTESTS
530 REM      OPINION = PROGRAM TO SCORE/ANALYZE METRIC OPINIONNAIRES
540 REM      ANCOVA  = PROGRAM TO CONDUCT PRETEST/POSTEST OR
550 REM      PRETEST/LABTEST ANALYSES OF COVARIANCE
560 REM      SIASCORE = PROGRAM TO SCORE AND SUMMARIZE THE SI ATTITUDE
570 REM      SCALE
580 REM
590 REM*****BEGIN MAIN PROGRAM
600      GOSUB 1000\REM CLEAR THE SCREEN
610      GOSUB 910\REM INITIALIZE NUMERIC VARIABLES
620      GOSUB 790\REM DESCRIBE THE PROGRAM TO THE USER
630      GOSUB 1040\REM OPTION TO USE THE 'FILEMGR' PROGRAM
640 REM      CONDITIONAL CHAIN TO THE 'FILEMGR' PROGRAM
650      IF K4=1 THEN CHAIN "FILEMGR"
660      GOSUB 1150\REM SELECT SCORE OR ANALYSIS OPTION
670 REM      FLAG TO JUMP IF NO SPECIFIC CLASS DATA IS INVOLVED
680      IF K1=1 THEN 710
690      GOSUB 1540\REM IDENTIFY FILE TO BE SCORED OR ANALYZED
700      GOSUB 1860\REM STORE DATA FILE DESCRIPTION IN 'DUMBFIL'
710 REM      CHAIN TO 'GRADER', 'OPINION', 'ANCOVA', OR 'SIASCORE'
720      OR K3 GOTO /30,740,750,760
730      CHAIN "GRADER"
740      CHAIN "OPINION"
750      CHAIN "ANCOVA"
760      CHAIN "SIASCORE"
770 REM*****END OF MAIN PROGRAM
780 REM
790 REM*****SUBROUTINE TO DESCRIBE THE PROGRAM PURPOSE TO THE USER
800      GOSUB 1000
810      !"      METRIC EDUCATION EVALUATION PROGRAMS"\!\!
820      !"      THIS PROGRAM WILL ROUTE YOU TO SEVERAL OTHER"\!
830      !"      PROGRAMS WHICH HAVE BE DESIGNED TO LET YOU SCORE AND"\!
840      !"      ANALYZE THE METRIC TESTS, ATTITUDE SCALE, AND OPIN-"!\!
850      !"      IONNAIRE DEVELOPED BY THE TRI-STATE METRIC CONSORTIUM."
860      !\!
870      INPUT "      PRESS THE <RETURN> KEY TO CONTINUE. ",Y$
880      GOSUB 1000
890      RETURN
900 REM
910 REM*****SUBROUTINE TO INITIALIZE NUMERIC VARIABLES
920      R1=0
930      R3=0
940      R4=0
950      RETURN
960 REM
970 REM*****SUBROUTINE TO INITIALIZE STRING VARIABLES
980 REM      NO INITIALIZATION NEEDED
990 REM

```

ROUTER (Continued)

```

1000 REM      SUBROUTINE TO CLEAR THE SCREEN
1010          !CHR$(27),"*"
1020          RETURN
1030 REM
1040 REM      SUBROUTINE TO OPT USE OF THE 'FILEMGR' PROGRAM
1050          GOSUB 1000
1060          !"          BEFORE GOING ANY FURTHER, DO YOU NEED TO CREATE"\!
1070          !"          (I.E., NAME AND SPECIFY THE DISK DRIVE NUMBER OF) OR"\!
1080          !"          TO DESTROY (I.E., ERASE FROM SOME DISK) A DATA FILE"\!
1090          !"          FOR SOME PARTICULAR GROUP OF PERSONS?"!\!
1100          INPUT "          ANSWER YES OR NO. ",Y$
1110          GOSUB 1000
1120          IF Y$="" THEN 1060 ELSE IF Y$(1,1)="N" THEN 1140
1130          R4=1
1140          RETURN
1150 REM      SUBROUTINE TO CHOOSE SCORING/ANALYSIS OPTION
1160          GOSUB 1000
1170          !"          YOU CAN USE THIS PROGRAM TO DO ANY ONE OF THE FOLLOW-"!\!
1180          !"          ING TASKS;"\!
1190          !"          1. GRADE A SET OF THE CONSORTIUM'S PRETESTS,"
1200          !"          POSTTESTS OR LABTESTS"\!
1210          !"          2. SCORE AND SUMMARIZE CLASS RESPONSES TO"
1220          !"          THE CONSORTIUM'S METRIC OPIONINNAIRE"\!
1230          !"          3. CONDUCT AN ANALYSIS OF COVARIANCE USING"
1240          !"          TESTS THAT HAVE ALREADY BEEN GRADED"\!
1250          !"          4. SCORE AND SUMMARIZE CLASS RESPONSES TO THE"
1260          !"          CONSORTIUM'S ATTITUDE SCALE (REGARDING U.S."
1270          !"          ADOPTION OF THE METRIC SYSTEM)"!\!
1280          INPUT "          TYPE THE NUMBER OF YOUR CHOICE. ",R3$
1290          GOSUB 1000
1300          IF R3$="" THEN 1170
1310          IF R3$<>"1" THEN IF R3$<>"2" THEN IF R3$<>"3" THEN 1320
1320          IF R3$<>"4" THEN 1170
1330          R3=VAL(R3$)
1340          IF R3<>1 THEN 1520
1350          !TAB(8),"DO YOU PLAN TO USE THE SCORES TO LATER PERFORM AN"\!
1360          !TAB(5),"ANALYSIS OF COVARIANCE?"!\!
1370          INPUT "          ANSWER YES OR NO. ",Y$
1380          GOSUB 1000
1390          IF Y$="" THEN 1350 ELSE IF Y$(1,1)="N" THEN 1520
1400          !"          SINCE YOU PLAN TO USE THE TEST SCORES TO CONDUCT AN"
1410          !"          ANALYSIS OF COVARIANCE, BE CERTAIN THAT YOU HAVE THE"
1420          !"          FOLLOWING: "\!
1430          !"          **BOTH A PRETEST AND POSTTEST FOR EACH PERSON IN THE"
1440          !"          CLASS IF YOU WISH TO DO A PRETEST/POSTTEST ANALYSIS"
1450          !"          AND"\!
1460          !"          **BOTH A PRETEST AND LABTEST FOR EACH PERSON IN THE"
1470          !"          CLASS IF YOU WISH TO DO A PRETEST/LABTEST ANALYSIS."!\!
1480          !"PLEASE CHECK TO SEE THAT YOU HAVE THESE 'PAIRINGS' BEFORE"
1490          !"BEGINNING TO ENTER ANY TEST RESULTS."!\!

```

111

ROUTER (Concluded)

```

1500      INPUT "      PRESS THE RETURN KEY TO CONTINUE. ",Y$
1510      GOTO 1520
1520      RETURN
1530  REM
1540  REM
1550  REM      SUBROUTINE TO INPUT THE NAME AND DRIVE NUMBER OF THE DATA
1560  REM      FILE WHICH IS TO RECEIVE GRADING OR ANALYSIS
1570      GOSUB 1000
1570      !"      PLEASE TYPE THE NAME OF THE DATA FILE WITH WHICH"
1580      !"YOU'LL BE WORKING."!\!
1590      !"      REMEMBER THAT THE NAME OF A DATA FILE CANNOT CONTAIN"
1600      !"MORE THAN 7 CHARACTERS AND THAT IT CANNOT CONTAIN SPACES"
1610      !"OR COMMAS."!\!
1620      INPUT "      WHAT IS THE NAME OF THE DATA FILE? ",N$
1630      GOSUB 1000
1640      IF N$="" THEN 1570 ELSE L=LEN(N$)
1650      IF L<8 THEN 1700
1660      !"      THE NAME OF A DATA FILE MAY HAVE AT MOST 7 CHARACTERS."
1670      !"THE FILE NAME ' ",N$," ' CONTAINS",L," CHARACTERS."!\!
1680      !"      PLEASE CHECK THAT NAME AND ENTER IT AGAIN."!\!
1690      GOTO 1620
1700      FOR I=1 TO L
1710      IF ASC(N$(I,I))=32 OR ASC(N$(I,I))=44 THEN EXIT 1740
1720      NEXT I
1730      GOTO 1770
1740      !"      SOMETHING'S WRONG. THE NAME OF DATA FILE CANNOT CONTAIN"
1750      !"SPACES OR COMMAS--AND ' ",N$," ' DOES. PLEASE CHECK THIS."!\!
1760      GOTO 1620
1770      !"      NOW TYPE THE NUMBER (1 OR 2) OF THE DISK DRIVE IN WHICH"
1780      !"IN WHICH THE DATA FILE ' ",N$," ' WILL BE HOUSED DURING ITS USE."
1790      INPUT "      ",D$
1800      GOSUB 1000
1810      IF D$="" THEN 1770
1820      IF D$<>"1" THEN IF D$<>"2" THEN 1770
1830      C$=N$+" ",D$
1840      RETURN
1850  REM
1860  REM      SUBROUTINE TO STORE DATA FILE DESCRIPTION 'DUMBFIL'
1870      OPEN #0, "DUMBFIL"
1880      WRITE #0, N$, D$, C$
1890      CLOSE #0
1900      RETURN

```

## APPENDIX XII(b)

## FILEMGR

```

10  REM*****PROGRAM NAME
20  REM      FILEMGR
30  REM
40  REM*****DATE OF LAST PROGRAM MODIFICATION
50  REM      1980-6-27
60  REM
70  REM
80  REM*****AUTHOR(S)
90  REM      BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER,
100 REM      BOX 3992 UNIVERSITY STATION, LARAMIE, WY  82071
110 REM      PHONE\ 307/766-6381
120 REM
130 REM*****PROGRAM DESCRIPTION
140 REM      THE PROGRAM PERMITS THE NONPROGRAMMER TO CREATE OR DESTROY
150 REM      DATA FILES.
160 REM
170 REM      AS WRITTEN, EACH FILE CREATED WOULD BE OF SIZE 2048 BYTES
180 REM      (THAT IS, 8 DISK SECTORS OF 256 BYTES EACH). THIS CONSTRAINT
190 REM      IS EASILY ALTERED BY CHANGING THE VALUE OF THE VARIABLE S
200 REM      USED IN THE PROGRAM.
210 REM
220 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
230 REM      9725 BYTES
240 REM
250 REM*****HARDWARE CONSIDERATIONS
260 REM      WRITTEN FOR THE NORTHSTAR HORIZON II MICROCOMPUTER WITH
270 REM      DUAL DISK DRIVES.
280 REM
290 REM*****LIST OF NUMERIC VARIABLES
300 REM      L = LENGTH OF FILE NAME
310 REM      D = DRIVE NUMBER OF FILE
320 REM      S = SIZE (IN SECTORS OF 256 BYTES EACH) OF FILE
330 REM      T = TYPE OF FILE (TYPE 3 IS A DATA FILE)
340 REM      C = CHOICE OF OPERATION ON FILE (1=CREATE, 2=DESTROY)
350 REM
360 REM*****DIMENSIONS OF NUMERIC ARRAYS
370 REM      NONE USED
380 REM
390 REM*****LIST OF STRING VARIABLES
400 REM      N$ = FILE NAME
410 REM      D$ = STRING VALUE OF D
420 REM      C$ = STRING VALUE OF C
430 REM
440 REM*****DIMENSIONS OF STRING ARRAYS
450 REM      DIM N$(20)
460 REM
470 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
480 REM      DUMBFIL = A FILE TO STORE THE NAME OF THE NEWLY CREATED
490 REM      FILE WHILE CHAINING TO THE MAIN PROGRAM

```

FILEMGR (Continued)

```

500 REM          ROUTER = NAME OF THE (SAMPLE) MAIN PROGRAM WHICH MAKES
510 REM          USE OF THE FILE JUST CREATED
520 REM
530 REM*****BEGIN MAIN PROGRAM
540     GOSUB 890\REM INITIALIZE NUMERIC VARIABLES
550     GOSUB 990\REM CLEAR SCREEN
560     GOSUB 720\REM DESCRIBE PROGRAM TO USER
570 REM     GO TO THE APPROPRIATE SUBROUTINE TO CREATE OR DESTROY A FILE
580     IF C=1 THEN GOSUB 1030 ELSE GOSUB 1550
590 REM     IF A FILE IS TO BE CREATED, STORE ITS DESCRIPTION IN 'DUMBFIL'
600     IF C=1 THEN GOSUB 1490
610 REM     GO TO THE APPROPRIATE SUBROUTINE TO CREATE OR DESTROY THE
620 REM     DATA FILE DESCRIBED
630     IF C=1 THEN GOSUB 1910 ELSE GOSUB 2030
640 REM     OPTION TO RERUN THIS PROGRAM OR TO CHAIN TO THE MAIN PROGRAM
650     GOSUB 990\REM CLEAR THE SCREEN
660     !"      DO YOU WISH TO USE THIS PROGRAM TO CREATE (OR DESTROY)"
670     INPUT "ANOTHER DATA FILE. (ANSWER YES OR NO.) ",Y$
680     GOSUB 990
690     IF Y$="" THEN 660 ELSE IF Y$(1,1)="Y" THEN 540 ELSE 2220
700 REM*****END OF MAIN PROGRAM
710 REM
720 REM*****SUBROUTINE TO DESCRIBE THE PROGRAM PURPOSE TO THE USER
730 INPUT "
740 !"
750     !"      DATA FILE CREATION/DESTRUCTION PROGRAM"\!
760     !"      THIS PROGRAM WILL PERMIT YOU TO CREATE OR DESTROY A",
770     !" DATA FILE."
780     !"WHICH OF THE FOLLOWING DO YOU WISH TO DO?"\!
790     !"      1.  CREATE A DATA FILE (I.E., GIVE THE FILE A"
800     !"      NAME AND SPECIFY ITS DISK DRIVE NUMBER)"
810     !"      2.  DESTROY A DATA FILE (I.E., ERASE AN EXIST-"
820     !"      FILE FROM A DISK)"\!
830     INPUT "TYPE THE NUMBER OF YOUR CHOICE. ",C$
840     GOSUB 990
850     IF C$="" THEN 750
860     IF C$<>"1" THEN IF C$<>"2" THEN 750
870     C=VAL(C$)
880     RETURN
890 REM
900 REM*****SUBROUTINE TO INITIALIZE NUMERIC VARIABLES
910     D=0
920     S=8
930     T=3
940     C=0
950     RETURN
960 REM
970 REM*****SUBROUTINE TO INITIALIZE STRING VARIABLES
980 REM     NOT NEEDED
990 REM     SUBROUTINE TO CLEAR THE SCREEN

```

FILEMGR (Continued)

```

1000      !CHR$(27),"*"
1010      RETURN
1020  REM
1030  REM      SUBROUTINE TO INPUT THE NAME AND DRIVE NUMBER OF THE DATA
1040  REM      FILE TO BE CREATED
1050      GOSUB 990
1060      !"      YOU MUST GIVE A NAME TO THE DATA FILE YOU ARE ABOUT"
1070      !"TO CREATE."!\!
1080      !"      THE NAME SHOULD CONSIST OF NO MORE THAN 7 CHARACTERS"
1090      !"(NUMBERS AND LETTERS)."\!
1100      !"      COMMAS AND SPACES ARE NOT PERMITTED AS PART OF A FILE"
1110      !"NAME."
1120      !
1130      INPUT "      WHAT NAME DO YOU WISH FOR YOUR FILE? ",N$
1140      GOSUB 990
1150      IF N$="" THEN 1030 ELSE L=LEN(N$)
1160      IF L<=7 THEN 1210
1170      !"      THE FILE NAME '"',N$,'" CONTAINS",L," CHARACTERS. I"
1180      !"CAN'T USE A FILE NAME OF MORE THAN 7 CHARACTERS."!\!
1190      !"      PLEASE CHOOSE A NAME WHICH IS",L-7," CHARACTER(S)"
1200      !"SHORTER." \GOTO 1120
1210  REM      LOOP TO CHECK FOR COMMAS OR SPACES IN N$
1220      FOR I=1 TO L
1230      IF ASC(N$(I,I))=32 OR ASC(N$(I,I))=44 THEN EXIT 1260
1240      NEXT I
1250      GOTO 1300
1260      !"      REMEMBER...A FILE NAME IS NOT ALLOWED TO CONTAIN ANY"
1270      !"SPACES OR COMMAS. THE NAME YOU GAVE ME ('",N$,'" ) DOES."
1280      !"PLEASE CHOOSE A FILE NAME WITHOUT SPACES OR COMMAS ."
1290      GOTO 1120
1300      !"      I MUST ALSO KNOW THE NUMBER (1 OR 2) OF THE DISK DRIVE"
1310      !"IN WHICH YOU WILL KEEP PLACE THE FILE '"',N$,'" WHEN USING IT."
1320      !
1330      INPUT "      CHOOSE A DRIVE NUMBER (1 OR 2): ",D$
1340      GOSUB 990
1350      IF D$="" THEN 1300 ELSE D=VAL(D$)
1360      IF D=1 OR D=2 THEN 1380
1370      !"      I DON'T HAVE A DISK DRIVE WITH THE NUMBER",D,"." \GOTO 1320
1380      !"      AS I UNDERSTAND IT, YOU WISH ME TO SET UP A DATA FILE AS"
1390      !"FOLLOWS: "\!
1400      !"
1410      !"      FILE NAME: ",N$
1420      !"      DISK DRIVE: ",D!\!
1430      INPUT "IS THIS CORRECT? (ANSWER YES OR NO.) ",Y$
1440      GOSUB 990
1450      IF Y$="" THEN 1380 ELSE IF Y$(1,1)="Y" THEN 1470
1460      !"      IN THAT CASE, I'LL HAVE TO ASK FOR THE INFORMATION AGAIN."
1470      !\GOTO 1030
1480      RETURN
1490  REM      SUBROUTINE TO PLACE THE FILE DESCRIPTION IN THE DUMMY FILE

```

FILEMGR (Continued)

