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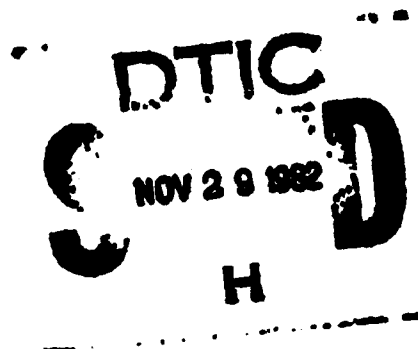
# DOCUMENTATION OF DECISION-AIDING SOFTWARE: SCORING RULE SYSTEM SPECIFICATION

DECISIONS AND DESIGNS INC.

Dorothy M. Amey  
/ Phillip H. Feuerwerger  
Roy M. Gulick

July 1979

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## ADVANCED DECISION TECHNOLOGY PROGRAM

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# **DOCUMENTATION OF DECISION-AIDING SOFTWARE: SCORING RULE SYSTEM SPECIFICATION**

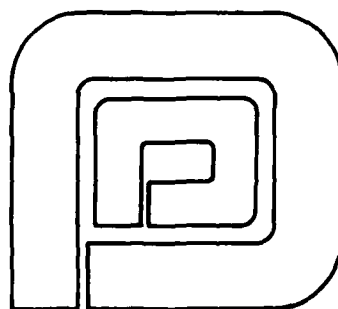
by

Dorothy M. Amey, Phillip H. Feuerwerger, and Roy M. Gulick

Sponsored by

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**DECISIONS and DESIGNS, INC.**

Suite 600, 8400 Westpark Drive  
P.O. Box 907  
McLean, Virginia 22101  
(703) 821-2828

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# SCORING RULE SYSTEM SPECIFICATION

## 1.0 INTRODUCTION

### 1.1 Purpose of the System Specification

The Scoring Rule System Specification is a technical document written for software development personnel. Together with the Scoring Rule Functional Description, it guides the software development effort by identifying the functional requirements and by providing structured logic diagrams that depict the flow, control, and processing of information within the system.

The Scoring Rule System Specification is generic and is intended to guide and facilitate the preparation of the language-specific program documentation and coding that are necessary to implement and operate Scoring Rule at an installation.

### 1.2 References

1.2.1 IBM, HIPO--A Design Aid and Documentation Technique. Technical Publication GC20-1851-0. White Plains, New York: IBM, October 1974.

1.2.2 Amey, Dorothy M.; Feuerwerger, Phillip H.; Gulick, Roy M. Documentation of Decision-Aiding Software: Scoring Rule Functional Description. McLean, Virginia: Decisions and Designs, Inc., July 1979.

1.2.3 Amey, Dorothy M.; Feuerwerger, Phillip H.;  
Gulick, Roy M. Documentation of Decision-Aiding  
Software: Scoring Rule Users Manual. McLean,  
Virginia: Decisions and Designs, Inc., July  
1979.

1.2.4 Brown, Rex V.; Kahr, Andrew S.; Peterson,  
Cameron R. Decision Analysis for the Manager.  
New York: Holt, Rinehart and Winston, 1974.

### 1.3 Terms and Abbreviations

1.3.1 Scoring Rule - Scoring Rule, the name of the  
system, is a short description of the function performed by  
the software, reflecting the system's method for testing,  
scoring, and training probability assessors.

1.3.2 SCORE - SCORE, an abbreviation for Scoring Rule,  
is used throughout this report to refer to the system.

1.3.3 Terms - Standard mathematical notations are used  
throughout this System Specification. Chapter 31 of refer-  
ence 1.2.4 provides additional background and insight into  
the terms and basic concepts underlying the procedures  
implemented by SCORE.

## 2.0 DESIGN DETAILS

### 2.1 Background

Systems development personnel should refer to the Scoring Rule Functional Description, reference 1.2.2, in conjunction with the documentation contained in this specification. The Functional Description details the testing procedure implemented by the software and discusses the specific functions that the software performs. In addition, systems development personnel may wish to refer to the Scoring Rule Users Manual, reference 1.2.3.

### 2.2 General Operating Procedures

SCORE is designed to interact with the user by presenting a sequential set of questions and alternative answers and asking the user to respond by selecting the correct answer and specifying the degree of certainty in the form of a probability. The user may optionally enter command characters (H, F, or S) which will allow the interruption of the question-answering mode. If the "H" command is entered, the system will return a list of available commands and an explanation of their use; the "F" command causes the output of intermediate results; and the "S" command causes an exit from the system prior to finishing the question set.

The system is also designed to be generally forgiving of procedural errors by the user.

### 2.3 System Logical Flow

SCORE is a hierarchically structured, modular system. The system structure and logical flow lends itself to

presentation in the form of HIPO diagrams, which are contained in this document.

