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ABSTRACT
        Decision flowcharts are efficient and effective
training tools for librarians and library employees below the
administrative level. In addition, the cost of training programs is
reduced by the use of flowcharts. Training staff in the performance
of routine procedures is particularly suited to the use o f decision
flowcharts. The two types of flowcharts commonly used are the type
that documents the conditions that must exist before a decision is
reached and the type that documents a sequence of operations and
decisions. Simplicity for ease of understanding is a requirement for
both. Decision flowcharts are efficient because the trainee can learn
complex tasks quickly. And, they are effective because they may be
used to increase motivation and to reduce training time. (SJ)

REPORT

No. 59

Decision Flowcharts as Training Tools
in Libraries

by

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Librarians are constantly being admonished to adopt some
of the techniques developed in the fields of management science and
applied mathematics in order to analyze operations and facilitate
decision making. While the careful documentation of procedures
and analysis of the total library system is clearly of value to the
library administrator in his roles of change agent, or budgeteer,
or decision maker, it is not so clear what value certain of these
techniques have for those farther down the chain of command. To
justify the use of flowcharts in documenting procedures, for example,
it is frequently stated that the act of producing the chart will
lead to insights as to how unnecessary steps may be identified and
eliminated and how paper work may be decreased. The assumption is
made that until one writes each step of a procedure in a rectangular
box and each decision in a diamond that he never clearly sees what
he is doing -- that the prime motivators in organizing tasks are
habit and tradition and that reliance on habit and tradition is
necessarily bad. It certainly is true that sometimes unnecessary
operations are identified and paper work is eliminated when a
procedure is flowcharted. It is also true that sometimes highly
efficient or highly inefficient procedures are immortalized in flow-
charts and no great insights are gained from the act of flowcharting.
How then can one recommend the use of flowcharts to those who are not
at the highest levels of library administration. One answer is that
decision flowcharts are efficient and effective as training tools.

That the development of better training methods is not an
unimportant activity can be shown by figures obtained by a survey
made at the Wayne State University Libraries in October, 1971.
It was found that 1.758 per cent of total staff time was spent in
training activities. If training time was spread equally over all
categories of employees, the cost would be approximately $48,000.
However, since librarians devote 3.348 per cent of their time train-
ing other staff members, this figure is actually much lower than
real costs.

Flowcharts are recommended as a means to reduce this cost
because they have the following capabilities:

(1) They reduce the length of time that it takes
the trainee to learn complex rules.

(2) They describe a routine in the same way that
the trainee performs the routine.

(3) They permit the division of routines into
manageable subroutines as well as provide an
overview of total operations.

(4) They may be used as a motivational device by
allowing the reorganization of jobs into "whole
units of work" and by "vertical job loading".

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(5) They may be written with little training
in flowcharting.

(6) They are more easily revised than written
procedures.

If one is willing to accept the contention that the use of decision
flowcharts is suitable for training activities and that the use of
this technique will reduce the high cost of teaching routine pro-
cedures to staff, there are still two questions that must be
answered. First, what procedures can be described in this way and;
second, how can this technique be adapted to suit this specific use?

In 1960, Herbert A. Simon distinguished two types of
decisions: programmed decisions and nonprogrammed decisions.
Programmed decisions are "...repetitive and routine, a definite
procedure has been worked out for handling them so that they don't
have to be treated de novo each time they occur". (1) Non-
programmed decisions are those that are "novel, unstructured, and
consequential". When dealing with nonprogrammed decisions, the
system "...must fall back on whatever general capacity it has for
intelligent, adaptive, problem-oriented action". (2) C. Edward
Weber further defines routinized (programmed) decision making.

> The essential characteristic of
> routinized decision making is that
> the rules are specialized to handle
> a limited class of problems and
> that these specialized rules make
> the situation highly structured.
> Nonroutinized decision making
> (problem solving) uses general
> purpose rules rather than special
> purpose ones. (3)

Weber then describes the role of habit and tradition.

> [Routinized decision making] is an
> automatic consequence of preceding
> events in most cases. He [the manager]
> has internalized a set of rules that
> bring him to a predetermined outcome.
> The organizational manual of standard
> operating procedures and the organization
> structure itself are parts of these rules,
> and the manager conforms to them in most
> situations. (4)

Training staff in routine procedures is then seeing to it that they internalize ways of performing work (that is, that they develop desired habits) whether or not they receive their instruction from written procedures or by word of mouth. When procedures are documented in flowcharts, it is possible for those with little experience to grasp complex rules more quickly than if they rely on the gradual build up of experience or rely on lengthy verbal descriptions. And since it is possible to describe complex rules more clearly in this way, it is also possible to determine which of the decisions thought to be nonprogrammed and intuitive are actually programmed but not documented in a written form. Whenever a procedure is repeated frequently, it is likely that programmed decisions are involved regardless of whether or not the procedure includes many steps or is difficult to describe. As Weber notes, "Most decisions in organizations are routinized, since organizations can afford to be creative only at the margin". (5)