```

1500      OPEN #0, "DUMBFIL"
1510      WRITE #0, N$, D, S, T
1520      CLOSE #0
1530      RETURN
1540  REM
1550  REM  SUBROUTINE TO INPUT THE NAME AND DRIVE NUMBER OF THE DATA
1560  REM  FILE TO BE DESTROYED
1570      !"TYPE THE NAME OF THE DATA FILE TO BE DESTROYED." \!
1580      INPUT "      ", N$
1590      GOSUB 990
1600      IF N$="" THEN 1570 ELSE L=LEN(N$)
1610      IF L<=7 THEN 1660
1620      !"      SOMETHING'S WRONG. A FILE NAME CAN HAVE AT MOST 7 CHAR--"
1630      !"ACTERS. HOWEVER, ',N$,' HAS",L," CHARACTERS. PLEASE CHECK"
1640      !"THE NAME OF THAT DATA FILE AGAIN.\!
1650      GOTO 1570
1660      FOR I=1 TO L
1670      IF ASC(N$(I,I))=32 OR ASC(N$(I,I))=44 THEN EXIT 1760
1680      NEXT I
1690      !"      WHAT IS THE NUMBER (1 OR 2) OF THE DISK DRIVE IN WHICH"
1700      !"THE DATA FILE ',N$,' IS HOUSED?" \!
1710      INPUT "      ", D$
1720      GOSUB 990
1730      IF D$="" THEN 1690
1740      IF D$<>"1" THEN IF D$<>"2" THEN 1690
1750      GOTO 1800
1760      !"      SOMETHING'S WRONG. A FILE NAME IS NOT ALLOWED TO"
1770      !"TO CONTAIN SPACES OR COMMAS--YET ',N$,' DOES. PLEASE"
1780      !"CHECK THE NAME OF THAT FILE AGAIN." \!
1790      GOTO 1570
1800      !"      AS I UNDERSTAND IT, YOU WISH ME TO DESTROY THE DATA FILE"
1810      !"DESCRIBED AS FOLLOWS: \!
1820      !"      FILE NAME: ',N$
1830      !"      DISK DRIVE: ',D$ \!
1840      INPUT "IS THIS CORRECT? (ANSWER YES OR NO.) ", Y$
1850      GOSUB 990
1860      IF Y$="" THEN 1800 ELSE IF Y$(1,1)="Y" THEN 1890
1870      !"      IN THAT CASE, I'LL HAVE TO ASK FOR THE INFORMATION AGAIN."
1880      !\GOTO 1570
1890      RETURN
1900  REM
1910  REM  SUBROUTINE TO CREATE THE FILE ON THE DISK SPECIFIED
1920      !"      I'M NOW READY TO CREATE THE FILE YOU REQUESTED ON"
1930      !"A DISK IN DRIVE #',D$,'." \!
1940      !"      CHECK TO MAKE CERTAIN THAT THERE IS A DISK NOW"
1950      !"IN DRIVE #',D$,'. THEN PRESS THE RETURN KEY." \!
1960      INPUT "      ", R$
1970  REM  THE NEXT LINE CREATES A DATA FILE FOR PRE-, POST-, LABTEST DATA
1980      CREATE N$+"", "+D$, S, T
1990  REM  THE NEXT LINE CREATES THE ASSOCIATED FILE FOR OPINIONNAIRE DATA

```

FILE (Concluded)

```

2000      CREATE "9"+N$+",""+I$, S, T
2010      RETURN
2020      REM
2030      REM      SUBROUTINE TO DESTROY THE DATA FILE ON THE DISK SPECIFIED
2040      REM
2050      !"      I'M NOW READY TO DESTROY THE DATA FILE '"',N$',"' WHICH"
2060      !"IS SUPPOSED TO BE IN DRIVE #"',D$',".'"!
2070      !"      CHECK TO MAKE CERTAIN THAT THE DISK CONTAINING THAT"
2080      !"FILE IS NOW IN DRIVE #"',D$',".'" THEN PRESS THE RETURN KEY.'"!
2090      INPUT "                ",R$
2100      GOSUB 990
2110      REM      CHECK TO SEE IF THE DATA FILE DESCRIBED IS ON THE DISK
2120      REM      INDICATED
2130      IF FILE(N$+",""+I$)=3 THEN 2200
2140      !"      I CANNOT FIND A DATA FILE NAMED '"',N$',"' ON THE DISK"
2150      !"IN DRIVE #"',D$',".'"!
2160      !"      DO YOU WISH TO PLACE A DIFFERENT DISK IN DRIVE #"',D$
2170      INPUT "AND TRY AGAIN? (ANSWER YES OR NO.) ",Y$
2180      GOSUB 990
2190      IF Y$="" THEN 2140 ELSE IF Y$(1,1)="Y" THEN 2050 ELSE 2210
2200      DESTROY N$+",""+I$
2210      RETURN
2220      REM      RETURN TO THE PROGRAM FOR WHICH THE DATA FILE WAS CREATED
2230      REM      OR DESTROYED
2240      REM      IN THIS EXAMPLE, THAT PROGRAM IS CALLED 'ROUTER' AND IS
2250      REM      HOUSED IN DISK DRIVE #1.
2260      CHAIN "ROUTER,1"

```

## APPENDIX XII(c)

## GRADER

```

10 REM*****PROGRAM NAME
20 REM    GRADER
30 REM*****LAST DATE OF REVISION
40 REM    1980-7-1
50 REM*****AUTHOR
60 REM    BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER,
70 REM    BOX 3992 UNIVERSITY STATION, LARAMIE, WY 82071
80 REM    PHONE (307)/766-6381
90 REM*****PROGRAM DESCRIPTION
100 REM    THE PROGRAM SCORES THE PRETESTS, POSTTESTS AND LABTESTS DEVELOPED
110 REM    BY THE TRI-STATE METRIC CONSORTIUM. RESULTS ARE STORED IN DATA
120 REM    FILES FOR EACH CLASS INVOLVED.
130 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
140 REM    23 300 BYTES
150 REM*****HARDWARE CONSIDERATIONS
160 REM    WRITTEN FOR A NORTHSTAR HORIZON II (48K) WITH DUAL DISK DRIVES
170 REM    AND USING VERSION 5.1 BASIC
180 REM*****LIST OF PRINCIPAL STRING VARIABLES USED BY THIS PROGRAM
190 REM    N$ = NAME OF THE DATA FILE
200 REM    D1$ = STRING NAME OF THE DISK DRIVE NUMBER OF THE DATA FILE
210 REM    C$ = N$+"", "+D$" (USED FOR PROGRAM ACCESS OF THE DATA FILE)
220 REM    I$ = INSTRUCTOR'S NAME (FOR THE CLASS N$)
230 REM    L$ = LOCATION AT WHICH THE CLASS N$ WAS TAUGHT
240 REM    D$ = DATE THE CLASS N$ BEGAN
250 REM*****DIMENSIONS OF STRING ARRAYS
260 DIM N$(8), C$(12), I$(55), L$(55), D$(55)
270 REM*****LIST OF PRINCIPAL NUMERIC VARIABLES USED IN THIS PROGRAM
280 REM    B(I),E(I),L(I) = ARRAYS HOLDING TEST RESPONSES INPUT FOR
290 REM    FOR A PARTICULAR STUDENT, I
300 REM    B1(I),E1(I),L1(I) = ARRAYS HOLDING THE TEST-KEY VALUES
310 REM    B9(I),E9(I),L9(I) = ARRAYS HOLDING TRIPLETS (PRETEST/POSTTEST/
320 REM    LABTEST) OF TEST SCORES FOR EACH STUDENT IN
330 REM    A GIVEN CLASS (MAXIMUM ENROLLMENT OF 100)
340 REM    K(I),A(I) = ARRAYS TEMPORARILY HOLDING VALUES COMPUTED IN THE
350 REM    PROCESS OF PRINTING SUBTEST RESULTS
360 REM    K1(I),A1(I),K2(I),A2(I),L5(I) = ARRAYS USED TO ACCUMULATE CLASS
370 REM    TOTALS ON SUBTESTS AND LABTEST
380 REM    ITEMS
390 REM*****DIMENSIONS OF NUMERIC ARRAYS
400 DIM B(52), E(52), L(52)
410 DIM B1(52), E1(52), L1(13), L2(13), L3(13), L4(13)
420 DIM B9(100), E9(100), L9(100)
430 DIM K(13), A(6)
440 DIM K1(8), A1(6), K2(8), A2(6), L5(13)
450 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
460 REM    DUMBFIL = A DATA FILE HOLDING A DESCRIPTION OF THE CLASS
470 REM    DATA FILE TO BE USED BY THIS PROGRAM
480 REM    ROUTER = A ROUTING PROGRAM WHICH USES THIS PROGRAM FOR
490 REM    GRADING AND WHICH RELATES IT TO OTHER PROGRAMS

```

GRADER (Continued)

```

500 REM                               IN THE SCORING/ANALYSIS PACKAGE
510 REM                               FILEMGR = A PROGRAM WHICH CREATES AND DESTROYS DATA FILES
520 REM                               USED BY THIS PROGRAM
530 REM*****MAIN PROGRAM BEGINS
540 GOSUB 3770
550 REM *** READ IN THE DATA FILE DESCRIPTION FROM 'DUMBFIL'
560 OPEN #0,"DUMBFIL"
570 READ #0, N$, D1$, C$
580 CLOSE #0
590 D9=VAL(D1$)
600 REM *** DESCRIBE PROGRAM FUNCTION TO THE USER
601 !\!\!
602 !"                               METRIC TEST SCORING PROGRAM"\!
610 !" THIS PROGRAM WILL PERFORM ANY OF THE FOLLOWING SCORING TASKS WITH"
620 !"RESPECT TO THE DATA FILE THAT YOU'VE CALLED '"',N$',"' : "\!
630 !"                               1. SCORE THE METRIC PRETESTS"
640 !"                               2. SCORE THE METRIC POSTTESTS"
650 !"                               3. SCORE THE METRIC LABTESTS"
660 !"                               4. VIEW THE CONTENTS OF '"',N$',"' . (THIS 'VIEWING' INCLUDES"
661 !"                               OPTION OF PRINTING THE RESULTS OF THE SCORING.)"\!
670 !"IN THE CASE OF EACH OF THE THREE SCORING TASKS, THE RESULTS OF THE"
680 !"SCORING WILL BE STORED IN '"',N$',"' ."\!
690 INPUT " TYPE THE NUMBER OF THE SCORING TASK YOU WISH TO PERFORM. ",R$
700 GOSUB 3770
710 IF R$="" THEN 610
720 IF R$<>"1" THEN IF R$<>"2" THEN IF R$<>"3" THEN IF R$<>"4" THEN 610
730 R=VAL(R$)
740 !" IN ORDER TO CARRY OUT THIS TASK, THE DATA FILE '"',N$',"' MUST"
750 !"BE HOUSED IN DISK DRIVE #"',D9,". PLEASE BE CERTAIN THAT IT IS THERE."
760 !\!" PRESS THE RETURN KEY TO CONTINUE. ",
770 INPUT Y$
780 GOSUB 3770
790 IF FILE(C$)=3 THEN 930
800 !" I CANNOT FIND A DATA FILE NAMED '"',N$',"' IN DRIVE #"',D$,".
810 !"WHICH OF THE FOLLOWING THINGS DO YOU WISH TO DO NOW?"\!
820 !"                               1. SEARCH FOR '"',N$',"' ON ANOTHER DISK (BY PLACING THAT"
830 !"                               DISK IN DRIVE #"',D9
840 !"                               2. CREATE A FILE NAMED '"',N$',"' ON DRIVE #"',D9
850 !"                               3. LEAVE THIS PROGRAM ALTOGETHER"\!
860 INPUT " TYPE THE NUMBER OF YOUR CHOICE. ",R1$
870 GOSUB 3770
880 IF R1$="" THEN 800
890 IF R1$<>"1" THEN IF R1$<>"2" THEN IF R1$<>"3" THEN 800
900 R1=VAL(R1$)
910 ON R1 GOTO 740,920,6070
920 CHAIN "FILEMGR"
930 IF R2=1 THEN 1360
940 IF R<>4 THEN 980
950 GOSUB 3830\REM READ THE DATA FILE
960 GOSUB 4530\REM PRINT THE CONTENTS OF THE DATA FILE
970 GOTO 3580\REM CHOOSE NEXT PROGRAM OPERATION
980 !" HAVE YOU ALREADY ENTERED ANY TEST SCORES IN THE FILE '"',N$',"' ?"
990 INPUT "(PLEASE ANSWER YES OR NO.) ",Y$

```

GRADER (Continued)

```

1000 GOSUB 3740
1010 IF Y$="" THEN 980
1020 IF Y$(1,1)="N" THEN 1030 ELSE 1330
1030 !TAB(25), "BE BACK IN A FEW SECONDS."
1040 GOSUB 4310\GOSUB 3740
1050 !"      I NOW NEED THE FOLLOWING ITEMS OF INFORMATION ABOUT THE CLASS"
1060 !"WHICH YOU HAVE GIVEN THE CODE NAME ',N$',"'. IN RESPONDING, DO NOT"
1070 !"TYPE A RESPONSE WHICH IS LONGER THAT THE ROW OF '=' MARKS WHICH IS"
1080 !"PROVIDED AS A TYPING GUIDE."
1090 GOSUB 3760
1100 INPUT "      INSTRUCTOR'S NAME: ",I$
1110 IF LEN(I$)<41 THEN 1130
1120 GOSUB 3710\GOTO 1090
1130 GOSUB 3760
1140 INPUT "      LOCATION OF CLASS: ",L$
1150 IF LEN(L$)<41 THEN 1170
1160 GOSUB 3710\GOTO 1130
1170 GOSUB 3760
1180 INPUT "      DATE CLASS BEGAN: ",D$
1190 IF LEN(D$)<41 THEN 1210
1200 GOSUB 3710\GOTO 1170
1210 !\!"                                     ==="
1220 INPUT "      TOTAL NUMBER OF CLASS SESSIONS: ",M9
1230 IF M9<100 THEN 1250
1240 GOSUB 3710\GOTO 1210
1250 !\!"                                     ===="
1260 INPUT "      LENGTH (MINUTES) OF EACH SESSION: ",T9
1270 IF T9<1000 THEN 1290
1280 GOSUB 3710\GOTO 1250
1290 GOSUB 5800
1300 GOSUB 3740
1310 IF E9=1 THEN 1090
1320 GOSUB 3740
1330 ON R GOTO 1340,1350,3090,950
1340 V1$="PRETEST"\V2$="A"\GOTO 1360
1350 V1$="POSTTEST"\V2$="B"
1360 !"      I'M READY TO ACCEPT SCORES ON THE ",V1$," (VERSION ",V2$," ) OF THE"
1370 !"MULTIPLE-CHOICE TESTS CONCERNING KNOWLEDGE ABOUT THE METRIC SYSTEM."!\!
1380 !"      FOR EACH STUDENT: "
1390 !"      ** FIRST INPUT THE 5 RESPONSES TO THE ITEMS OF QUIZ 1."
1400 !"      ** THEN, IN GROUPS NO LARGER THAN 10, INPUT THE 47 RESPONSES"
1410 !"      TO QUIZ 2."
1420 !"      ** INPUT A ZERO (0) IF A RESPONSE IS OMITTED."
1430 !\GOSUB 5670
1440 IF Q=2 THEN 2280
1450 K=P6\REM P6 IS THE NUMBER OF PRETEST GRADES ALREADY IN THE FILE
1460 REM ***** PRETEST SCORING ROUTINE *****
1470 RESTORE 4400
1480 FOR I=1 TO 52
1490 READ B1(I)\REM READ IN THE KEY TO THE PRETEST

```

GRADER (Continued)