The main purpose of the HIPO diagrams is to provide, in a pictorial manner, the complete set of modular elements necessary to the operation of SCORE including all input, output, and internal functional processing. This is done by displaying input items of the process step which uses them, defining the process, and showing the resulting output of the process step.

The documentation diagrams are designed and drawn in a hierarchical fashion from the main calling routines to the detail-level operation/calculation routines. Extended written descriptions are given below a HIPO diagram whenever it is deemed necessary.

A complete explanation of the symbolic notation used in the HIPO diagrams is given in reference 1.2.1. An abbreviated legend for the symbols used in this specification is given in Figure 2-1. Note that:

- a. External subroutines appear partly in the process block and partly out. Internal subroutines are shown within the process block.
- b. Overview diagrams show general inputs and outputs only, whereas detail/subroutine-level diagrams show specific input/output tables and/or displays.
- c. Rectangular boxes inside the input/output block areas are generally used to denote single data items. Two or more boxes are grouped to show several data items are input/output.

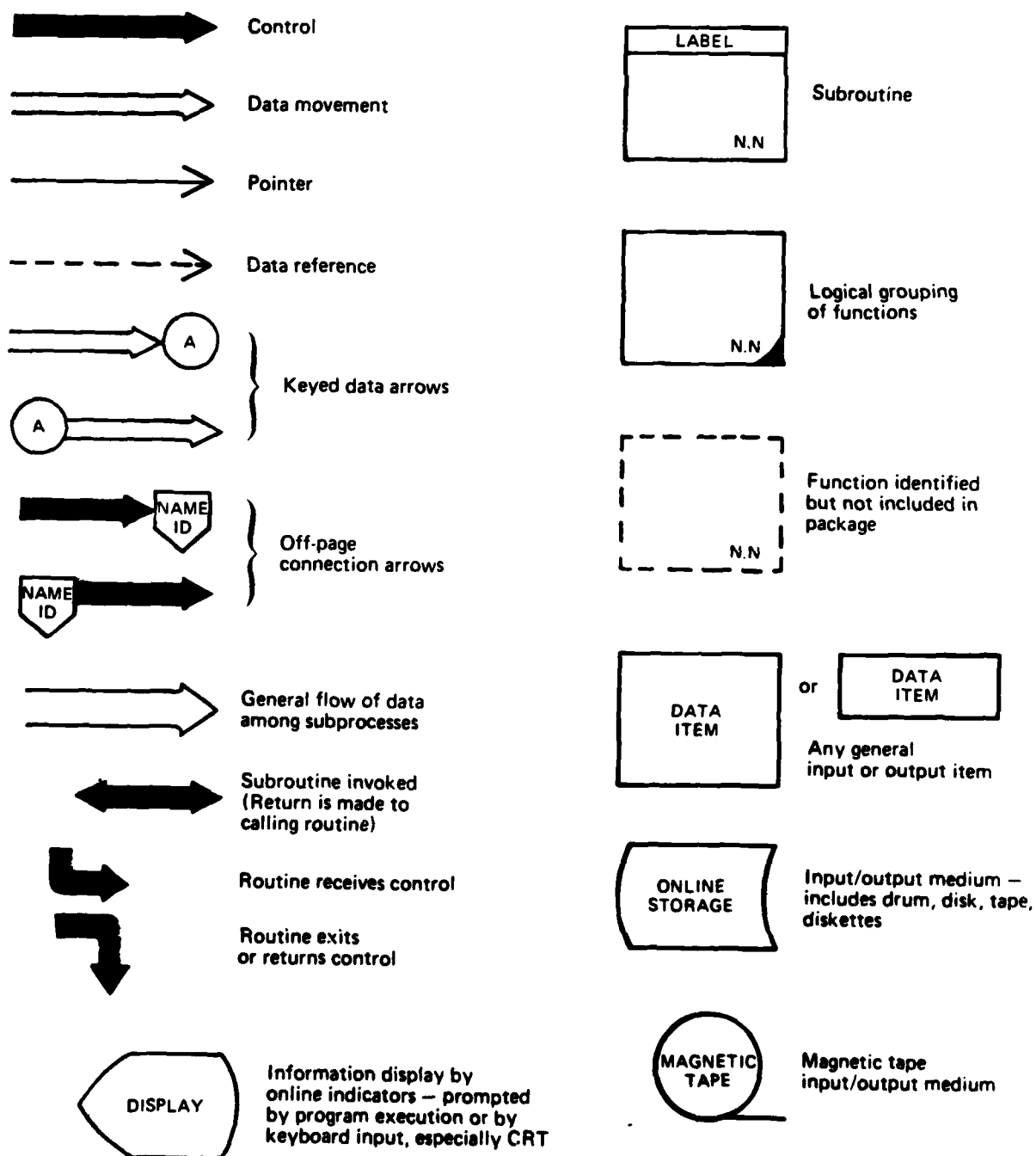


Figure 2-1  
LEGEND OF HIPO SYMBOLS

- d. Rectangular boxes inside the process block indicate repetitive subprocesses.