The Shiffman Medical Library is using flowcharts for the following functions: check-in of serials, claiming of serials, selection for binding, bindery preparation, processing of photo-duplication requests, determination of whether a serial title should be treated as a classed monographic series or as an un-classed serial, temporary binding routine, and processing of standing order invoices for serials. In <u>Scientific Management of Library Operations</u>, a flowchart appears on pages 60 to 64 that was used "to aid a bibliographic staff in learning the processes of screening and searching when a book was physically available as contrasted to screening and searching when only an order card was available". (6)

Two types of flowcharts are being used at the Shiffman Library. The first is the type that documents the conditions that must exist before a decision is reached. The flowchart for determining whether a series should be treated as a monographic series or as an unclassed serial (Example A) and the flowchart for bindery selection are of this type. The second type is the flowchart that documents a sequence of operations and decisions. The flowchart for bindery preparation is of this type. (Example C)

Since the purpose of both types is to train someone to either do something or to decide something, the first requirement is that they be easily understood. To accomplish this, only a few symbols are used and each chart is written following the same conventions. Symbols are restricted to the process block; the decision diamond; the terminal, or start/stop; the on-page connector; the off-page connector and the comment. Since the purpose is not to show what array of equipment is required, or whether a file is being merged, or if an operation is manual, and

so on, there is nothing to be gained by using additional symbols.
The desire for clarity (as well as increased comparability
between departments) determines the conventions used.

The conventions used are that the sequence of operations
moves from top to bottom and from left to right; flowlines do
not cross or intersect; and diagonal flowlines are not used.
When a loop is encountered, as in Figure 1A, a connector is used
to continue the flow, as in Figure 1B.
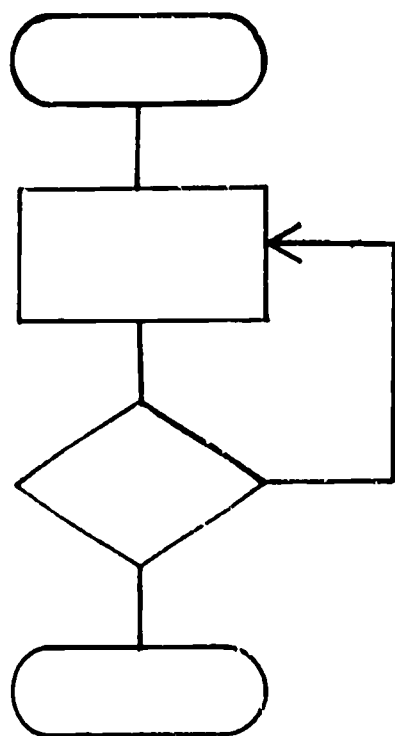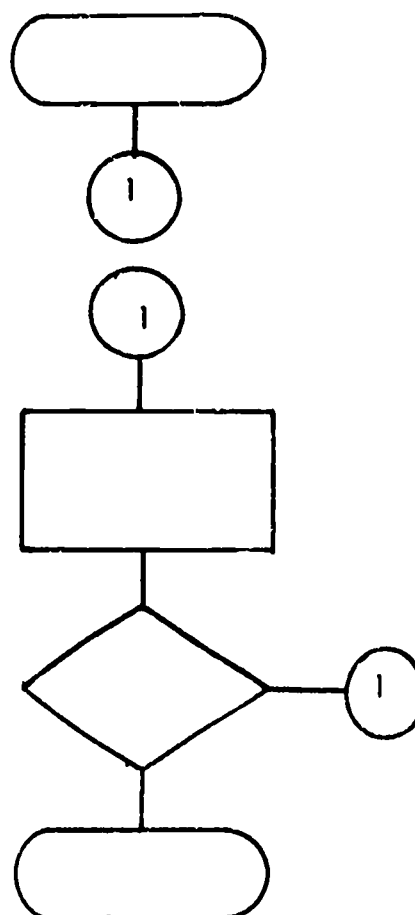
Figure 1A   Figure 1B

While this might appear to complicate the chart, it is possible by
this means to divide long procedures into manageable parts. The
learner may, for example, perform all operations between points
four and eight on a flowchart before he learns the entire operation.
Writing these very simplified flowcharts doesn't require any know-
ledge of computers, programming or systems analysis. It does require
knowledge as to how work is performed and willingness to go through
the drudgery of listing every step of an operation.

When writing the first type flowchart, that is the type
that documents conditions rather than a sequential flow of operations
and decisions, it is presumed that the user already knows what
operations would be performed and how to perform them. For example,
the user of the flowchart in Example A knows the relevant sources
to consult to determine whether or not a given serial is being
indexed. This flowchart could have been produced in the form of
a decision table as in Example B. However, with the large number
of combinations of conditions that are involved, it becomes difficult
to determine whether all combinations are represented in a table.
Example A could also be written as a narrative description, but such
a description would be extremely unwieldy. The only practical way
of documenting how this decision is reached in this particular set-
ting, rather than relying on a limited number of generally applied
criteria such as periodicity, editorship, and so on, is by producing
a document that actually reflects the way the decision maker
habitually approaches the problem when the action to be taken is not
clear cut.