```

1500 NEXT I
1510 GOSUB 3740\K=K+1
1520 !" PRETEST RESPONSES FOR STUDENT #",K
1530 !" (SEPARATE RESPONSES BY COMMAS.)"
1540 !\!" ITEMS 1 - 5 OF QUIZ 1, PRETEST: =====
1550 INPUT " ", B(1),B(2),B(3),B(4),B(5)
1560 FOR I=1 TO 4
1570 !\!" ITEMS ",10*I-9," -",10*I," OF QUIZ 2, PRETEST: =====",
1580 !"=====
1590 H=10*I\!TAB(6),
1600 INPUT B(H-4),B(H-3),B(H-2),B(H-1),B(H),B(H+1),B(H+2),B(H+3),B(H+4),B(H+5)
1610 NEXT I
1620 !\!" ITEMS 41 - 47 OF QUIZ 2, PRETEST: =====",
1630 !"===== "\INPUT " ", B(46),B(47),B(48),B(49),B(50),B(51),B(52)
1640 GOSUB 5980
1650 GOSUB 3740
1660 IF E9=1 THEN 1520
1670 FOR I=1 TO 52
1680 I5=I
1690 IF B(I)<>B1(I) THEN 2160
1700 B9(K)=B9(K)+1
1710 IF I>13 AND I<27 THEN 1950
1720 IF I>26 AND I<40 THEN 1990
1730 IF I>39 THEN 2030
1740 Z5=1\REM FLAG THAT A PRETEST ITEM FROM 1-13 IS BEING SCORED
1750 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR PRETEST ITEMS 1-13
1760 ON I GOTO 1780,1780,1780,1780,1780,1790,1790,1790,1790,1790,1790,1790
1770 REM *** NEXT 8 LINES UPDATE THE PRETEST LEVEL-OF-KNOWLEDGE SUBTEST SCORES
1780 K1(1)=K1(1)+1\GOTO 1940
1790 K1(2)=K1(2)+1\GOTO 1940
1800 K1(3)=K1(3)+1\GOTO 1940
1810 K1(4)=K1(4)+1\GOTO 1940
1820 K1(5)=K1(5)+1\GOTO 1940
1830 K1(6)=K1(6)+1\GOTO 1940
1840 K1(7)=K1(7)+1\GOTO 1940
1850 K1(8)=K1(8)+1\GOTO 1940
1860 REM *** NEXT 6 LINES UPDATE THE PRETEST ATTRIBUTE SUBTEST SCORES
1870 A1(1)=A1(1)+1\GOTO 2150
1880 A1(2)=A1(2)+1\GOTO 2150
1890 A1(3)=A1(3)+1\GOTO 2150
1900 A1(4)=A1(4)+1\GOTO 2150
1910 A1(5)=A1(5)+1\GOTO 2150
1920 A1(6)=A1(6)+1\GOTO 2150
1930 P6=K\REM COUNTER FOR THE TOTAL NUMBER OF PRETESTS GRADED
1940 ON Z5 GOTO 2070, 2090, 2110, 2130
1950 Z5=2\REM FLAG THAT A PRETEST ITEM FROM 14-26 IS BEING SCORED
1960 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR PRETEST ITEMS 14-26
1970 I=I-13
1980 ON I GOTO 1800,1800,1800,1800,1800,1810,1810,1810,1810,1810,1820,1820,1820
1990 Z5=3\REM FLAG THAT A PRETEST ITEM FROM 27-39 IS BEING SCORED

```

GRADER (Continued)

```

2000 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR PRETEST ITEMS 27-39
2010 I=I-26
2020 ON I GOTO 1820,1820,1820,1800,1800,1800,1800,1800,1800,1830,1830,1830,1830
2030 Z5=4\REM FLAG THAT A PRETEST ITEM FROM 40-52 IS BEING SCORED
2040 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR PRETEST ITEMS 40-52
2050 I=I-39
2060 ON I GOTO 1830,1830,1830,1840,1840,1840,1840,1840,1850,1850,1850,1850,1850
2070 REM *** ATTRIBUTE CLASSIFICATION FOR PRETEST ITEMS 1-13
2080 ON I GOTO 1890,1870,1910,1900,1880,1870,1870,1880,1890,1870,1900,1890,1910
2090 REM *** ATTRIBUTE CLASSIFICATION FOR PRETEST ITEMS 14-26
2100 ON I GOTO 1870,1890,1910,1880,1900,1870,1910,1880,1900,1890,1880,1910,1870
2110 REM *** ATTRIBUTE CLASSIFICATION FOR PRETEST ITEMS 27-39
2120 ON I GOTO 1890,1890,1900,1920,1920,1920,1920,1920,1920,1870,1900,1920
2130 REM *** ATTRIBUTE CLASSIFICATION FOR PRETEST ITEMS 40-52
2140 ON I GOTO 1880,1890,1870,1880,1920,1890,1870,1910,1890,1910,1880,1870,1900
2150 I=I5\REM RESET I-VALUE (WHICH MAY HAVE BEEN CHANGED IN A GOTO STATEMENT)
2160 NEXT I
2170 !\GOSUB 5690
2180 P6=P6+1\GOSUB 3740
2190 !"THE PRETEST RAW SCORE FOR STUDENT NUMBER",K," IS",B9(K),"."
2200 !"      PRESS THE RETURN KEY IF YOU HAVE ANOTHER PRETEST TO GRADE."
2210 !"      TYPE 'DONE' IF YOU HAVE NO MORE PRETESTS TO GRADE."
2220 !\GOSUB 5690
2230 !\INPUT "      ",Y$
2240 GOSUB 3740\IF Y$="" THEN 2250 ELSE 2260
2250 GOSUB 4060\GOTO 1510
2260 P7=1\GOSUB 4060
2270 P7=0\GOTO 3550
2280 K=P8\REM P8 IS THE NUMBER OF POSTTEST GRADES ALREADY IN THE FILE
2290 REM ***** POSTTEST SCORING ROUTINE *****
2300 RESTORE 4430
2310 FOR I=1 TO 52
2320 READ E1(I)\REM READ IN KEY TO POSTTEST
2330 NEXT I
2340 GOSUB 3740\K=K+1
2350 !"  POSTTEST RESPONSES FOR STUDENT #",K
2360 !"  (SEPARATE RESPONSES BY COMMAS.)"
2370 !\!"  ITEMS 1 - 5 OF QUIZ 2, POSTTEST: ====="
2380 INPUT "      ", E(1),E(2),E(3),E(4),E(5)
2390 FOR I=1 TO 4
2400 !\!"  ITEMS ",10*I-9," -",10*I," OF QUIZ 2, POSTTEST: =====",
2410 !"=====
2420 H=10*I\!TAB(6),
2430 INPUT E(H-4),E(H-3),E(H-2),E(H-1),E(H),E(H+1),E(H+2),E(H+3),E(H+4),E(H+5)
2440 NEXT I
2450 !\!"  ITEMS 41 - 47 OF QUIZ 2, POSTTEST: =====",
2460 !"===== "\INPUT "      ", E(46),E(47),E(48),E(49),E(50),E(51),E(52)
2470 GOSUB 5980
2480 GOSUB 3740
2490 IF E9=1 THEN 2350

```



GRADER (Continued)

```

2500 FOR I=1 TO 52
2510 I5=I
2520 IF E(I) <> E1(I) THEN 2990
2530 E9(K)=E9(K)+1
2540 IF I>13 AND I<27 THEN 2780
2550 IF I>26 AND I<40 THEN 2820
2560 IF I>39 THEN 2860
2570 Z5=1\REM FLAG THAT A POSTTEST ITEM FROM 1-13 IS BEING SCORED
2580 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR POSTTEST ITEMS 1-13
2590 ON I GOTO 2610,2610,2610,2610,2610,2620,2620,2620,2620,2620,2620,2620
2600 REM *** NEXT 8 LINES UPDATE THE POSTTEST LEVEL-OF-KNOWLEDGE SUBTEST SCORES
2610 K2(1)=K2(1)+1\GOTO 2770
2620 K2(2)=K2(2)+1\GOTO 2770
2630 K2(3)=K2(3)+1\GOTO 2770
2640 K2(4)=K2(4)+1\GOTO 2770
2650 K2(5)=K2(5)+1\GOTO 2770
2660 K2(6)=K2(6)+1\GOTO 2770
2670 K2(7)=K2(7)+1\GOTO 2770
2680 K2(8)=K2(8)+1\GOTO 2770
2690 REM *** NEXT 6 LINES UPDATE THE POSTTEST ATTRIBUTE SURTEST SCORES
2700 A2(1)=A2(1)+1\GOTO 2980
2710 A2(2)=A2(2)+1\GOTO 2980
2720 A2(3)=A2(3)+1\GOTO 2980
2730 A2(4)=A2(4)+1\GOTO 2980
2740 A2(5)=A2(5)+1\GOTO 2980
2750 A2(6)=A2(6)+1\GOTO 2980
2760 P8=K\REM COUNTER FOR THE TOTAL NUMBER OF POSTTEST GRADED
2770 ON Z5 GOTO 2900, 2920, 2940, 2960
2780 Z5=2\REM FLAG THAT A POSTTEST ITEM FROM 14-26 IS BEING SCORED
2790 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR POSTTEST ITEMS 14-26
2800 I=I-13
2810 ON I GOTO 2630,2630,2630,2630,2630,2640,2640,2640,2640,2640,2650,2650,2650
2820 Z5=3\REM FLAG THAT A POSTTEST ITEM FROM 27-39 IS BEING SCORED
2830 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR POSTTEST ITEMS 27-39
2840 I=I-26
2850 ON I GOTO 2650,2650,2650,2630,2630,2630,2630,2630,2630,2660,2660,2660,2660
2860 Z5=4\REM FLAG THAT A POSTTEST ITEM FROM 40-52 IS BEING SCORED
2870 REM *** LEVEL-OF-KNOWLEDGE CLASSIFICATION FOR POSTTEST ITEMS 40-52
2880 I=I-39
2890 ON I GOTO 2660,2660,2660,2670,2670,2670,2670,2670,2680,2680,2680,2680,2680
2900 REM *** ATTRIBUTE CLASSIFICATION FOR POSTTEST ITEMS 1-13
2910 ON I GOTO 2720,2730,2700,2740,2710,2720,2710,2700,2700,2700,2730,2740,2720
2920 REM *** ATTRIBUTE CLASSIFICATION FOR POSTTEST ITEMS 14-26
2930 ON I GOTO 2720,2730,2710,2740,2700,2720,2740,2710,2730,2700,2710,2740,2720
2940 REM *** ATTRIBUTE CLASSIFICATION FOR POSTTEST ITEMS 27-39
2950 ON I GOTO 2700,2730,2720,2750,2750,2750,2750,2750,2750,2750,2700,2730,2750
2960 REM *** ATTRIBUTE CLASSIFICATION FOR POSTTEST ITEMS 40-52
2970 ON I GOTO 2700,2720,2700,2710,2750,2720,2700,2740,2720,2730,2710,2700,2740
2980 I=I5\REM RESET THE I-VALUE (WHICH MAY HAVE CHANGED IN THE GOTO STATEMENTS)
2990 NEXT I

```

GRADER (Continued)

```

3000 P8=P8+1\GOSUB 3740
3010 !"THE POSTTEST RAW SCORE FOR STUDENT NUMBER",K," IS",E9(K),"."
3020 !"      PRESS THE RETURN KEY IF YOU HAVE ANOTHER POSTTEST TO GRADE."
3030 !"      TYPE 'DONE' IF YOU HAVE NO MORE POSTTESTS TO GRADE."
3040 !\INPUT "      ",Y$
3050 GOSUB 3740\IF Y$="" THEN 3060 ELSE 3070
3060 GOSUB 4060\GOTO 2340
3070 P9=1\GOSUB 4060
3080 P9=0\GOTO 3550
3090 K=L8\REM L8 IS THE NUMBER OF LABTEST GRADES ALREADY IN THE FILE
3100 REM ***** LABTEST SCORING ROUTINE *****
3110 GOSUB 3740
3120 IF M1<>0 THEN 3170
3130 !"      BEFORE I CAN GRADE THE LABTESTS, I NEED TO KNOW THE MASS (IN"
3140 !"KILOGRAMS) OF THE PERSON USED IN ITEM 7 OF THE LABTEST."
3150 !\INPUT "      MASS OF PERSON IN ITEM 7: ",M1
3160 GOSUB 3740
3170 REM *** READ IN THE ANSWERS TO THE LABTEST
3180 RESTORE 4460
3190 FOR I=1 TO 13
3200 IF I<>7 THEN 3230
3210 L1(I)=M1-5\L2(I)=M1+5\L3(I)=M1-7.5\L4(I)=M1+7.5
3220 GOTO 3240
3230 READ L1(I),L2(I),L3(I),L4(I)
3240 NEXT I
3250 !"      I'M NOW READY TO GRADE THE LABTESTS.  ENTER ALL 13 RESPONSES"
3260 !"(SEPARATED BY COMMAS) ON ONE LINE."!
3270 INPUT "      PRESS THE RETURN KEY WHEN YOU'RE READY TO BEGIN. ",Y$
3280 GOSUB 3740\K=K+1
3290 !"      LABTEST ITEMS 1-13 FOR STUDENT #",K,"; "
3300 !TAB(6),
3310 INPUT L(1),L(2),L(3),L(4),L(5),L(6),L(7),L(8),L(9),L(10),L(11),L(12),L(13)
3320 GOSUB 5980
3330 GOSUB 3740
3340 IF E9=1 THEN 3290
3350 FOR I=1 TO 13
3360 X=0
3370 IF L(I)<L3(I) OR L(I)>L4(I) THEN 3410
3380 IF L(I)>=L1(I) AND L(I)<=L2(I) THEN X=2
3390 IF X=2 THEN 3410
3400 X=1
3410 L9(K)=L9(K)+X\L5(I)=L5(I)+X
3420 NEXT I
3430 L8=L8+1\GOSUB 3740
3440 !"THE LABTEST RAW SCORE FOR STUDENT NUMBER",K," IS",L9(K),"."
3450 !\GOSUB 5690
3460 !"      PRESS THE RETURN KEY IF YOU HAVE ANOTHER LABTEST TO GRADE."
3470 !"      TYPE 'DONE' IF YOU HAVE NO MORE LABTESTS TO GRADE."
3480 !
3490 GOSUB 5690

```

GRADER (Continued)

```

3500 !\INPUT "      ",Y$
3510 GOSUB 3740\IF Y$="" THEN 3520 ELSE 3530
3520 GOSUB 4060\GOTO 3280
3530 L9=1\GOSUB 4060
3540 L9=0\GOTO 3550
3550 REM *** ROUTINE TO SELECT FURTHER PROGRAM USE
3560 GOSUB 3740
3570 !"      WHICH OF THE FOLLOWING THINGS DO YOU WISH TO DO NOW?"\!
3580 !"          1. DO MORE WORK WITH THE FILE '"',N$,'" (I.E., VIEW THE CURRENT"
3590 !"              CONTENTS OF THE FILE OR SCORE MORE PRE-, POST-, OR LABTESTS)"
3600 !"          2. WORK WITH A DATA FILE OTHER THAN '"',N$,'"
3610 !"          3. CONDUCT AN ANALYSIS OF COVARIANCE"
3620 !"          4. SCORE A SET OF METRIC OPINIONNAIRES"
3630 !"          5. LEAVE THIS PROGRAM ALTOGETHER"\!
3640 INPUT "      TYPE THE NUMBER OF YOUR CHOICE. ",Q$
3650 GOSUB 3740
3660 IF Q$="" THEN 3570
3670 IFQ$<>"1"THENIFQ$<>"2"THENIFQ$<>"3"THENIFQ$<>"4"THENIFQ$<>"5"THEN3570
3680 Q=VAL(Q$)
3690 R2=1\REM FLAG A POSSIBLE RERUN USING SAME FILE
3700 ON Q GOTO 600, 6030, 6030, 6030, 6040
3710 REM *** SUBROUTINE TO LIMIT LENGTHS OF I$, L$ AND D$ TO 40 CHARACTERS
3720 !"      YOUR RESPONSE WAS LONGER THAN THAT PERMITTED BY THE TYPING GUIDE."
3730 !"PLEASE ENTER A SHORTER RESPONSE."\RETURN
3740 REM *** SUBROUTINE TO CLEAR THE SCREEN
3750 !CHR$(27),"*\RETURN
3760 REM *** SUBROUTINE TO TYPE THE TYPING GUIDE
3770 !
3780 !"          =====
3790 RETURN
3800 REM *** SUBROUTINE TO READ THE CLASS DATA FILE
3810 OPEN #0, C$
3820 READ #0, N$, I$, L$, D$, M1, M9, T9, P6, P7, P8, P9, L8, L9
3830 IF P6=0 AND P8=0 AND L8=0 THEN 4040
3840 REM *** NOW FIND THE GREATEST NUMBER OF TESTS (PRE-, POST-, LAB-) SCORED
3850 GOSUB 5730
3860 FOR I=1 TO J
3870 READ #0, B9(I),E9(I),L9(I)\REM READ TESTS SCORES FOR STUDENT I
3880 NEXT I
3890 FOR I=1 TO 8
3900 READ #0, K1(I)\REM LEVEL-OF-KNOWLEDGE SUBTEST RESULTS ON PRETEST
3910 NEXT I
3920 FOR I=1 TO 6
3930 READ #0, A1(I)\REM ATTRIBUTE SUBTEST RESULTS FOR PRETEST
3940 NEXT I
3950 FOR I=1 TO 8
3960 READ #0, K2(I)\REM LEVEL-OF-KNOWLEDGE SUBTEST RESULTS FOR POSTTEST
3970 NEXT I
3980 FOR I=1 TO 6
3990 READ #0, A2(I)\REM ATTRIBUTE SUBTEST RESULTS FOR POSTTEST

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GRADER (Continued)

```

4000 NEXT I
4010 FOR I=1 TO 13
4020 READ #0, L5(I)\REM TOTAL SCORE ON EACH LABTEST ITEM
4030 NEXT I
4040 CLOSE #0
4050 RETURN
4060 REM *** SUBROUTINE TO WRITE ALL TEST RESULTS TO THE CLASS DATA FILE
4070 REM *** FIRST FIND GREATEST NUMBER OF TESTS (PRE-, POST-, LAB-) SCORED
4080 GOSUB 5730
4090 OPEN #0, C$
4100 WRITE #0,N$,I$,L$,D$,M1,M9,T9,P6,P7,P8,P9,L8,L9
4110 FOR I=1 TO J
4120 WRITE #0, B9(I),E9(I),L9(I)\REM WRITE TEST SCORES FOR STUDENT I
4130 NEXT I
4140 FOR I=1 TO 8
4150 WRITE #0, K1(I)\REM LEVEL-OF-KNOWLEDGE SUBTEST RESULTS FOR PRETEST
4160 NEXT I
4170 FOR I=1 TO 6
4180 WRITE #0, A1(I)\REM ATTRIBUTE SUBTEST RESULTS FOR PRETEST
4190 NEXT I
4200 FOR I=1 TO 8
4210 WRITE #0, K2(I)\REM LEVEL-OF-KNOWLEDGE SUBTEST RESULTS FOR POSTTEST
4220 NEXT I
4230 FOR I=1 TO 6
4240 WRITE #0, A2(I)\REM ATTRIBUTE SUBTEST RESULTS FOR POSTTEST
4250 NEXT I
4260 FOR I=1 TO 13
4270 WRITE #0, L5(I)\REM TOTAL SCORE ON EACH LABTEST ITEM
4280 NEXT I
4290 CLOSE #0
4300 RETURN
4310 REM SUBROUTINE TO SET INITIAL VALUES FOR HEADER ENTRIES IN DATA FILE
4320 OPEN #0, C$
4330 WRITE #0, "FILE****", "INSTRUCTOR'S NAME*****"
4340 WRITE #0, "CLASS LOCATION*****"
4350 WRITE #0, "DATE CLASS BEGAN*****"
4360 WRITE #0,0,0,0,0,0,0,0,0,0
4370 CLOSE #0
4380 RETURN
4390 REM *** ANSWER KEY FOR VERSION A, QUIZZES 1 AND 2
4400 DATA 1,2,2,3,4,1,1,1,3,3,3,4,4,2,2,2,4,3,1,2,2,3,4,3,1,3,4,4,4
4410 DATA 3,1,2,5,1,2,2,1,1,2,4,3,2,2,3,2,4,4,1,2,3,2,3
4420 REM *** ANSWER KEY FOR VERSION B, QUIZZES 1 AND 2
4430 DATA 1,1,2,3,4,1,2,2,2,3,3,3,4,1,2,3,3,4,1,1,2,3,4,2,1,1,3,2,1
4440 DATA 1,4,3,1,4,5,3,3,3,4,1,4,3,3,2,2,2,1,1,1,1,3,4
4450 REM *** ANSWER KEY FOR LAB QUIZ
4460 DATA 16.25,17.75,15,19,26,28,24,30,16.3,17.75,15.5,18.5
4470 DATA 413,500,375,546,26,33.75,24,35,600,800,500,1000
4480 DATA 350,450,300,500,30,37.5,20,45,900,1020,750,1125
4490 DATA 48,52,45,55,32,37,30,40,18,22,15,25

```

GRADER (Continued)

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4500 REM *** SUBROUTINE TO PRINT THE CONTENTS OF THE DATA FILE
4510 GOSUB 3740
4520 !" HOW DO YOU WISH TO HAVE THE CONTENTS OF YOUR FILE DISPLAYED?"
4530 !TAB(10), "1. USING A PRINTER"
4540 !TAB(10), "2. USING A TELEVISION SCREEN"
4550 INPUT " INPUT THE NUMBER OF YOUR CHOICE. ",Q
4560 Q$=STR$(Q)\IF Q$="" THEN 4550
4570 IF Q=1 OR Q=2 THEN 4580 ELSE 4510
4580 IF Q=2 THEN 4620 ELSE O1=1\GOSUB 3740
4590 !" BE CERTAIN THAT THE PRINTER POWER IS ON. WHEN YOU ARE READY,"
4600 INPUT "PRESS THE RETURN KEY IN ORDER TO CONTINUE. ",Y$
4610 GOSUB 3740\!TAB(30), "HERE WE GO.\!TAB(29), "HANG IN THERE!"
4620 IF O1=1 THEN 4630 ELSE GOSUB 3740
4630 GOSUB 5690\!#01 "
4640 !#01 TAB(31), N$
4650 GOSUB 5690
4660 !#01 "
4670 !#01 " INSTRUCTOR: ",I$
4680 !#01 " CLASS LOCATION: ",L$
4690 !#01 " DATE CLASS BEGAN: ",D$
4700 !#01 " TOTAL NUMBER OF SESSIONS: ",M9
4710 !#01 "LENGTH OF EACH SESSION (MINUTES): ",T9
4720 IF O1=1 THEN 4740
4730 \!INPUT "PRESS THE RETURN KEY TO CONTINUE. ",Y$
4740 GOSUB 3740
4750 !#01 " NUMBER OF PRETESTS GRADED: ",P6
4760 IF P6=0 THEN 5160
4770 S1=0
4780 FOR I=1 TO P6
4790 S1=S1+B9(I)
4800 NEXT I
4810 LET T=52*P6
4820 !#01 " CLASS PRETEST AVERAGE: ",INT((S1/P6)*100+.5)/100,
4830 !#01 " (OUT OF A POSSIBLE 52)"
4840 FOR I=1 TO 8
4850 K(I)=INT((K1(I)/P6)*100+.5)/100
4860 NEXT I
4870 FOR I=1 TO 6
4880 A(I)=INT((A1(I)/P6)*100+.5)/100
4890 NEXT I\!#01
4900 GOSUB 4910\GOSUB 5690\GOTO 5160
4910 REM *** SUBROUTINE TO PRINT QUIZ SUBTEST AVERAGES *****
4920 !#01 " ### LEVEL-OF-KNOWLEDGE SUBTEST AVERAGES ###"
4930 !#01 " GROSS UNIT: ",K(1)," (OUT OF A POSSIBLE 5)"
4940 !#01 " SPECIFIC UNIT: ",K(2)," (OUT OF A POSSIBLE 8)"
4950 !#01 " TOTAL MEASURE: ",K(3)," (OUT OF A POSSIBLE 11)"
4960 !#01 " APPROPRIATE UNIT: ",K(4)," (OUT OF A POSSIBLE 5)"
4970 !#01 " PREFIX: ",K(5)," (OUT OF A POSSIBLE 6)"
4980 !#01 " CUSTOMARY SYSTEM REFERENT: ",K(6)," (OUT OF A POSSIBLE 7)"
4990 !#01 " SYMBOLS: ",K(7)," (OUT OF A POSSIBLE 5)"

```

GRADER (Continued)

```

5000 !#01 "      INTRASYSTEM CONVERSION: ",K(8)," (OUT OF A POSSIBLE 5)"
5010 !#01\!#01 "      *** ATTRIBUTE SUBTEST AVERAGES ***"
5020 IF Z9=1 THEN 5050
5030 !#01 "      LENGTH: ",A(1)," (OUT OF A POSSIBLE 11)"
5040 GOTO 5070
5050 !#01 "      LENGTH: ",A(1)," (OUT OF A POSSIBLE 12)"
5060 GOTO 5090
5070 !#01 "      AREA: ",A(2)," (OUT OF A POSSIBLE 8)"
5080 GOTO 5100
5090 !#01 "      AREA: ",A(2)," (OUT OF A POSSIBLE 7)"
5100 !#01 "      MASS: ",A(3)," (OUT OF A POSSIBLE 10)"
5110 !#01 "      VOLUME (LITRE): ",A(4)," (OUT OF A POSSIBLE 7)"
5120 !#01 "      VOLUME (CUBIC): ",A(5)," (OUT OF A POSSIBLE 7)"
5130 !#01 "      TEMPERATURE: ",A(6)," (OUT OF A POSSIBLE 9)"
5140 Z9=0
5150 RETURN
5160 IF O1=1 THEN 5190
5170 INPUT "PRESS RETURN TO CONTINUE. ",Y$
5180 GOSUB 3740
5190 Q1=0
5200 !#01 "      NUMBER OF POSTTESTS GRADED: ",P8
5210 IF P8=0 THEN 5370
5220 S2=0
5230 FOR I=1 TO P8
5240 S2=S2+E9(I)
5250 NEXT I
5260 T=52*P8
5270 !#01 "      CLASS POSTTEST AVERAGE: ",INT((S2/P8)*100+.5)/100,
5280 !#01 " (OUT OF A POSSIBLE 52)"
5290 FOR I=1 TO 8
5300 K(I)=INT((K2(I)/P8)*100+.5)/100
5310 NEXT I
5320 FOR I=1 TO 6
5330 A(I)=INT((A2(I)/P8)*100+.5)/100
5340 NEXT I\!#01
5350 Z9=1\REM *** FLAG THAT POSTTEST SUBTEST RESULTS ARE TO BE PRINTED
5360 GOSUB 4910\GOSUB 5690
5370 IF O1=1 THEN 5400
5380 INPUT "PRESS THE RETURN KEY TO CONTINUE. ",Y$
5390 GOSUB 3740
5400 !#01 "      NUMBER OF LABTESTS GRADED: ",L8
5410 IF L8=0 THEN 5530
5420 S=0
5430 FOR I=1 TO L8
5440 S=S+L9(I)
5450 NEXT I
5460 !#01 "      CLASS LABTEST AVERAGE: ",INT((S/L8)*100+.5)/100," (OUT",
5470 !#01 " OF A POSSIBLE 26)"
5480 !#01 "=== MASS OF THE PERSON USED IN ITEM #7 WAS",M1," KILOGRAMS ==="
5490 !#01\!#01 "AVERAGE SCORE (MAXIMUM = 2) ON EACH LABTEST ITEM: "

```

GRADER (Concluded)

```

5500 FOR I=1 TO 13
5510 !#01 TAB(8), "ITEM",I," : ",INT((L5(I)/L8)*100+.5)/100
5520 NEXT I
5530 GOSUB 5690\GOSUB 5730
5540 IF 01=1 THEN 5570
5550 INPUT "PRESS THE RETURN KEY TO CONTINUE. ",Y$
5560 GOSUB 3740
5570 !#01 "          ### COMPLETE LIST OF STUDENT TEST SCORES ###"
5580 !#01 "          ### NOW IN THE FILE ' ",N$, "' ###"
5590 !#01
5600 !#01 "STUDENT      PRETEST      POSTTEST      LABTEST"
5610 !#01 "NUMBER      SCORE          SCORE          SCORE"
5620 FOR I=1 TO J
5630 !#01 TAB(2),I,TAB(14),B9(I),TAB(26),E9(I),TAB(39),L9(I)
5640 NEXT I
5650 GOSUB 5690\IF 01=0 THEN GOSUB 5670 ELSE GOSUB 3740
5660 !"          THAT COMPLETES THE PRINTING OF THE FILE WITH CODE NAME ' ",N$, "' ."
5670 INPUT "PRESS THE RETURN KEY TO CONTINUE. ",Y$
5680 GOSUB 3740\RETURN
5690 REM *** SUBROUTINE TO PRINT BOUNDARY OF '*S
5700 !#01"*****"
5710 !#01 "*****"
5720 RETURN
5730 REM *** SUBROUTINE TO FIND THE GREATEST NUMBER OF TESTS (PRE-, POST-
5740 REM *** OR LAB-) GRADED THUS FAR
5750 IF P6>=P8 AND P6>=L8 THEN 5780
5760 IF P8>=P6 AND P8>=L8 THEN 5790
5770 J=L8\RETURN
5780 J=P6\RETURN
5790 J=P8\RETURN
5800 REM *** SUBROUTINE TO CHECK HEADER INFO FOR THE DATA FILE
5810 GOSUB 3740
5820 !"IS ALL OF THE FOLLOWING CLASS INFORMATION CORRECT?"\!
5830 !"          INSTRUCTOR: ",I$
5840 !"          CLASS LOCATION: ",L$
5850 !"          DATE CLASS BEGAN: ",D$
5860 !"          TOTAL NUMBER OF SESSIONS: ",M9
5870 !"          LENGTH OF EACH SESSION (MINUTES): ",T9
5880 !\INPUT "PLEASE ANSWER YES OR NO. ",Y$
5890 E9=0
5900 IF Y$="" THEN 5880
5910 IF Y$(1,1)="Y" THEN 5970
5920 !\GOSUB 5690
5930 !"SINCE THERE IS AN ERROR, I MUST HAVE YOU ENTER THAT DATA AGAIN."
5940 GOSUB 5690\!
5950 E9=1
5960 GOSUB 5670
5970 RETURN
5980 REM *** SUBROUTINE TO CHECK THAT STUDENT DATA WAS ENTERED CORRECTLY
5990 GOSUB 5690
6000 !"DID YOU CORRECTLY ENTER THE DATA FOR STUDENT #",K,"?"
6010 GOSUB 5880
6020 RETURN
6030 CHAIN "ROUTER"
6040 END

```

APPENDIX XII(d)

ANCOVA

```

10 REM*****PROGRAM NAME
20 REM      ANCOVA
30 REM
40 REM*****DATE OF LAST REVISION
50 REM      1980-8-30
60 REM
70 REM*****AUTHOR(S)
80 REM      BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER
90 REM      BOX 3992 UNIVERSITY STATION, LARAMIE, WY   82071
100 REM      PHONE\ 307/766-6381
110 REM
120 REM*****PROGRAM DESCRIPTION
130 REM      THIS PROGRAM CONDUCTS PRETEST/POSTTEST OR PRETEST/LABTEST
140 REM      ANALYSES OF COVARIANCE
150 REM
160 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
170 REM      15 500 BYTES
180 REM
190 REM*****HARDWARE CONSIDERATIONS
200 REM      WRITTEN FOR THE NORTHSTAR HORIZON II MICROCOMPUTER WITH
210 REM      DUAL DISK DRIVES
220 REM
230 REM*****LIST OF PRINCIPAL NUMERIC VARIABLES USED IN THIS PROGRAM
240 REM
250 REM      R = NUMBER INDICATING THE COMPARISON (PRETEST/POSTTEST
260 REM      OR PRETEST/LABTEST) TO BE MADE
270 REM      R1 = FLAG TO CONTROL THE PRINTING OPTION (WHERE R1=1 IS
280 REM      FOR THE MONITOR AND R2=2 IS FOR THE PRINTER)
290 REM
300 REM      B(I) = PRETEST SCORE OF A CONTROL GROUP MEMBER
310 REM      E(I) = POSTTEST SCORE OF A CONTROL GROUP MEMBER
320 REM      L(I) = LABTEST SCORE OF A CONTROL GROUP MEMBER
330 REM
340 REM      B9(I) = PRETEST SCORE OF AN EXPERIMENTAL GROUP MEMBER
350 REM      E9(I) = POSTTEST SCORE OF AN EXPERIMENTAL GROUP MEMBER
360 REM      L9(I) = LABTEST SCORE OF AN EXPERIMENTAL GROUP MEMBER
370 REM
380 REM      D1(I) = APPROPRIATE DEPENDENT VARIABLE TEST SCORE (EXPERIMENTAL)
390 REM      D2(I) = APPROPRIATE DEPENDENT VARIABLE TEST SCORE (CONTROL)
400 REM
410 REM      N = NUMBER OF PERSONS IN THE EXPERIMENTAL GROUP
420 REM      M = NUMBER OF PERSONS IN THE CONTROL GROUP
430 REM
440 REM      K1 = PRETEST MEAN FOR THE EXPERIMENTAL GROUP
450 REM      K2 = DEPENDENT VARIABLE MEAN FOR THE EXPERIMENTAL GROUP
460 REM      S4 = PRETEST VARIANCE FOR THE EXPERIMENTAL GROUP
470 REM      S6 = DEPENDENT VARIABLE VARIANCE FOR THE EXPERIMENTAL GROUP
480 REM
490 REM      B1 = PRETEST MEAN FOR THE CONTROL GROUP

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ANCOVA (Continued)