This flowchart reflects the fact that in this particular
setting unclassed serials do not circulate while classed series do.
Access to serials is primarily through photocopy service but requests
are accepted for only those articles that can be photocopied in
thirty exposures or less. In this library, review-type serials
are not circulated, unless the articles cannot be photocopied,
regardless of their pattern of publication. Example A also reflects
the likelihood of a title being indexed in the future by including
periodicity and separate authorship of separate articles. Certainly
there are enough conditions present which would influence the final
decision so that it would take the learner a considerable time to
master them. The approach used in writing this type flowchart is
to list every condition that might influence the final decision.
The list is then arranged in a logical sequence and the flowchart
is written from this list.

When preparing to write the second type flowchart, the
type that documents the sequence of operations as well as decisions,
a block diagram may be drawn in order to select a manageable part
of a procedure to flowchart. A block diagram to provide an overview
of the bindery operation appears below. From this diagram, the
procedures for determining whether the title is ready for binding,
the procedures for preparing the title for binding, and the temporary
binding routine were selected for flowcharting. The relatively
simple procedure for updating records after the bindery shipment is
returned was described in a written form. Next, all operations to
be carried out and all decisions that might have to be made are
listed. The list is then used as a mnemonic aid when writing the
flowchart.

```
┌─────────────┐
│  Pull title │
│     for     │
│   Binding   │
└──────┬──────┘
       │
┌──────┴──────┐   No   ┌─────────────┐
│    Ready    │────────│ Temp. Bind. │
│     to      │        │  or Return  │
│    Bind?    │        │  to Shelves │
└──────┬──────┘        └──────┬──────┘
     Yes                      │
┌──────┴──────┐        ┌──────┴──────┐
│   Prepare   │        │   Update    │
│     for     │        │   Records   │
│   Bindery   │        │             │
└──────┬──────┘        └─────────────┘
       │
┌──────┴──────┐
│   Receive   │
│ Bindery and │
│Update Records│
└─────────────┘
```
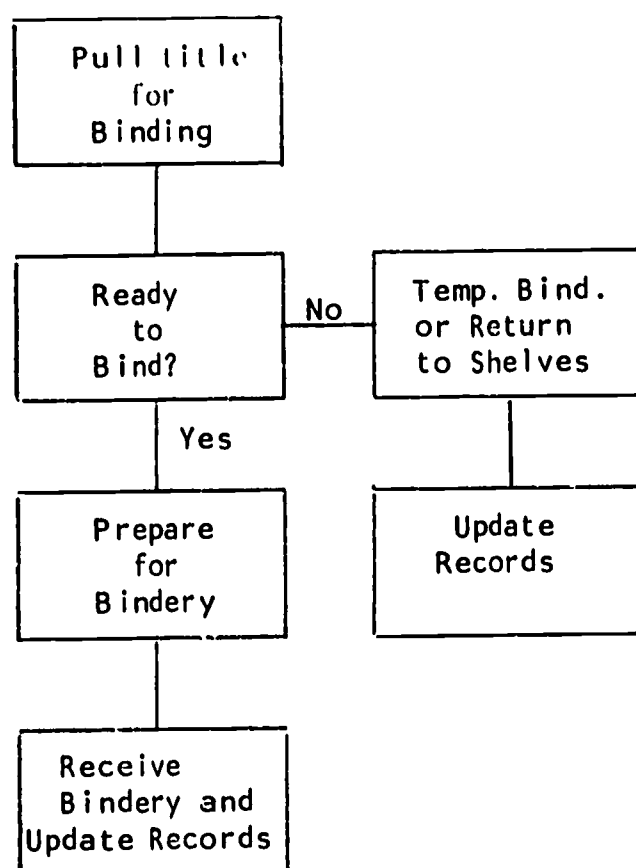
One value of the flowchart as a training aid is that it describes a routine in the same way that a person performs the routine. That is, the person gathers information, determines a course of action, then either makes a decision(s) or performs an operation(s). He then gathers more information, again determines a course of action, again makes a decision or performs an operation until he completes the total routine. When steps are irrelevant in a particular case, they are bypassed. Another value of the flowchart is that not only can operations be divided into manageable parts but they can be gathered into meaningful wholes.

Whenever tasks are divided into simple, highly routinized components, and the method for carrying out each of these components is highly structured, there is the danger of reducing the motivation of the worker performing the tasks. However, since it is possible to gather these tasks into meaningful wholes, it is also possible to reorganize task assignments so that this danger is eliminated and motivation is, in fact, increased.