500 REM B2 = DEPENDENT VARIABLE MEAN FOR THE CONTROL GROUP  
 510 REM S3 = PRETEST VARIANCE FOR THE CONTROL GROUP  
 520 REM S5 = DEPENDENT VARIABLE VARIANCE FOR THE CONTROL GROUP  
 530 REM  
 540 REM Y1 = SUM OF SQUARES OF PRETEST RAW SCORES (EXPERIMENTAL)  
 550 REM X1 = SUM OF SQUARES OF DEPENDENT VARIABLE RAW  
 560 REM SCORES (EXPERIMENTAL)  
 570 REM  
 580 REM Y2 = SUM OF SQUARES OF PRETEST RAW SCORES (CONTROL)  
 590 REM X2 = SUM OF SQUARES OF DEPENDENT VARIABLE RAW  
 600 REM SCORES (CONTROL)  
 610 REM  
 620 REM F1 = SUM OF PRETEST RAW SCORES (EXPERIMENTAL)  
 630 REM G1 = SUM OF DEPENDENT VARIABLE RAW SCORES (EXPERIMENTAL)  
 640 REM  
 650 REM F2 = SUM OF PRETEST RAW SCORES (CONTROL)  
 660 REM G2 = SUM OF DEPENDENT VARIABLE RAW SCORES (CONTROL)  
 670 REM  
 680 REM Y = TOTAL SUM OF PRETEST RAW SCORES (EXPERIMENTAL+CONTROL)  
 690 REM X = TOTAL SUM OF DEPENDENT VARIABLE RAW SCORES (EXPERI-  
 700 REM MENTAL+CONTROL)  
 710 REM  
 720 REM P1 = SUM OF PRODUCTS (PRETEST RAW SCORES TIMES DEPENDENT  
 730 REM VARIABLE RAW SCORES) FOR THE EXPERIMENTAL GROUP  
 740 REM P2 = SUM OF PRODUCTS (PRETEST RAW SCORES TIMES DEPENDENT  
 750 REM VARIABLE RAW SCORES) FOR THE CONTROL GROUP  
 760 REM  
 770 REM A1 = BETWEEN SUM OF SQUARES OF MEAN DEVIATIONS ON PRETEST  
 780 REM A2 = WITHIN SUM OF SQUARES OF MEAN DEVIATIONS ON THE PRETEST  
 790 REM A3 = TOTAL SUM OF SQUARES OF MEAN DEVIATIONS ON THE PRETEST  
 800 REM  
 810 REM A4 = BETWEEN SUM OF SQUARES OF MEAN DEVIATIONS ON THE  
 820 REM DEPENDENT VARIABLE  
 830 REM A5 = WITHIN SUM OF SQUARES OF MEAN DEVIATIONS ON THE  
 840 REM DEPENDENT VARIABLE  
 850 REM A6 = TOTAL SUM OF SQUARES OF MEAN DEVIATIONS ON THE  
 860 REM DEPENDENT VARIABLE  
 870 REM  
 880 REM A7 = BETWEEN SUM OF PRODUCTS OF MEAN DEVIATIONS  
 890 REM A8 = WITHIN SUM OF PRODUCTS OF MEAN DEVIATIONS  
 900 REM A9 = TOTAL SUM OF PRODUCTS OF MEAN DEVIATIONS  
 910 REM  
 920 REM L1 = ADJUSTED TOTAL SUM OF SQUARES  
 930 REM L2 = ADJUSTED WITHIN SUM OF SQUARES  
 940 REM L1-L2 = ADJUSTED BETWEEN SUM OF SQUARES  
 950 REM L3 = SLOPE OF WITHIN GROUPS REGRESSION LINE  
 960 REM  
 970 REM S1 = ADJUSTED BETWEEN GROUPS VARIANCE  
 980 REM S2 = ADJUSTED WITHIN GROUPS VARIANCE  
 990 REM

ANCOVA (Continued)

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1000 REM          M1 = ADJUSTED MEAN ON DEPENDENT VARIABLE (EXPERIMENTAL)
1010 REM          M2 = ADJUSTED MEAN ON DEPENDENT VARIABLE (CONTROL)
1020 REM
1030 REM          F = F-STATISTIC
1040 REM
1050 REM          O1 = SETS PRINTING OPTION (USES SCREEN IF O1=0 AND USES
1060 REM                PRINTER IF O1=1)
1070 REM
1080 REM*****LIST OF PRINCIPAL STRING VARIABLES USED IN THIS PROGRAM
1090 REM          N$ = NAME OF DATA FILE OF THE EXPERIMENTAL GROUP
1100 REM          D1$ = STRING VALUE OF THE DRIVE HOUSING THE DATA FILE
1110 REM                OF THE EXPERIMENTAL GROUP
1120 REM          P$ = DESCRIPTION OF THE PARTICULAR COMPARISON
1130 REM                (PRETEST/POSTTEST OR PRETEST/LABTEST) BEING MADE
1140 REM          I$ = NAME OF INSTRUCTOR OF CLASS BEING ANALYZED
1150 REM          L$ = LOCATION WHERE CLASS WAS HELD
1160 REM          D$ = DATE CLASS BEGAN
1170 REM
1180 REM*****DIMENSIONS OF STRING ARRAYS
1190 DIM N$(8)
1200 DIM D1$(10)
1210 DIM P$(20)
1220 DIM I$(30), L$(40), D$(30)
1230 REM
1240 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
1250 REM          DUMBFIL = A FILE TO STORE THE NAME OF THE NEWLY CREATED
1260 REM                FILE WHILE CHAINING TO THE MAIN PROGRAM
1270 REM
1280 REM          ROUTER = NAME OF THE (SAMPLE) MAIN PROGRAM WHICH MAKES
1290 REM                USE OF THE FILE JUST CREATED
1300 REM
1310 REM          FILEMGR = A PROGRAM WHICH CREATES AND DESTROYS DATA FILES
1320 REM                USED BY THIS PROGRAM
1330 REM
1340 REM          GRADER = A PROGRAM WHICH SCORES THE PRETESTS, POSTTESTS,
1350 REM                AND LABTESTS DEVELOPED BY THE TRI-STATE METRIC
1360 REM                CONSORTIUM
1370 REM
1380 REM*****BEGIN MAIN PROGRAM
1390 GOSUB 2220\ REM CLEAR SCREEN
1400 GOSUB 3300\ REM INITIALIZE NUMERIC VARIABLES
1410 GOSUB 1540\ REM GET DATA FILE DESCRIPTION FROM 'DUMBFIL'
1420 GOSUB 1610\ REM DESCRIBE PROGRAM FUNCTION TO THE USER
1430 GOSUB 2350\ REM ADVISE USER OF THE NEED TO DO SOME COMPUTING
1440 GOSUB 1930\ REM FIND NUMBER OF PERSONS IN THE EXPERIMENTAL GROUP
1450 GOSUB 2110\ REM FIND NUMBER OF PERSONS IN THE CONTROL GROUP
1460 GOSUB 2290\ REM DIMENSION THE NUMERIC ARRAYS
1470 GOSUB 1930\ REM READ THE EXPERIMENTAL GROUP DATA FILE
1480 GOSUB 2110\ REM READ THE CONTROL GROUP DATA FILE
1490 GOSUB 2590\ REM CONDUCT APPROPRIATE ANALYSIS OF COVARIANCE

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ANCOVA (Continued)

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1500 GOSUB 2400\ REM PRESENT PRINTING OPTIONS
1510 GOSUB 3470\ REM PRINT THE RESULTS OF THE ANALYSIS
1520 GOSUB 4040\ REM PRESENT OPTIONS FOR FURTHER ANALYSIS/GRADING
1530 GOTO 1470\ REM DO SECOND ANALYSIS POSSIBLE FOR THIS FILE
1540 REM****SUBROUTINE TO READ THE DATA FILE DESCRIPTION FROM 'DUMBFIL'
1550 OPEN #0,"DUMBFIL"
1560 READ #0, N$, D1$, C$
1570 CLOSE #0
1580 D9=VAL(D1$)
1590 RETURN
1600 REM
1610 REM****SUBROUTINE TO DESCRIBE THE PROGRAM FUNCTION TO THE USER
1620 ININ
1630 !"          METRIC TEST ANALYSIS PROGRAM"
1640 !"          (ANALYSIS OF COVARIANCE)"\!
1650 !"          THIS PROGRAM PERMITS YOU TO CONDUCT AN ANALYSIS OF COVARIANCE"
1660 !"          (PRETEST/POSTTEST OR PRETEST/LABTEST) OF THE TEST SCORES IN THE DATA"
1670 !"          FILE NAMED '",N$,"'."!\!
1680 !"          TO USE THE PROGRAM, YOU ALREADY MUST HAVE RECORDED THE APPROPRIATE"
1690 !"          PAIRS OF TEST SCORES IN '",N$,"'. HAVE YOU DONE THIS? (PLEASE"
1700 INPUT "RESPOND YES OR NO.) ",R$
1710 GOSUB 2220
1720 IF R$="" THEN 1680 ELSE IF R$(1,1)="Y" THEN 1820
1730 !"          DO YOU WISH TO ENTER THOSE SCORES (OR TO CHECK TO SEE IF THEY'VE"
1740 INPUT "BEEN ENTERED)? PLEASE ANSWER YES OR NO. ",R$
1750 GOSUB 2220
1760 IF R$="" THEN 1730 ELSE IF R$(1,1)="N" THEN 1800
1770 !"          OKAY. I'LL TAKE YOU TO THE PROGRAM WHICH WILL LET YOU DO THAT."
1780 GOSUB 2250
1790 CHAIN "ROUTER"
1800 !"          I'M SORRY THAT I CAN'T BE OF SERVICE AT THE MOMENT."!\!
1810 STOP
1820 !"          I CAN DO ONLY ONE OF THE FOLLOWING COMPARISONS AT A TIME."
1830 !"          1. A PRETEST/POSTTEST ANALYSIS OF COVARIANCE"
1840 !"          2. A PRETEST/LABTEST ANALYSIS OF COVARIANCE"
1850 !"PLEASE TYPE THE NUMBER OF THE COMPARISION WHICH YOU WISH TO DO NOW."!\!
1860 INPUT "          ",R$
1870 GOSUB 2220
1880 IF R$="" THEN 1820
1890 IF R$="1" THEN 1900 ELSE IF R$<>"2" THEN 1820
1900 R=VAL(R$)
1910 RETURN
1920 REM
1930 REM****SUBROUTINE TO READ THE CLASS DATA FILE
1940 OPEN #0,C$
1950 REM MANY OF THE VARIABLES TO BE READ BY THE NEXT STATEMENT ARE NOT
1960 REM USED BY THIS PROGRAM. FOR A DESCRIPTION OF THESE VARIABLES, SEE
1970 REM THE LISTING FOR THE PROGRAM CALLED 'GRADER'.
1980 READ #0, N$, I$, L$, D$, M1, M9, T9, P6, P7, P8, P9, L8, L9
1990 N=P6

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ANCOVA (Continued)

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2000 REM THE NEXT TWO STATEMENTS CONTROL FLOW THROUGH THIS SUBROUTINE
2010 REM FLOW DEPENDS ON WHETHER OR NOT THE NUMERIC ARRAYS HAVE BEEN
2020 REM DIMENSIONED.
2030 IF Z1=0 THEN Z1=1 ELSE Z1=0
2040 IF Z1=1 THEN 2080
2050 FOR I=1 TO N
2060 READ #0,B9(I),E9(I),L9(I)\REM READ TEST SCORES FOR STUDENT I
2070 NEXT I
2080 CLOSE #0
2090 RETURN
2100 REM
2110 REM***SUBROUTINE TO READ THE CONTROL GROUP DATA
2120 OPEN #1,"CONTROL"
2130 READ #1, M
2140 IF Z2=0 THEN Z2=1 ELSE Z2=0
2150 IF Z2=1 THEN 2190
2160 FOR I=1 TO M
2170 READ #1,B(I),E(I),L(I)\REM READ SCORES FOR STUDENT I
2180 NEXT I
2190 CLOSE #1
2200 RETURN
2210 REM
2220 REM*****SUBROUTINE TO CLEAR THE SCREEN
2230 !CHR$(27),"*" \RETURN
2240 REM
2250 REM*****PRESS-TO-CONTINUE SUBROUTINE
2260 !\INPUT " PRESS THE RETURN KEY IN ORDER TO CONTINUE. ",R$
2270 GOSUB 2220 \RETURN
2280 REM
2290 REM*****SUBROUTINE TO DIMENSION THE NUMERIC ARRAYS
2300 DIM B9(N), E9(N), L9(N)
2310 DIM B(M), E(M), L(M)
2320 DIM D1(N), D2(M)
2330 RETURN
2340 REM
2350 REM*****SUBROUTINE TO ADVISE USER OF COMPUTING DELAY
2360 !" THERE WILL NOW BE A SHORT DELAY WHILE I DO SOME COMPUTING."
2370 !"HANG IN THERE!"\!
2380 RETURN
2390 REM
2400 REM*****SUBROUTINE TO PRESENT PRINTING OPTIONS TO THE USER
2410 GOSUB 2220
2420 !" THAT COMPLETES THE COMPUTATIONS FOR THE ",P$," ANALYSIS"
2430 !"WHICH YOU REQUESTED." \!
2440 !" THE RESULTS OF THAT ANALYSIS CAN BE PRESENTED IN ONE OF TWO"
2450 !"WAYS: "
2460 !" 1. USING THE SCREEN ON YOUR MONITOR"
2470 !" 2. USING A PRINTER" \!
2480 INPUT "TYPE THE NUMBER CORRESPONDING TO YOUR CHOICE. ",R$
2490 GOSUB 2220

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ANCOVA (Continued)

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2500 IF R$="" THEN 2440
2510 IF R$="1" THEN 2520 ELSE IF R$<>"2" THEN 2440
2520 R1=VAL(R$)
2530 IF R1=1 THEN 2570
2540 O1=1\REM SETS DISPLAY OPTION OF PRINT STATEMENTS TO USE PRINTER
2550 !"      WHEN YOU HAVE MADE CERTAIN THAT THE PRINTER IS TURNED ON, PLEASE"
2560 GOSUB 2250
2570 RETURN
2580 REM
2590 REM****SUBROUTINE TO CONDUCT ANALYSIS OF COVARIANCE
2600 IF R=1 THEN P$="PRETEST/POSTTEST" ELSE P$="PRETEST/LABTEST"
2610 REM  PLACE APPROPRIATE EXPERIMENTAL GROUP DEPENDENT VARIABLE
2620 REM  TEST SCORES IN D1(I)
2630 FOR I=1 TO N
2640 IF R=1 THEN D1(I)=E9(I) ELSE D1(I)=L9(I)
2650 NEXT I
2660 REM
2670 REM  PLACE APPROPRIATE CONTROL GROUP DEPENDENT VARIABLE SCORES
2680 REM  IN D2(I)
2690 FOR I=1 TO M
2700 IF R=1 THEN D2(I)=E(I) ELSE D2(I)=L(I)
2710 NEXT I
2720 REM
2730 FOR I=1 TO N
2740 F1=F1+B9(I)
2750 G1=G1+D1(I)
2760 Y1=Y1+B9(I)*2
2770 X1=X1+D1(I)*2
2780 NEXT I
2790 K1=F1/N
2800 K2=G1/N
2810 FOR I=1 TO N
2820 S4=S4+(B9(I)-K1)*2
2830 S6=S6+(D1(I)-K2)*2
2840 NEXT I
2850 S4=S4/(N-1)
2860 S6=S6/(N-1)
2870 FOR I=1 TO M
2880 F2=F2+B(I)
2890 G2=G2+D2(I)
2900 Y2=Y2+B(I)*2
2910 X2=X2+D2(I)*2
2920 NEXT I
2930 B1=F2/M
2940 B2=G2/M
2950 FOR I=1 TO M
2960 S3=S3+(B(I)-B1)*2
2970 S5=S5+(D2(I)-B2)*2
2980 NEXT I
2990 S3=S3/(M-1)

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ANCOVA (Continued)

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3000 S5=S5/(M-1)
3010 Y=F1+F2
3020 X=G1+G2
3030 FOR I=1 TO N
3040 P1=P1+(B9(I)*D1(I))
3050 NEXT I
3060 FOR I=1 TO M
3070 P2=P2+(B(I)*D2(I))
3080 NEXT I
3090 A1=( (F1↑2)/N + (F2↑2)/M ) - (Y↑2)/(M+N)
3100 A3=Y1+Y2-((Y↑2)/(M+N))
3110 A2=A3-A1
3120 A4=( (G1↑2)/N + (G2↑2)/M ) - (X↑2)/(M+N)
3130 A6=(X1+X2)-((X↑2)/(M+N))
3140 A5=A6-A4
3150 A8= P1+P2-( (F1*G1)/N + (F2*G2)/M )
3160 A9= P1+P2-( (X*Y)/(M+N) )
3170 A7=A9-A8
3180 K3=(F1+F2)/(M+N)
3190 L1=A6-((A9↑2)/A3)
3200 L2=A5-((A8↑2)/A2)
3210 S1=L1-L2
3220 S2=L2/(M+N-3)
3230 F=S1/S2
3240 L3=A8/A2
3250 M1=(L3*(K3-K1))+K2
3260 M2=(L3*(K3-B1))+B2
3270 Z3=Z3+1\ REM FLAG THAT ONE OF THE TWO POSSIBLE ANALYSES HAS BEEN DONE.
3280 RETURN
3290 REM
3300 REM*****SUBROUTINE TO INITIALIZE NUMERIC VARIABLES
3310 R=0\R1=0
3320 M=0\M1=0\M2=0\N=0
3330 F=0\F1=0\F2=0
3340 G1=0\G2=0
3350 K1=0\K2=0\K3=0
3360 B1=0\B2=0
3370 S1=0\S2=0\S3=0\S4=0\S5=0\S6=0
3380 X=0\X1=0\X2=0
3390 Y=0\Y1=0\Y2=0
3400 P1=0\P2=0
3410 A1=0\A2=0\A3=0\A4=0\A5=0\A6=0\A7=0\A8=0\A9=0
3420 L1=0\L2=0\L3=0
3430 D1=0
3440 Z1=0\Z2=0\Z3=0
3450 RETURN
3460 REM
3470 REM*****SUBROUTINE TO PRINT THE RESULTS OF THE ANALYSIS
3480 !#01\!#01\!#01
3490 !#01 TAB(32),P$

```

ANCOVA (Continued)

```

3500 !#01 TAB(29),"ANALYSIS OF COVARIANCE"
3510 !#01\!#01
3520 !#01 "          INSTRUCTOR: ",I$
3530 !#01 "          CLASS LOCATION: ",L$
3540 !#01 "          DATE CLASS BEGAN: ",D$
3550 !#01
3560 !#01 "          NUMBER OF SESSIONS: ",M9
3570 !#01 "LENGTH OF A SESSION (MINUTES): ",T9
3580 !#01
3590 IF O1=0 THEN GOSUB 2250
3600 GOSUB 3990
3610 !#01 TAB(30), "BETWEEN", TAB(45), "WITHIN", TAB(60), "TOTAL"
3620 !#01 TAB(30), "-----"
3630 !#01 "SUM OF SQUARES (PRETEST)",
3640 !#01 TAB(30), A1, TAB(45), A2, TAB(60), A3
3650 IF R=1 THEN P1$="POSTTEST" ELSE P1$="LABTEST"
3660 !#01 "SUM OF SQUARES (",P1$,")",
3670 !#01 TAB(30), A4, TAB(45), A5, TAB(60), A6
3680 !#01 "SUM OF PRODUCTS", TAB(30), A7, TAB(45), A8, TAB(60), A9
3690 !#01 "DEGREES OF FREEDOM", TAB(30), 1, TAB(45), M+N-2, TAB(60), M+N-1
3700 !#01 "ADJUSTED SUM OF SQUARES",
3710 !#01 TAB(30), L1-L2, TAB(45), L2, TAB(60), L1
3720 !#01 "ADJUSTED DEGREES OF FREEDOM",
3730 !#01 TAB(30), 1, TAB(45), M+N-3, TAB(60), M+N-2
3740 GOSUB 3990
3750 IF O1=0 THEN GOSUB 2250
3760 GOSUB 3990
3770 !#01 TAB(23), "CONTROL GROUP", TAB(54), "EXPERIMENTAL GROUP"
3780 !#01 TAB(12), "-----",
3790 !#01 "-----"
3800 !#01 TAB(13), "MEAN", TAB(27), "STD. DEV.", TAB(47), "MEAN",
3810 !#01 TAB(61), "STD. DEV."
3820 !#01 TAB(12), "-----",
3830 !#01 TAB(46), "-----"
3840 !#01 "PRETEST", TAB(13), B1, TAB(27), SQRT(S3), TAB(47), K1,
3850 !#01 TAB(61), SQRT(S4)
3860 !#01 P1$, TAB(13), B2, TAB(27), SQRT(S5), TAB(47), K2,
3870 !#01 TAB(61), SQRT(S6)
3880 !#01
3890 !#01 "ADJ. MEANS", TAB(13), M2, TAB(47), M1
3900 !#01\!#01
3910 !#01 "          NUMBER IN CONTROL GROUP: ",M
3920 !#01 "NUMBER IN EXPERIMENTAL GROUP: ",N
3930 GOSUB 3990
3940 !#01\!#01 TAB(20), "F-STATISTIC: ",F
3950 !#01\!#01
3960 IF O1=0 THEN GOSUB 2250
3970 RETURN
3980 REM
3990 REM*****SUBROUTINE TO PRINT LINES

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ANCOVA (Concluded)

```

4000 !#01 "-----",
4010 !#01 "-----"
4020 RETURN
4030 REM
4040 REM*****PRESENT THE USER WITH OPTIONS FOR FURTHER ANALYSIS/GRADING
4050 GOSUB 2220
4060 IF Z3<>1 THEN 4230
4070 !"      THAT COMPLETES THE PRINTING OF THE ",P$," ANALYSIS FOR THE"
4080 !"TEST SCORES IN THE DATA FILE CALLED '",N$,"'. "\!
4090 IF R=1 THEN P$="PRETEST/LABTEST" ELSE P$="PRETEST/POSTTEST"
4100 !"      DO YOU NOW WISH TO DO A ",P$," ANALYSIS FOR THE DATA IN"
4110 !"THE FILE CALLED '",N$,"'? PLEASE RESPOND YES OR NO."
4120 !\INPUT "      ",R$
4130 GOSUB 2220
4140 IF R$="" THEN 4100 ELSE IF R$(1,1)="N" THEN 4250
4150 !"      AS SOON AS YOU'RE READY TO BEGIN THAT ANALYSIS, JUST"
4160 GOSUB 2250
4170 M4=M\N4=N
4180 Z4=Z3
4190 IF R=1 THEN R3=2 ELSE R3=1
4200 GOSUB 3300\ REM INITIALIZE NUMERIC VARIABLES
4210 M=M4\N=N4\R=R3\Z3=Z4
4220 RETURN
4230 !"      THAT COMPLETES THE PRINTING OF ALL ANALYSES POSSIBLE FOR THE"
4240 !"CLASS HAVING TEST SCORES STORED IN THE DATA FILE CALLED '",N$,"'. "\!
4250 !"      DO YOU WISH TO DO SOME GRADING OF TESTS OR CONDUCT THE ANALYSIS"
4260 !"OF SCORES FOR A CLASS OTHER THAN THAT IN '",N$,"'? PLEASE RESPOND"
4270 INPUT "YES OR NO. ",R$
4280 GOSUB 2220
4290 IF R$="" THEN 4250 ELSE IF R$="Y" THEN 4320
4300 !"      BYE FOR NOW."
4310 !\!END
4320 !"      IN ORDER TO RETURN TO THE PROGRAM THAT WILL ALLOW THAT,"
4330 GOSUB 2250
4340 CHAIN "ROUTER"
4350 RETURN

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## APPENDIX XII(e)

## CONLOAD

```

10 REM*****PROGRAM NAME
20 REM     CONLOAD
30 REM
40 REM*****LAST DATE OF REVISION
50 REM     1980-8-10
60 REM
70 REM*****AUTHOR(S)
80 REM     BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER,
90 REM     BOX 3992 UNIVERSITY STATION, LARAMIE, WY  82071
100 REM     PHONE\ 307/766-6381
110 REM
120 REM*****PROGRAM DESCRIPTION
130 REM     THIS PROGRAM LOADS PRETEST, POSTTEST AND LABTEST SCORES FOR
140 REM     THE CONTROL GROUP (OF SIZE 20) INTO A DATA FILE CALLED
150 REM     'CONTROL'.
160 REM
170 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
180 REM     1900 BYTES
190 REM
200 REM*****HARDWARE CONSIDERATIONS
210 REM     WRITTEN FOR THE NORTHSTAR HORIZON II MICROCOMPUTER
220 REM     (VERSION 5.1 MICROSOFT BASIC).  IT USES TWO DISK DRIVES.
230 REM
240 REM*****LIST OF PRINCIPLE NUMERIC VARIABLES USED IN THIS PROGRAM
250 REM     M = NUMBER OF PERSONS IN THE CONTROL GROUP
260 REM     B(I) = PRETEST SCORE FOR EACH CONTROL GROUP MEMBER
270 REM     E(I) = POSTTEST SCORE FOR EACH CONTROL GROUP MEMBER
280 REM     L(I) = LABTEST SCORE FOR EACH CONTROL GROUP MEMBER
290 REM
300 REM*****DIMENSIONS OF NUMERIC ARRAYS
310 DIM B(20), E(20), L(20)
320 REM
330 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
340 REM     CONTROL = THE DATA FILE IN WHICH THE SCORES FOUND IN THE DATA
350 REM     LINES OF THIS PROGRAM WILL BE STORED
360 REM
370 REM*****BEGIN MAIN PROGRAM
380 READ M
390 FOR I=1 TO M
400 READ B(I),E(I),L(I)
410 NEXT I
420 OPEN #0,"CONTROL"
430 WRITE #0, M
440 FOR I=1 TO M
450 WRITE #0, B(I), E(I), L(I)
460 NEXT I
470 CLOSE #0
480 REM*****THE NEXT DATA LINE TELLS THE NUMBER OF PERSONS IN THE CONTROL GROUP
490 DATA 20
500 REM*****THE REMAINING DATA LINES GIVE THE TEST SCORES (PRETEST/POSTTEST/
510 REM     LABTEST) FOR EACH PERSON IN THE CONTROL GROUP
520 DATA 32,34,6,32,33,5,31,33,3,31,31,5,30,30,5
530 DATA 30,28,3,29,28,6,29,28,4,28,26,4,27,23,0
540 DATA 26,23,2,25,23,2,25,23,4,24,23,3,23,22,3
550 DATA 22,21,4,20,21,2,20,21,0,17,19,0,14,14,1

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## APPENDIX XII(f)

## SIASCORE

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10 REM ***** PROGRAM NAME
20 REM      SIASCORE
30 REM
40 REM ***** DATE OF LAST REVISION
50 REM      1980-8-10
60 REM
70 REM ***** AUTHOR(S)
80 REM      R. L. MORISSETTE AND BOB KANSKY, SCIENCE & MATHEMATICS TEACHING
90 REM      CENTER, BOX 3992 UNIVERSITY STATION, LARAMIE, WY 82071.
100 REM      PHONE--307/766-6381
110 REM
120 REM ***** PROGRAM DESCRIPTION
130 REM      THIS PROGRAM WILL SCORE AND PRINT THE SUMMARY OF STUDENT
140 REM      RESPONSES TO THE 'SI ATTITUDE SCALE' DEVELOPED FOR USE BY
150 REM      THE TRI-STATE METRIC CONSORTIUM.
160 REM
170 REM ***** BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
180 REM      10450 BYTES
190 REM
200 REM ***** HARDWARE CONSIDERATIONS
210 REM      WRITTEN FOR A NORTH STAR HORIZON II MICROCOMPUTER (VERSION 5.1
220 REM      MICROSOFT BASIC) WITH DUAL DISK DRIVES
230 REM
240 REM ***** LIST OF PRINCIPAL NUMERIC VARIABLES AND ARRAYS
250 REM      A(I,J) = A 4 BY 7 ARRAY USED AS TEMPORARY, SUBSCRIPTED STORAGE
260 REM      FOR THE 28 RESPONSES BY A PARTICULAR PERSON
270 REM      B(I,J) = A 3 BY 8 ARRAY WHICH ACCUMULATES THE ATTITUDE SUB-
280 REM      TOTAL, BEHAVIOR SUBTOTAL, AND TOTAL FOR THE ENTIRE
290 REM      SCALE (ALL 28 ITEMS) FOR A PARTICULAR PERSON
300 REM      N = NUMBER OF PERSONS IN THE GROUP
310 REM      C = FLAG TO STORE OR NOT TO STORE INDIVIDUAL SCORES
320 REM      O1 = VARIABLE TO SEND PRINT STATEMENTS TO A PRINTER PORT
330 REM      A1 = THE AVERAGE ATTITUDE SUBSCORE FOR THE GROUP
340 REM      S1 = STANDARD DEVIATION OF THE ATTITUDE SCORES OF THE GROUP
350 REM      B1 = THE AVERAGE BEHAVIOR SUBSCORE FOR THE GROUP
360 REM      S2 = STANDARD DEVIATION OF THE BEHAVIOR SCORES OF THE GROUP
370 REM      T1 = THE AVERAGE TOTAL SCALE SCORE FOR THE GROUP
380 REM      S3 = STANDARD DEVIATION OF TOTAL SCALE SCORES OF THE GROUP
390 REM      S4 = SUM OF SQUARES OF ATTITUDE RAW SCORES FOR THE GROUP
400 REM      S5 = SUM OF SQUARES OF BEHAVIOR RAW SCORES FOR THE GROUP
410 REM      S6 = SUM OF SQUARES OF ALL RAW SCORES FOR THE GROUP
420 REM      R = SIZE OF DATA BLOCKS IN THE DATA FILE
430 REM
440 REM ***** DIMENSIONS OF NUMERIC ARRAYS
450 DIM A(4,7),B(3,8)
460 REM ***** LIST OF PRINCIPAL STRING VARIABLES
470 REM      N$ = CODE NAME OF CLASS TEST FILE
480 REM      D1$ = NUMERAL FOR DRIVE NUMBER OF CLASS TEST FILE
490 REM      C$ = N$+D1$

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## SIASCORE (Continued)

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500 REM          I$ = INSTRUCTOR'S NAME
510 REM          L$ = CLASS LOCATION
520 REM          D$ = DATE CLASS BEGAN
530 REM
540 REM ***** DIMENSIONS OF STRING VARIABLES
550 DIM I$(55), L$(55), D$(55)
560 REM
570 REM ***** INITIALIZATION OF NUMERIC VARIABLES
580 N=0\O=0\A1=0\B1=0\T1=0\S1=0\S2=0\S3=0\S4=0\S5=0\S6=0\O1=1\R=15
590 REM
600 REM ***** LIST OF DATA FILES USED BY THIS PROGRAM
610 REM          DUMBFIL = THIS DATA FILE HOLDS THE CODE NAME (N$) AND
620 REM          DRIVE NUMBER LOCATION (D$) OF THE CLASS TEST FILE
630 REM          SI-DATA = THIS DATA FILE IS USED TO STORE BOTH THE THREE
640 REM          SI ATTITUDE SCALE SUBSCORES (ATTITUDE, BEHAVIOR,
650 REM          TOTAL) OF EACH PERSON IN THE CLASS AND THE CLASS
660 REM          STATISTICS. THE PROGRAM ASSUMES THIS FILE HAS
670 REM          BEEN CREATED ON A DISK IN DRIVE #2 AND THAT IT
680 REM          PERMITS 15 BYTES OF STORAGE PER PERSON IN THE CLASS.
690 REM
700 REM ***** MAIN PROGRAM BEGINS
710 REM
720 GOSUB 1880
730 REM *** READ 'DUMBFIL' TO GET THE CODE NAME OF THE CLASS FILE
740 OPEN #0, "DUMBFIL"
750 READ #0, N$, D1$, D$
760 CLOSE #0
770 REM
780 REM *** READ THE CLASS TEST FILE TO GET DESCRIPTIVE INFO ABOUT THE CLASS
790 OPEN #0, C$
800 READ #0, N$, I$, L$, D$
810 CLOSE #0
820 REM
830 INDI
840 !"          SI ATTITUDE SCALE"
850 !"          (SCORING/ANALYSIS PROGRAM)"\!
860 !"          YOU MAY USE THIS PROGRAM TO DO THE FOLLOWING THINGS:"\!
870 !"          1. SCORE A SET OF RESPONSES TO THE 'SI ATTITUDE SCALE' AND"
880 !"          PRINT A SUMMARY OF THOSE RESPONSES"\!
890 !"          2. DO EVERYTHING IN ITEM #1 ABOVE AND SAVE THE RESPONSES IN"
900 !"          IN A FILE CALLED 'SI-DATA'"!\!
910 INPUT "          PLEASE TYPE THE NUMBER CORRESPONDING TO YOUR CHOICE. ",C$
920 GOSUB 1880
930 IF C#="" THEN 910 ELSE C=VAL(C$)
940 IF C<0 OR C>2 THEN 910
950 INDI
960 !"          USE OF THIS PROGRAM REQUIRES THE USE OF A PRINTER FOR MAKING"\!
970 !"          HANDCOPY OF THE RESULTS."!\!
980 !"          CHECK TO BE CERTAIN THAT THE PRINTER IS CONNECTED AND READY TO"\!
990 !"          BEGIN PRINTING. WHEN YOU'RE CERTAIN THAT EVERYTHING IS READY,"!\!