In _The Motivated Working Adult_, Ray C. Hackman proposes a theory of job motivation. His theory depends on a view of the central nervous system as "an entity in its own right" with "the other systems in the body -- the muscular system, the circulatory system,

and the rest...its servants [which] [aid] and abet its need for survival". (7) He makes one basic assumption about this entity: "...its maintenance and development depend on the extent to which it receives stimulation". (8) Hackman notes that since the successful completion of a task (closure) reinforces motivation and since man seeks closure at ever-increasing levels of complexity, "it is reasonable to suggest that closure seeking is a natural function of this entity and serves to increase the stimulation potential of its psychological environment".(9) This definition contains a causal element, that is, stimulation seeking generates activity leading to the completion of ever-increasingly complex tasks. Successful completion of the tasks leads to further stimulation seeking. That is, stimulation seeking is self-reinforcing.

It was mentioned in this paper that by the use of flowcharts that make it possible to describe complex procedures, one is able to identify routines and decisions that are thought to be non-programmed and intuitive but which are actually programmed but not documented. This capability in turn makes it possible to load jobs vertically, that is to make the job more challenging by adding more difficult tasks to the job (as opposed to horizontal loading in which more tasks of the type already performed are added to the job). It also makes possible the assignment of whole units of work. (A whole unit of work may be defined as work that is organized as a unit and is performed by an individual -- as opposed to work in which separate tasks of a unit of work are assigned to various individuals.) That the organization of tasks into whole units of work is a powerful motivator is shown by experiments such as those carried out at the American Telephone and Telegraph Company and reported in <u>Motivation Through the Work Itself</u>.(10)

It is frequently noted that it is preferable to have those who perform work document that work so that actual routines are described. There is another practical reason that makes this desirable. It is far easier to teach subordinates to write these simplified decision flowcharts and to assist them in their charting than it is to learn all the minutia of someone else's job. It is also a compliment to that person to say, in effect, that they are performing their work so well and know their jobs so well that they are the ones best able to do the documentation. If the tasks being flowcharted are performed by the supervisor, it may be decided that the task -- now seen to be routinized -- should be assigned to a subordinate to vertically load the subordinate's job or to form a whole unit of work.

Decision flowcharts as training tools are, then, efficient because they allow the trainee to learn complex tasks quickly. And they are effective because they may be used to increase motivation and to reduce time spent on training thus allowing concentration on the real goals of the unit rather than on the means to achieve these goals.

REFERENCES

1. Herbert A. Simon, <u>The New Science of Management Decision</u> (New York: Harper & Brothers, 1960), p.5.

2. Simon, p.6.

3. C. Edward Weber and Gerald Peters, eds., <u>Management Action: Models of Administrative Decisions</u> (Scranton, Pa.: International Textbook Company, 1969), p.6.

4. Weber, pp. 7-8.

5. Weber, p. 7.

6. Richard M. Dougherty and Fred J. Heinritz, <u>Scientific Management of Library Operation</u> (New York, Scarecrow Press, 1966), p. 57.