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SIASCORE (Continued)

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1000 INPUT "      PRESS THE <RETURN> KEY TO CONINUE WITH THIS PROGRAM. ",Y$
1010 GOSUB 1880\!\!\!\!
1020 IF C=1 THEN 1090
1030 !"      SINCE YOU WISH TO STORE THE RESPONSES FOR FUTURE USE, YOU"\!
1040 !"      MUST HAVE A DATA FILE NAMED 'SI-DATA' ON THE DISK IN DRIVE #2."!\!
1050 !"      THE DATA FILE SHOULD BE LARGE ENOUGH TO ALLOW 20 BYTES OF "\!
1060 !"      SPACE FOR EACH PERSON IN THE GROUP."!\!
1070 !"      CHECK TO SEE THAT THE FILE IS READY AND THEN PRESS THE"\!
1080 INPUT "      <RETURN> KEY IN ORDER TO CONTINUE WITH THIS PROGRAM. ",Y$
1090 GOSUB 2290 \ REM PRINT HEADINGS FOR INDIVIDUAL SCORES
1100 IF C=2 THEN GOSUB 1920 \ REM OPEN THE DATA FILE CALLED 'SI-DATA'
1110 GOSUB 1290 \ REM SCORE ONE SI ATTITUDE SCALE
1120 IF C=2 THEN GOSUB 1840 \ REM STORE INDIVIDUAL'S SUBSCORES IN THE DATA FILE
1130 GOSUB 2410 \ REM PRINT SUMMARY INFORMATION FOR ONE ATTITUDE SCALE
1140 GOSUB 1880\!\!\!\!
1150 !"      DO YOU HAVE ANOTHER ATTITUDE SCALE TO SCORE? PLEASE RESPOND"
1160 INPUT "      YES OR NO. ",Y$
1170 GOSUB 1880 \ IF Y$="" THEN 1150
1180 IF Y$(1,1)="Y" THEN 1110
1190 IF Y$(1,1)="N" THEN 1200 ELSE 1140
1200 GOSUB 2490 \ REM PRINT THE CLASS STATISTICS
1210 IF C=2 THEN GOSUB 1960 \ REM CLOSE THE DATA FILE 'SI-DATA'
1220 \!\!\!\!
1230 !"      DO YOU WISH TO RETURN TO THE MAIN DIRECTORY OF PROGRAMS FOR"\!
1240 !"      SCORING AND ANALYZING METRIC TESTS, OPINIONNAIRES AND ATTITUDE"\!
1250 !"      SCALES?"!\!
1260 INPUT "      PLEASE RESPOND YES OR NO. ",Y$
1270 GOSUB 1880 \ IF Y$="" THEN 1260
1280 IF Y$(1,1)="Y" THEN CHAIN "ROUTER" ELSE STOP
1290 REM *** SUBROUTINE TO SCORE ONE ATTITUDE SCALE
1300 IF N<>0 THEN 1390
1310 GOSUB 1880
1320 \!\!\!
1330 !"      SCORING ROUTINE FOR PERSON #",N+1 \!\!
1340 !"      I'M READY FOR YOU TO INPUT THE RESPONSES FOR PERSON",N+1,"."!\!
1350 !"      I'LL GIVE YOU THE ITEM NUMBERS ONE AT AT TIME. YOU GIVE ME THE"\!
1360 !"      RESPONSE (A NUMBER FROM 1 TO 5) AND PRESS THE <RETURN> KEY."!\!
1370 INPUT "      PRESS THE <RETURN> KEY WHEN YOU'RE READY TO BEGIN. ",Y$
1380 GOSUB 1880
1390 !"***** RESPONSES FOR PERSON",N+1\!
1400 K=1
1410 FOR I=1 TO 4
1420 FOR J=1 TO 7
1430 IF K/2=INT(K/2) THEN 1480
1440 !TAB(20),"ITEM",K,
1450 INPUT I T
1460 A(I,J)=I
1470 GOTO 1510
1480 !TAB(40),"ITEM",K,
1490 INPUT T

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## SIASCORE (Continued)

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1500 A(1,J)=1
1510 K=K+1
1520 NEXT J
1530 NEXT I
1540 !CHR$(7) \ REM RING BELL
1550 GOSUB 2030
1560 REM *** THE NEXT 3 LINES REVERSE THE VALUES OF 'NEGATIVE' ITEMS
1570 A(1,1)=6-A(1,1)\A(1,2)=6-A(1,2)\A(1,3)=6-A(1,3)\A(1,5)=6-A(1,5)
1580 A(1,7)=6-A(1,7)\A(2,6)=6-A(2,6)\A(3,2)=6-A(3,2)\A(3,3)=6-A(3,3)
1590 A(3,5)=6-A(3,5)\A(4,1)=6-A(4,1)\A(4,2)=6-A(4,2)
1600 REM *** THE NEXT SECTION COMPUTES THE SUBSCORES FOR THE THREE SCALES
1610 REM      (ATTITUDE, BEHAVIOR, TOTAL) FOR THE INDIVIDUAL WHOSE TEST WAS
1620 REM      JUST ENTERED.
1630 B(1,1)=A(1,1)+A(2,1)\B(2,1)=A(3,1)+A(4,1)\B(3,1)=B(1,1)+B(2,1)
1640 B(1,2)=A(1,2)+A(2,2)\B(2,2)=A(3,2)+A(4,2)\B(3,2)=B(1,2)+B(2,2)
1650 B(1,3)=A(1,3)+A(2,3)\B(2,3)=A(3,3)+A(4,3)\B(3,3)=B(1,3)+B(2,3)
1660 B(1,4)=A(1,4)+A(2,4)\B(2,4)=A(3,4)+A(4,4)\B(3,4)=B(1,4)+B(2,4)
1670 B(1,5)=A(1,5)+A(2,5)\B(2,5)=A(3,5)+A(4,5)\B(3,5)=B(1,5)+B(2,5)
1680 B(1,6)=A(1,6)+A(2,6)\B(2,6)=A(3,6)+A(4,6)\B(3,6)=B(1,6)+B(2,6)
1690 B(1,7)=A(1,7)+A(2,7)\B(2,7)=A(3,7)+A(4,7)\B(3,7)=B(1,7)+B(2,7)
1700 FOR I=1 TO 3\FOR J=1 TO 7\B(I,8)=B(I,8)+B(I,J)\NEXT J\nEXT I
1710 REM *** COMPUTE THE CURRENT THREE SUBSCALE TOTALS FOR ALL PERSONS IN
1720 REM      THE GROUP AT THIS POINT
1730 A1=A1+B(1,8)
1740 B1=B1+B(2,8)
1750 T1=T1+B(3,8)
1760 REM *** COMPUTE THE SUM OF SQUARES OF THE SUBSCALE SCORES OF ALL
1770 REM      PERSONS IN THE GROUP AT THIS POINT
1780 S1=S1+(B(1,8))^2
1790 S2=S2+(B(2,8))^2
1800 S3=S3+(B(3,8))^2
1810 REM *** ADVANCE THE COUNTER OF PERSONS
1820 N=N+1
1830 RETURN
1840 REM *** SUBROUTINE TO PLACE ONE PERSON'S SUBSCORES IN THE DATA FILE
1850 WRITE #120,N,NOENDMARK
1860 WRITE #120,(N-1)*R+5,B(1,8),B(2,8),B(3,8),NOENDMARK
1870 RETURN
1880 REM *** SUBROUTINE TO CLEAR THE SCREEN
1890 !CHR$(27),"*"
1900 RETURN
1910 REM
1920 REM *** SUBROUTINE TO OPEN THE DATA FILE
1930 OPEN #1,"SI-DATA,2"
1940 RETURN
1950 REM
1960 REM *** SUBROUTINE TO CLOSE THE DATA FILE AFTER ADDING THE
1970 REM      CLASS STATISTICS AND THE INSTRUCTOR'S NAME
1980 WRITE #12,N*N*R+5,A1,S1,B1,NOENDMARK
1990 WRITE #12,(N+1)*R+5,S2,T1,S3,NOENDMARK

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SIAScore (Continued)

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2000 WRITE #1Z((N+2)*R+5),N$
2010 CLOSE #1 \ RETURN
2020 REM
2030 REM *** SUBROUTINE TO CHANGE RESPONSES
2040 !\N!
2050 !"          DO YOU WISH TO MAKE ANY CHANGES IN THE RESPONSES JUST ENTERED"\!
2060 !"          FOR PERSON NUMBER",N+1," ?"\!
2070 INPUT "          PLEASE ANSWER YES OR NO. ",Y$
2080 GOSUB 1880 \ IF Y$="" THEN 2040
2090 IF Y$(1,1)="N" THEN 2280
2100 IF Y$(1,1)="Y" THEN 2110 ELSE 2040
2110 !\N!
2120 INPUT "          WHAT IS THE NUMBER OF THE ITEM TO BE CHANGED? ",A
2130 IF A<1 OR A>28 THEN 2120
2140 !"          WHAT IS THE CORRECT RESPONSE TO ITEM #",A,
2150 INPUT B
2160 IF B<1 OR B>5 THEN 2140
2170 GOSUB 1880
2180 IF A>7 THEN 2190 ELSE A(1,A)=B \ GOTO 2220
2190 IF A>14 THEN 2200 ELSE A(2,A-7)=B \ GOTO 2220
2200 IF A>21 THEN 2210 ELSE A(3,A-14)=B \ GOTO 2220
2210 A(4,A-21)=B
2220 !\N!
2230 !"          DO YOU WISH TO MAKE ANY MORE CHANGES IN THE RESPONSES OF"\!
2240 !"          PERSON #",N+1," ?"\!
2250 INPUT "          PLEASE ANSWER YES OR NO. ",Y$
2260 GOSUB 1880 \ IF Y$="" THEN 2250
2270 IF Y$(1,1)="Y" THEN 2110
2280 RETURN
2290 REM *** SUBROUTINE TO PRINT THE HEADING FOR INDIVIDUAL SCORES
2300 !#01\!#01\!#01
2310 !#01 "*****"\!#01
2320 !#01 "          INSTRUCTOR: ",I$
2330 !#01 "          CLASS LOCATION: ",L$
2340 !#01 "          DATE CLASS BEGAN: ",D$\!#01
2350 !#01 "*****"\!#01
2360 !#01 "          PERSON  ATTITUDE  BEHAVIOR  TOTAL"
2370 !#01 "          NUMBER    SCORE    SCORE    SCORE"\!#01
2380 !#01 "*****"\!#01
2390 RETURN
2400 REM
2410 REM *** SUBROUTINE TO PRINT THE SCORES FOR AN INDIVIDUAL
2420 !#01 TAB(7),N,
2430 !#01 TAB(17),B(1,8),
2440 !#01 TAB(28),B(2,8),
2450 !#01 TAB(37),B(3,8)
2460 B(1,8)=0\B(2,8)=0\B(3,8)=0
2470 RETURN
2480 REM
2490 REM *** SUBROUTINE TO PRINT THE CLASS STATISTICS

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SIASCORE (Concluded)

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2500 !#01
2510 !#01 "*****" \!#01
2520 !#01 "          CLASS STATISTICS"
2530 !#01 "          ( N = " , N , " ) " \!#01
2540 !#01 "          ATTITUDE          BEHAVIOR          TOTAL"
2550 !#01 "          -----"
2560 !#01 "          AVE. S.D.          AVE. S.D.          AVE. S.D."
2570 !#01 "          -----" \!#01
2580 S1=SQRT((S4-((A1↑2)/N))/(N-1))
2590 S2=SQRT((S5-((B1↑2)/N))/(N-1))
2600 S3=SQRT((S6-((T1↑2)/N))/(N-1))
2610 A1=A1/N
2620 B1=B1/N
2630 T1=T1/N
2640 !#01 TAB(6),INT(A1),TAB(9),(INT((S1*10)+.5))/10,
2650 !#01 TAB(17),INT(B1),TAB(22),(INT((S2*10)+.5))/10,
2660 !#01 TAB(30),INT(T1),TAB(35),(INT((S3*10)+.5))/10
2670 !#01
2680 !#01 "*****"
2690 RETURN

```

## APPENDIX XII(g)

## OPINION

```

10 REM*****PROGRAM NAME
20 REM      OPINION
30 REM
40 REM*****LAST DATE OF REVISION
50 REM      1980-8-10
60 REM
70 REM*****AUTHOR(S)
80 REM      BOB KANSKY, SCIENCE & MATHEMATICS TEACHING CENTER,
90 REM      BOX 3992 UNIVERSITY STATION, LARAMIE, WY  82071
100 REM     PHONE\ 307/766-6381
110 REM
120 REM*****PROGRAM DESCRIPTION
130 REM     THE PROGRAM SCORES THE METRIC WORKSHOP OPINIONNAIRE
140 REM
150 REM*****BYTES OF MEMORY REQUIRED (INCLUDING ARRAYS USED BY THE PROGRAM)
160 REM     15 400 BYTES
170 REM
180 REM*****HARDWARE CONSIDERATIONS
190 REM     WRITTEN FOR THE NORTHSTAR HORIZON II MICROCOMPUTER
200 REM     (VERSION 5.1 MICROSOFT BASIC).  IT USES TWO DISK DRIVES.
210 REM
220 REM*****LIST OF PRINCIPAL NUMERIC VARIABLES USED IN THIS PROGRAM
230 REM     A(I) = ARRAY HOLDING TEST RESPONSES FOR A STUDENT I
240 REM     B(I),D(I),E(I),F(I) = ARRAYS HOLDING THE SUMS OF RESPONSES
250 REM     TO EACH QUESTION
260 REM     K(I),L(I),L1(I) = ARRAYS HOLDING THE NUMBER OF PEOPLE WHO
270 REM     ANSWERED EACH QUESTION
280 REM     R(1),R(2),R(3),R(4) = ARRAYS HOLDING THE TOTAL NUMBER OF
290 REM     RESPONSES BY STATES AND OVERALL TOTAL
300 REM     P5,P6,P = NUMBER OF PEOPLE IN THE CLASS
310 REM     P7 = NUMBER OF PEOPLE TO BE ADDED TO THE DATA FILE
320 REM     F = FLAG THAT THE PROGRAM-USE OPTION IN EFFECT IS TO PRINT
330 REM     F1 = FLAG THAT THE PROGRAM-USE OPTION IS TO ADD OPINIONNAIRE
340 REM     DATA TO A FILE WHICH ALREADY CONTAINS SOME DATA
350 REM     S1 = IDENTIFIES THE STATE TO BE USED IN PRINTING THE SUMMARY
360 REM     OF THE OPINIONNAIRED DATA (1=IDAHO, 2=MONTANA, 3=WYOMING)
370 REM     O1 = THIS VARIABLE IS PART OF THE PRINT STATEMENTS OF THE FORM
380 REM     '!#01' .  WHEN O1=1, ALL PRINTING GOES TO THE PRINTER PORT,
390 REM     WHEN O1=0, PRINTING IS DONE ON THE CRT SCREEN.
400 REM
410 REM*****DIMENSIONS OF NUMERIC ARRAYS
420 DIM A(37),B(37),D(148),E(37),F(37),K(148),L(37),R(4),L1(37),P6(100),P(100)
430 REM
440 REM*****LIST OF PRINCIPAL STRING VARIABLES USED IN THIS PROGRAM
450 REM     N$ = NAME OF THE DATA FILE
460 REM     D1$ = STRING NAME OF THE DISK DRIVE NUMBER OF THE DATA FILE
470 REM     O$ = USED TO ACCESS FILE CONTAINING OPINIONNAIRE DATA FOR CLASS
480 REM     O1$ = USED TO ACCESS CLASS TEST FILE
490 REM     I$ = INSTRUCTOR'S NAME (FOR THE CLASS N$)

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OPINION (Continued)

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500 REM      L$ = LOCATION AT WHICH THE CLASS N$ WAS TAUGHT
510 REM      D$ = DATE THE CLASS N$ BEGAN
520 REM
530 REM*****DIMENSIONS OF STRING ARRAYS
540 DIM N$(8),O$(12),I$(55),L$(55),D$(55),O1$(12)
550 REM
560 REM*****INITIALIZE NUMERIC VARIABLES
570 F=0\PS=1\O1=1
580 REM
590 REM*****LIST OF DATA FILES AND/OR OTHER PROGRAMS USED BY THIS PROGRAM
600 REM      DUMBFIL = A FILE TO STORE THE NAME OF THE NEWLY CREATED
610 REM              FILE WHILE CHAINING TO THE MAIN PROGRAM
620 REM
630 REM      ROUTER = A ROUTING PROGRAM WHICH USES THIS PROGRAM FOR
640 REM              GRADING AND WHICH RELATES IT TO THE OTHER PRO-
650 REM              GRAMS IN THE SCORING/ANALYSIS PACKAGE
660 REM
670 REM      FILEMGR = A PROGRAM WHICH CREATES AND DESTROYS DATA FILES
680 REM              USED BY THIS PROGRAM
690 REM
700 REM      O1$ = THIS IS A DATA FILE CONTAINING THE PRETEST, POSTTEST
710 REM              AND LABTEST DATA FOR THE CLASS WHOSE OPINIONNAIRE
720 REM              DATA WILL BE STORED IN THE DATA FILE O$. FOR THE
730 REM              PURPOSE OF THIS PROGRAM, THE IMPORTANT THING ABOUT
740 REM              O1$ IS THE DESCRIPTIVE DATA (INSTRUCTOR'S NAME, ETC.)
750 REM              THAT IT CONTAINS.
760 REM
770 REM*****BEGIN MAIN PROGRAM
780 REM
790 GOSUB 3670\ REM CLEAR SCREEN
800 GOSUB 1000\ REM GET CLASS FILE NAME FROM 'DUMBFIL'
810 GOSUB 1090\ REM GET DESCRIPTIVE DATA (INSTRUCTOR'S NAME, ETC.) FROM O1$
820 GOSUB 1160\ REM DESCRIBE PROGRAM FUNCTION TO USER
830 REM
840 REM***NEXT FOUR LINES RESPOND TO THE OPTION TO PRINT THE GRAPH USING
850 REM      EXISTING DATA (I.E., WITHOUT ENTERING NEW DATA IN THE CLASS FILE).
860 REM
870 IF F=1 THEN GOSUB 3710\REM READ DATA FILE PREPARATORY TO PRINTING
880 IF F=1 THEN P6=P\REM MUST SET P6=P TO USE THE GRAPH-PRINTING ROUTINE
890 IF F=1 THEN GOSUB 4140\REM READ THE DATA STORED IN 'CONSORT' FILE
900 IF F=1 THEN 2810\REM PRINT THE GRAPH
910 REM
920 REM***THE NEXT LINE BEGINS THE OPTION OF ADDING ENTRIES TO THE CLASS FILE.
930 REM
940 GOSUB 1290\REM ASK IF DATA FILE ALREADY HAS SOME ENTRIES
950 IF F1=0 THEN 1370\REM INPUT DATA FROM OPINIONNAIRES FOR THE FIRST TIME
960 GOSUB 3710\REM READ DATA FILE BEFORE ADDING NEW DATA TO THE CLASS FILE
970 GOSUB 3950\REM FIND OUT HOW MANY PERSONS ARE TO BE ADDED TO THE DATA FILE
980 GOTO 1590\REM INPUT DATA FROM ADDITIONAL OPINIONNAIRES
990 REM

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OPINION (Continued)

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1000 REM****SUBROUTINE TO GET CLASS FILE NAME AND DRIVE NUMBER FROM 'DUMBFIL'
1010 REM
1020 OPEN #0,"DUMBFIL"
1030 READ #0, N$, I$
1040 CLOSE #0
1050 O1$=N$+"", "+I$"
1060 O$="9"+N$+"", "+I$"
1070 RETURN
1080 REM
1090 REM****SUBROUTINE TO GET DESCRIPTIVE CLASS DATA FROM CLASS TEST FILE
1100 REM
1110 OPEN #0, O1$
1120 READ #0, N$, I$, L$, D$
1130 CLOSE #0
1140 RETURN
1150 REM
1160 REM****SUBROUTINE TO DESCRIBE THE PROGRAM'S FUNCTION TO THE USER
1170 REM
1180 !"
1190 !" METRIC WORKSHOP OPINIONNAIRE PROGRAM"\!
1200 !" YOU CAN USE THIS PROGRAM TO DO ONE OF THE FOLLOWING THINGS."
1210 !" 1. ENTER OPINIONNAIRE DATA FOR THE CLASS WITH FILE NAME ",
1220 !" IN$, ""
1230 !" 2. PRINT A SUMMARY OF THE OPINIONNAIRE DATA IN THAT FILE"\!
1240 INPUT "TYPE THE NUMBER CORRESPONDING TO YOUR CHOICE. ", R$
1250 GOSUB 3670
1260 IF R$="" THEN 1190
1270 IF R$<>"1" THEN IF R$<>"2" THEN 1190 ELSE R=VAL(R$)
1280 IF R=2 THEN F=1
1290 RETURN
1300 !" HAVE YOU ALREADY STORED ANY OPINIONNAIRE DATA FOR THE CLASS"
1310 !" WITH FILE NAME ", N$, ""?"
1320 INPUT " PLEASE RESPOND YES OR NO. ", R$
1330 GOSUB 3670
1340 IF R$="" THEN 1300 ELSE IF R$(1,1)="Y" THEN F1=1
1350 RETURN
1360 REM
1370 REM **** ROUTINE TO ADD NEW DATA TO THE CLASS FILE
1380 REM
1390 !" I MUST KNOW IN WHICH STATE THE WORKSHOP WAS HELD. THE"
1400 !" POSSIBILITIES ARE:"
1410 !" 1. IDAHO"
1420 !" 2. MONTANA"
1430 !" 3. WYOMING"\!
1440 INPUT " TYPE THE NUMBER OF THE PROPER STATE. ", S1
1450 GOSUB 3670
1460 IF S1>3 THEN 1390
1470 Q=S1*37
1480 IF S1=1 THEN S1$="IDAHO"
1490 IF S1=2 THEN S1$="MONTANA"

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OPINION (Continued)

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1500 IF S1=S THEN S1$="WYOMING"
1510 !"          PLEASE COUNT THE NUMBER OF OPINIONNAIRES THAT YOU PLAN TO"
1520 !"          SCORE AT THIS TIME." \!
1530 INPUT "          HOW MANY SUCH OPINIONNAIRES ARE THERE? ",P
1540 FOR I=1 TO 37
1550 L1(I)=P*REM INPUTS MAXIMUM NUMBER OF RESPONSES POSSIBLE TO A GIVEN ITEM
1560 NEXT I
1570 GOSUB 3670
1580 REM
1590 REM ROUTINE TO ENTER THE RESPONSES ON EACH OPINIONNAIRE
1600 REM
1610 !"          I'LL NOW ASK FOR THE RESPONSES FROM A SINGLE OPINIONNAIRE."
1620 !"WHEN I'VE STORED THAT INFORMATION, I'LL ASK FOR THE RESPONSES"
1630 !"FROM THE NEXT OPINIONNAIRE." \!
1640 INPUT "          PRESS THE RETURN KEY TO CONTINUE. ",Y$
1650 GOSUB 3670
1660 FOR J=PS TO P
1670 !"          I'M READY FOR YOU TO GIVE ME THE OPINIONNAIRE RESPONSES FOR"
1680 !"INDIVIDUAL #",J,"." \!
1690 !"          ENTER THOSE RESPONSES IN FOUR LINES USING THE FORMAT SHOWN"
1700 !"BELOW. PRESS THE RETURN KEY AT THE END OF EACH OF THE FOUR LINES." \!
1710 !"          IF THE INDIVIDUAL DOES NOT RESPOND TO A GIVEN ITEM, TYPE THE"
1720 !"NUMBER 0 AS THE RESPONSE TO THAT ITEM." \!
1730 !"          HERE'S THE FORMAT FOR ENTERING THE RESPONSES." \! \!
1740 !"  **,**,**,**,**,**,**,**      (RESPONSES TO ITEMS 1 - 10)"
1750 !"  **,**,**,**,**,**,**,**      (RESPONSES TO ITEMS 11 - 20)"
1760 !"  **,**,**,**,**,**,**,**      (RESPONSES TO ITEMS 21 - 31)"
1770 !"  **,**,**,**,**      (RESPONSES TO ITEMS 32 - 37)"
1780 INPUT1 A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9),A(10) \!
1790 INPUT1 A(11),A(12),A(13),A(14),A(15),A(16),A(17),A(18),A(19),A(20) \!
1800 INPUT1 A(21),A(22),A(23),A(24),A(25),A(26),A(27),A(28),A(29),A(30),A(31) \!
1810 INPUT1 A(32),A(33),A(34),A(35),A(36),A(37) \!
1820 FOR I=1 TO 37
1830 IF A(I)>5 THEN EXIT 1870
1840 IF I>=32 AND A(I)>2 THEN EXIT 1870
1850 NEXT I
1860 !GOTO 1980
1870 GOSUB 3670 \! \! \!
1880 !"          THERE IS SOMETHING WRONG WITH ONE OF THE RESPONSES YOU"
1890 !"          ENTERED FOR THAT LAST OPINIONNAIRE. THE VALUES ENTERED FOR"
1900 !"          ITEMS 1-31 SHOULD RANGE FROM 0 TO 5; THE VALUES ENTERED FOR"
1910 !"          ITEMS 32-37 SHOULD RANGE FROM 0-2. OF COURSE, ALL VALUES"
1920 !"          SHOULD BE WHOLE NUMBERS." \!
1930 !"          I'M GOING TO HAVE TO ASK YOU TO ENTER ALL VALUES OF THAT"
1940 !"          LAST OPINIONNAIRE AGAIN." \!
1950 !"          PLEASE PRESS THE RETURN KEY AS SOON AS YOU'RE READY TO BEGIN"
1960 INPUT "          TO RE-ENTER THOSE VALUES. ",Y$
1970 GOSUB 3670 \GOTO 1670
1980 !"          DO YOU WISH TO MAKE ANY CHANGES IN THE INFORMATION ENTERED FOR"
1990 !"          THE LAST OPINIONNAIRE?" \!

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OPINION (Continued)

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2000 INPUT " PLEASE RESPOND Y OR N. ",X$
2010 GOSUB 3670
2020 IF X$="N" THEN 2070
2030 !" OKAY. I'M PREPARED TO HAVE YOU RE-ENTER ALL OF THE INFORMATION"
2040 !" FOR THAT LAST OPINIONNAIRE."!\!
2050 INPUT " PRESS THE RETURN KEY WHEN YOU'RE READY TO BEGIN. ",Y$
2060 GOSUB 3670\GOTO 1670
2070 FOR I=T TO 37
2080 R(I)=R(I)+A(I)
2090 IF A(I)<>0 THEN 2150
2100 REM
2110 REM***THE NEXT STATEMENT REDUCES THE MAXIMUM NUMBER OF POSSIBLE RESPONSES
2120 REM TO ITEM I BY 1 BECAUSE SOME PARTICIPANT DID NOT RESPOND TO ITEM I.
2130 REM
2140 L1(I)=L1(I)-1
2150 NEXT I
2160 NEXT J
2170 REM
2180 REM***THE FOLLOWING LOOP UPDATES THE TOTAL NUMBER OF PERSONS RESPONDING
2190 REM TO EACH OPINIONNAIRE ITEM--THAT NUMBER BEING L(I)--BY THE NUMBER
2200 REM OF REPOSSES TO EACH ITEM--DENOTED BY L1(I)--CONTRIBUTED BY THE
2210 REM OPINIONNAIRES JUST SCORED.
2220 REM
2230 FOR I=1 TO 37
2240 L(I)=L(I)+L1(I)
2250 NEXT I
2260 P6=P6 +P
2270 IF R=2 THEN 2420
2280 GOSUB 3850\REM UPDATE THE CLASS DATA FILE
2290 GOSUB 3670
2300 !" WILL YOU NEED TO ADD FURTHER OPINIONNAIRE RESPONSES FOR THIS"
2310 !" CLASS AT SOME FUTURE DATE?"!\!
2320 INPUT " PLEASE RESPOND Y OR N. ",X$
2330 GOSUB 3670\IF X$(1,1)=" " THEN 2300
2340 IF X$(1,1)="Y" THEN 3610
2350 REM
2360 REM****ROUTINE TO UPDATE THE STATE-AND-CONSORTIUM FILE (CONSORT).
2370 REM
2380 REM THE FILE CALLED 'CONSORT' CONTAINS THE SUM OF THE RESPONSES
2390 REM TO EACH OPINIONNAIRE ITEM (AND THE NUMBER OF PERSONS RESPONDING
2400 REM TO EACH ITEM) FOR EACH OF FOUR GROUPS. THESE GROUPS, AND THE
2410 REM SPACES OF THE 'CONSORT' FILE RESERVED FOR EACH, ARE GIVEN BELOW.
2420 REM
2430 REM SPACES 1-74 \ SUMS FOR ALL PERSONS IN THE CONSORTIUM
2440 REM SPACES 75-148\ SUMS FOR ALL PERSONS IN IDAHO
2450 REM SPACES 149-222\ SUMS FOR ALL PERSONS IN MONTANA
2460 REM SPACES 223-296\ SUMS FOR ALL PERSONS IN WYOMING
2470 REM SPACE 297\ NUMBER OF PERSONS IN THE CONSORTIUM (=R(1))
2480 REM SPACE 298\ NUMBER OF PERSONS FROM IDAHO (=R(2))
2490 REM SPACE 299\ NUMBER OF PERSONS FROM MONTANA (=R(3))

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OPINION (Continued)

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2500 REM          SPACE 300\ NUMBER OF PERSONS FROM WYOMING (=R(4))
2510 REM
2520 OPEN #1,"CONSORT"
2530 FOR I=1 TO 148
2540 READ #1,D(I),K(I)
2550 NEXT I
2560 READ #1,R(1),R(2),R(3),R(4)
2570 FOR I=1 TO 37
2580 D(I)=D(I)+R(I)
2590 K(I)=K(I)+L(I)
2600 Q=S1*S/
2610 D(Q+1)=D(Q+1)+R(I)
2620 K(Q+1)=K(Q+1)+L(I)
2630 NEXT I
2640 R(1)=R(1)+P6
2650 R(S1+1)=R(S1+1)+P6
2660 CLOSE #1
2670 OPEN #1,"CONSORT"
2680 FOR I=1 TO 148
2690 WRITE #1,D(I),K(I)
2700 NEXT I
2710 WRITE #1,R(1),R(2),R(3),R(4)
2720 CLOSE #1
2730 IF P=1 THEN 2810
2740 GOSUB 3670
2750 ! "          ALL OF THE FILES HAVE BEEN UPDATED. DO YOU NOW WISH TO SEE"
2760 INPUT "          A GRAPH OF THE RESULTS? (RESPOND Y OR N.)",X$
2770 GOSUB 3670
2780 IF X$="Y" THEN 2740
2790 IF X$(1,1)="Y" THEN 2810 ELSE 3600
2800 REM
2810 REM*****ROUTINE TO PRINT THE GRAPH
2820 REM
2830 ! "          BE CERTAIN THAT THE PRINTER IS TURNED ON. WHEN IT'S READY,"
2840 INPUT "          PRESS THE RETURN KEY TO BEGIN THE PRINTING OF THE GRAPH.",X$
2850 GOSUB 3670\!\!\!\!
2860 ! "          *****\!\!\!\!
2870 ! "          HANG IN THERE...\!\!\!\!
2880 ! "          THIS TAKES A BIT OF TIME.\!\!\!\!
2890 ! "          *****"
2900 GOSUB 4090
2910 !#01"          INSTRUCTOR: ",I$
2920 !#01"          WORKSHOP LOCATION: ",L$!\#01
2930 GOSUB 4090
2940 !#01"          KEY TO THE BAR GRAPH"\!#01!\#01
2950 !#01"          * : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS"
2960 !#01"          OPINIONNAIRE ITEM BY THE",P6," PERSONS IN THIS"
2970 !#01"          PARTICULAR METFIC WORKSHOP.\!\#01
2980 !#01"          † : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS"
2990 !#01"          OPINIONNAIRE ITEM BY THE",R(S1+1)," PERSONS FROM"

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OPINION (Continued)

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3000 !#01"          ",S1$," WHO HAVE TAKEN A METRIC WORKSHOP." \!#01
3010 !#01"          $ : INDICATES THE AVERAGE NUMERICAL RESPONSE TO THIS"
3020 !#01"          OPINIONNAIRE ITEM BYE THE",R(1)," PERSONS IN THE"
3030 !#01"          ENTIRE CONSORTIUM WHO HAVE TAKEN A METRIC WORKSHOP." \!#01
3040 GOSUB 4090
3050 !#01 \!#01
3060 !#01 "QUESTION #",TAB(14),"1.0          2.0          3.0          4.0          5.0"
3070 !#01 "          I-----I-----I-----I-----I"
3080 FOR I=1 TO 31
3090 !#01 I,TAB(15),"I",
3100 IF L(I)<>0 THEN 3130
3110 !#01 TAB(21),"NO PARTICIPANT IN THE CLASS RESPONDED TO THIS ITEM."
3120 GOTO 3170
3130 FOR J=16 TO (R(I)/L(I)+.5)*10
3140 !#01 "*",
3150 NEXT J
3160 !#01
3170 !#01 TAB(15),"I",
3180 FOR J=16 TO (R(Q+I)/K(Q+I)+.5)*10
3190 !#01 "+",
3200 NEXT J
3210 !#01
3220 !#01 TAB(15),"I",
3230 FOR J=16 TO (R(I)/K(I)+.5)*10
3240 !#01 "$",
3250 NEXT J
3260 !#01 \!#01
3270 NEXT I
3280 !#01 "          I-----I-----I-----I-----I"
3290 !#01 \!#01
3300 !#01 "          1.0          1.5          2.0"
3310 !#01 "          I-----I-----I"
3320 FOR I=32 TO 37
3330 !#01 I,TAB(30),"I",
3340 IF L(I)<>0 THEN 3370
3350 !#01 TAB(21),"NO PARTICIPANT IN THE CLASS RESPONDED TO THIS ITEM."
3360 GOTO 3410
3370 FOR J=31 TO (R(I)/L(I)+.5)*20
3380 !#01 "*",
3390 NEXT J
3400 !#01
3410 !#01 TAB(30),"I",
3420 FOR J=31 TO (R(Q+I)/K(Q+I)+.5)*20
3430 !#01 "+",
3440 NEXT J
3450 !#01
3460 !#01 TAB(30),"I",
3470 FOR J=31 TO (R(I)/K(I)+.5)*20
3480 !#01 "$",
3490 NEXT J

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OPINION (Continued)

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3500 !#01\!#01
3510 NEXT I
3520 !#01 " I-----I-----I"
3530 !#01\!#01
3540 GOSUB 4090
3550 !#01\!#01 TAB(12), "# OF PEOPLE WHO HAVE ANSWERED THIS OPINIONNAIRE"
3560 !#01 TAB(22), " IDAHO MONT WYO CONSORTIUM"
3570 !#01 TAB(22), Z7I, R(2), R(3), R(4), R(1)
3580 !#01
3590 GOSUB 4090
3600 GOSUB 3670
3610 !" DO YOU WISH TO DO ANY FURTHER WORK WITH METRIC TESTS OR"
3620 !" OPINIUNNAIRES?"\!
3630 INPUT " PLEASE ANSWER YES OR NO. ", Y$
3640 IF Y$="" THEN 3630
3650 IF Y$(1,1)="Y" THEN CHAIN "ROUTER" ELSE STOP
3660 REM
3670 REM*****SUBROUTINE TO CLEAR THE SCREEN
3680 REM
3690 !CHR$(27), "*" \ RETURN
3700 REM
3710 REM*****SUBROUTINE TO READ THE CONTENTS OF THE CLASS OPINION DATA FILE
3720 REM
3730 OPEN #0, D$
3740 READ #0, P, NREM P IS THE NUMBER OF PERSONS HAVING DATA IN D$
3750 READ #0, S1, NREM S1 IDENTIFIES THE STATE USED IN THE ANALYSIS
3760 FOR I=1 TO 37
3770 READ #0, B(I), L(I)
3780 NEXT I
3790 IF S1=1 THEN S1$="IDAHO"
3800 IF S1=2 THEN S1$="MONTANA"
3810 IF S1=3 THEN S1$="WYOMING"
3820 CLOSE #0
3830 RETURN
3840 REM
3850 REM*****SUBROUTINE TO WRITE DATA TO THE CLASS OPINION FILE
3860 REM
3870 OPEN #0, D$
3880 WRITE #0, P, S1
3890 FOR I=1 TO 37
3900 WRITE #0, B(I), L(I)
3910 NEXT I
3920 CLOSE #0
3930 RETURN
3940 REM
3950 REM SUBROUTINE TO PREPARE COUNTER TO ENTER P5 MORE PEOPLE TO THE DATA FILE
3960 REM
3970 !" HOW MANY MORE PERSONS DO YOU WISH TO ADD TO THE DATA FILE AT"
3980 INPUT "THIS TIME? ", P5
3990 FOR I=1 TO 37

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