7. Ray C. Hackman, <u>The Motivated Working Adult</u> (New York, American Management Association, 1969), p. 140.

8. Loc.cit.

9. Hackman, p. 141.

10. Robert N. Ford, <u>Motivation Through Work Itself</u> (New York, York, American Management Association, 1969).

class/
don't class

com-
plete in
fixed
vols. — yes — class

no

selective
acquisi-
tion — yes — class

no

unclassed
journal
supple-
ments
circulate

suppl.
to journal — yes — don't class

no

can't bind
because of
format or
periodic
revisions
as in some
govt. series

shelving
or binding
probs. — yes — solved
by classing — yes — class

no   no
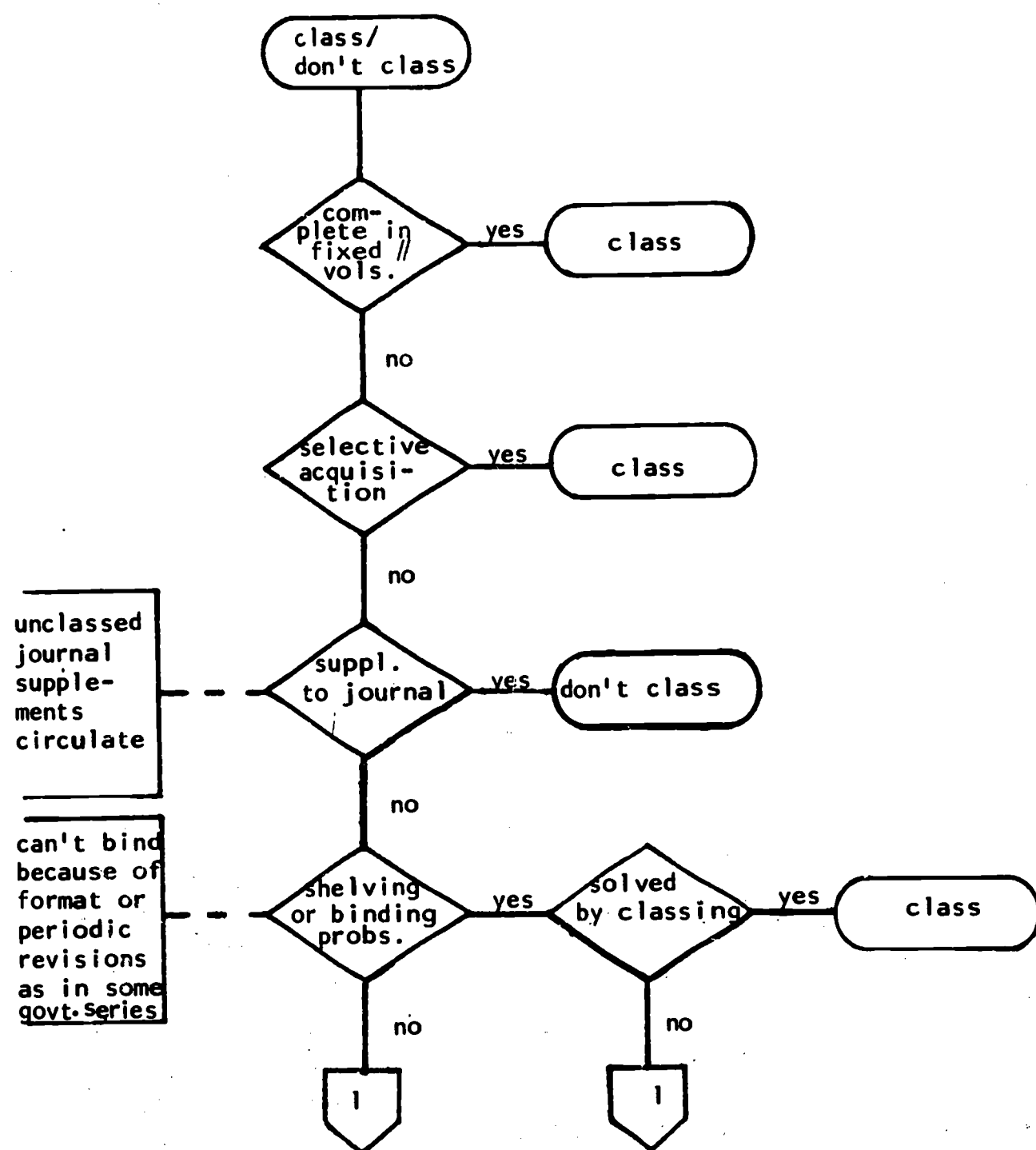
Example A-1
Chart drawn by Ruth Taylor and Carolyn Navarre
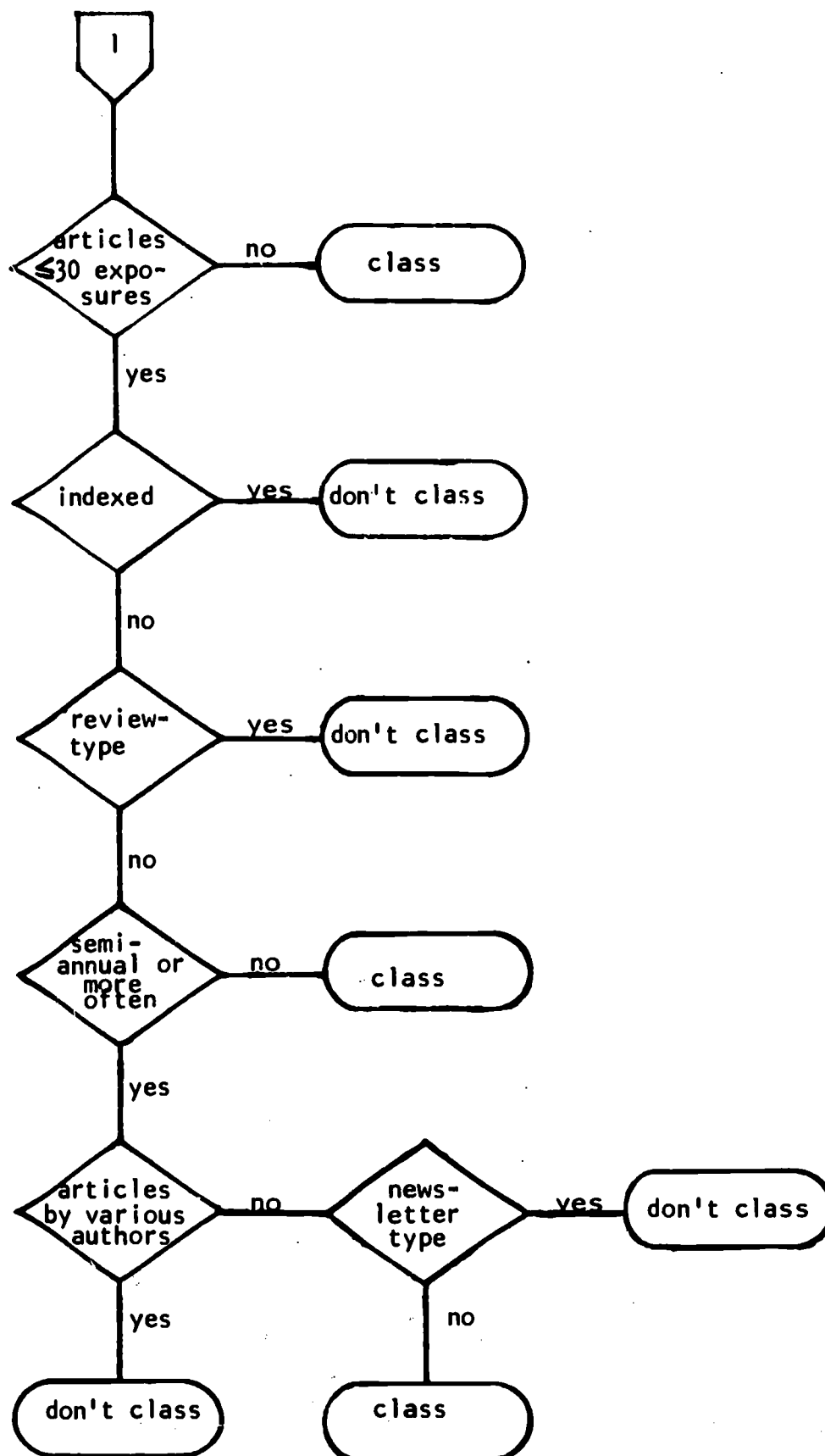
Example A-2

Column numbers	1	2	3	4	5	6	7	8	9	10	11	12	
Complete in fixed # of vols	Y	N	N	N	N	N	N	N	N	N	N	N	
Acquired selectively		Y	N	N	N	N	N	N	N	N	N	N	
Supplement to a journal			Y	N	N	N	N	N	N	N	N	N	
Shelving or binding problems				Y	Y	N	N	N	N	N	N	N	
Such problems solved by classing				Y	N	-	-	-	-	-	-	-	
Articles less than or = to 30 exposures					N	N	Y	Y	Y	Y	Y	Y	
Indexed							Y	N	N	N	N	N	ELSE
Review type								Y	N	N	N	N	
Semiannual or more frequent									N	Y	Y	Y	
Articles by various authors										Y	N	N	
Newsletter type											Y	N	
Serial			X				X	X		X	X		
Classed series	X	X		X	X	X			X			X	
Investigate error													X

Y = yes

N = no

X = action to be taken

Table is read down the numbered columns

Example B

```
  prep
  path
    │
    ▼
 ┌─────────┐
 │ bindery │  yes   ┌───┐
 │ plate   │───────▶│ 1 │
 └─────────┘        └───┘
    │ no
    ▼
 ┌─────────┐
 │  new    │  yes    ( 2 )
 │  title  │───────▶
 └─────────┘
    │ no
    ▼
 ┌─────────┐
 │  in     │
 │  last   │  yes    ( 3 )
 │shipment │───────▶
 └─────────┘
    │ no
    ▼
 ┌─────────┐
 │  will   │
 │be bound │  yes    ( 2 )
 │ again   │───────▶
 └─────────┘
    │ no
    ▼
   ( 3 )
```

```
      ( 2 )                      ( 3 )
        │                          │
        ▼                          ▼
 ┌───────────┐            ┌─────────────┐
 │write "new"│            │write "do not│
 │ on slip   │            │make plate"  │
 │           │            │ on slip     │
 └───────────┘            └─────────────┘
        │                          │
        ▼                          ▼
 ┌───────────┐            ┌─────────────┐
 │type title │            │type title   │
 │  and      │            │and color    │
 │ color     │            │ on slip     │
 └───────────┘            └─────────────┘
        │                          │
        ▼                          ▼
      ┌ 4 ┐                      ┌ 4 ┐
```
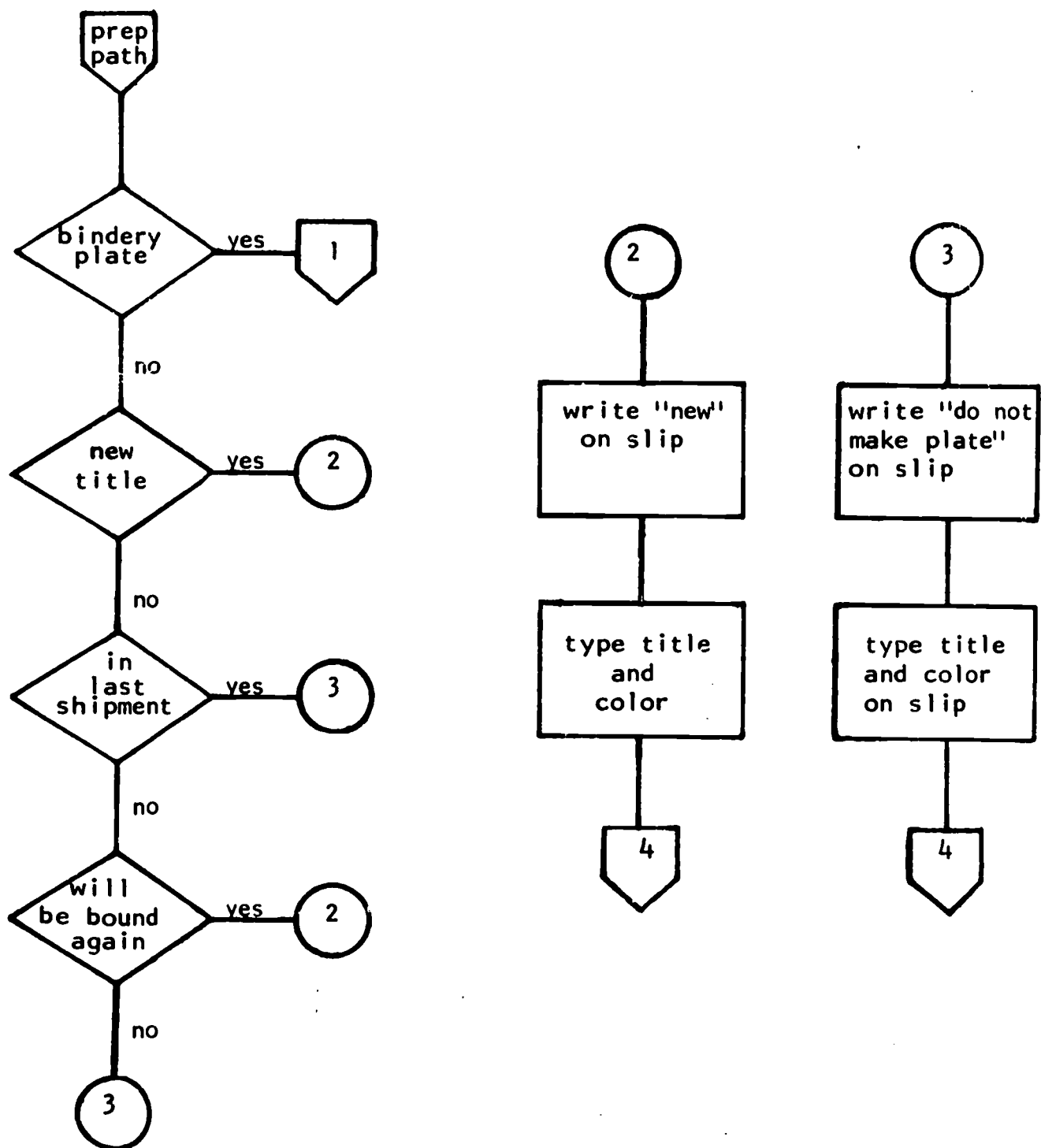
Example C-1 Bindery Preparation

Chart drawn by Mary Ann Neal and Carolyn Navarre

13

```
        ┌─┐
        │1│
        └┬┘
         │
    ╱title╲          ╱code ╲   yes   ┌──────────────┐
   ╱ correct╲──yes──╲match ╱────────▶│ use plate    │
   ╲        ╱        ╲    ╱          │ to print     │
    ╲      ╱          ╲  ╱           │ bindery slip │
      │no               │no          └──────┬───────┘
      ▼                 ▼                    ▼
┌───────────┐    ┌───────────┐            ┌───┐
│type title │    │correct code│           │ 7 │
│and send   │    │and send    │           └───┘
│plate back │    │plate back  │
│for correct-│   │for correct-│
│    ion    │    │    ion     │
└─────┬─────┘    └─────┬──────┘
      │                │
     (4)              (4)
```

```
     (4)
      │
   ╱indexed ╲   no   ╱ title    ╲   no   ┌──────────┐
  ╱separately╲──────╲page index ╱───────▶│Mark "bind│
  ╲          ╱       ╲          ╱         │as is"    │
    │yes               │yes               └────┬─────┘
    ▼                  ▼                        ▼
┌──────────┐    ┌───────────┐                ┌───┐
│mark "index│   │write      │                │ 7 │
│in back"   │   │"gather TP!│                └───┘
└─────┬────┘    │and put in │
      │         │front"     │
     ┌┴┐        └─────┬─────┘
     │5│             ┌┴┐
     └─┘             │6│
                     └─┘
```

Example C-2

14

```
                    ┌─────┐
                    │  5  │
                    └──┬──┘
                       │
                       │
                   ╱───┴───╲              ┌──────────────┐
                  ╱  covers  ╲    yes     │   mark       │
                 ╱  numbered  ╲──────────→│  "covers on" │
                  ╲          ╱            └──────┬───────┘
                   ╲───┬───╱                     │
                       │                         │
                       │no                       │
               ┌───────┴──────┐                ┌─┴─┐
               │   mark       │                │ 6 │
               │  "covers out"│                └───┘
               └───────┬──────┘
                       │
                     ┌─┴─┐
                     │ 6 │
                     └───┘


                     ┌───┐
                     │ 6 │
                     └─┬─┘
                       │
                   ╱───┴───╲              ┌──────────────┐
                  ╱   ads    ╲    yes     │   mark       │
                 ╱  numbered  ╲──────────→│  "ads in"    │
                  ╲          ╱            └──────┬───────┘
                   ╲───┬───╱                     │
                       │                         │
                       │no                       │
               ┌───────┴──────┐                ┌─┴─┐
               │   mark       │                │ 7 │
               │  "ads out"   │                └───┘
               └───────┬──────┘
                       │
                     ┌─┴─┐
                     │ 7 │
                     └───┘
```
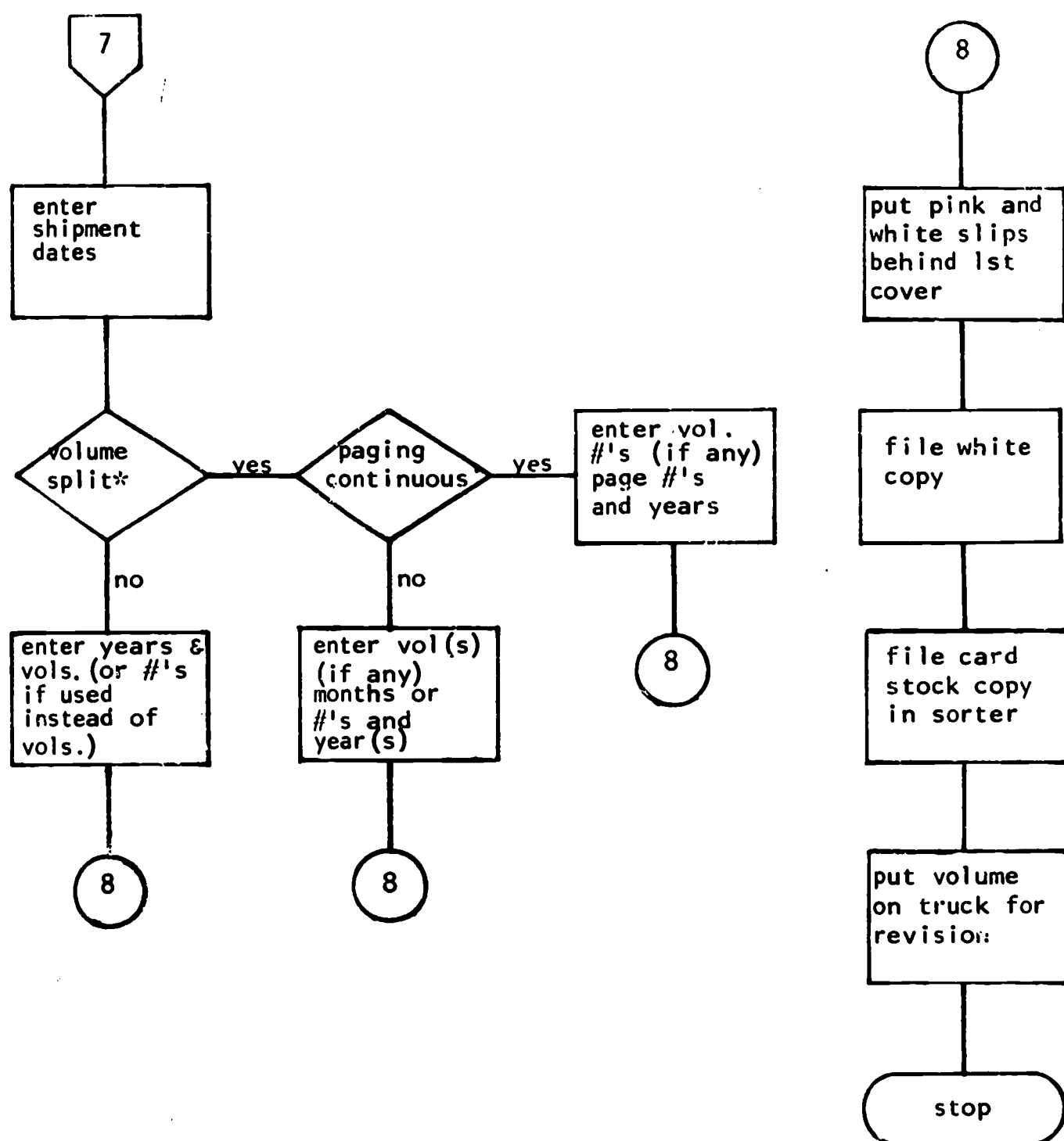
Example C-3

Example C-4

* Instructions included as part of bindery selection flowchart