The HIPO diagrams appear in the next section, which completes the System Specification.

## 2.4 HIPO Documentation

The HIPO diagram identification numbers and figure numbers used in this section stand alone; i.e., they start with 1.0, increase hierarchically, and are independent of the number scheme used to this point in this document.

Figure 2-2 is a system structure chart and represents the overall program logic flow in a visual table of contents. The Visual Table of Contents diagram shows the hierarchical structure, the functional description labels, and the diagram (chart) identifiers of functions of SCORE.

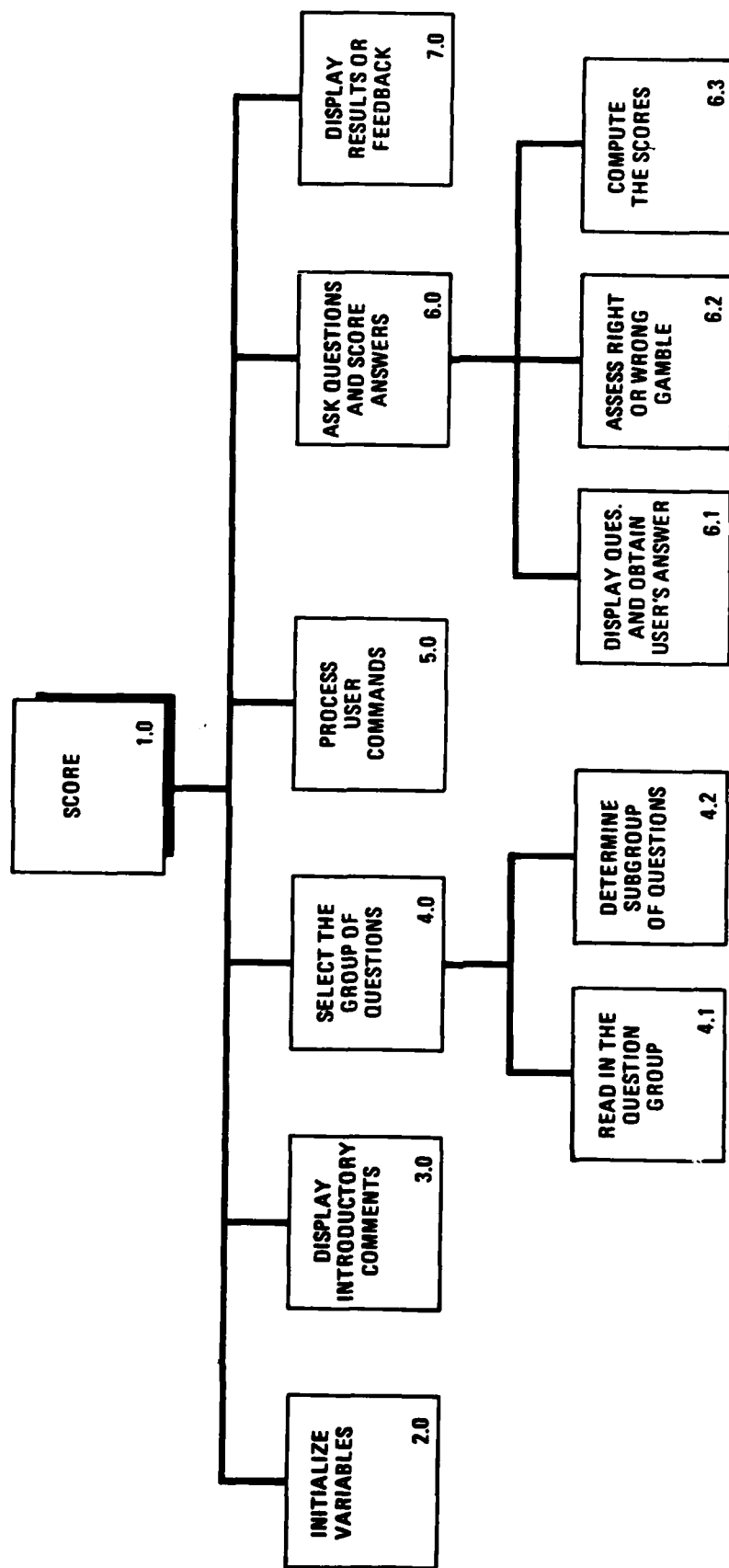
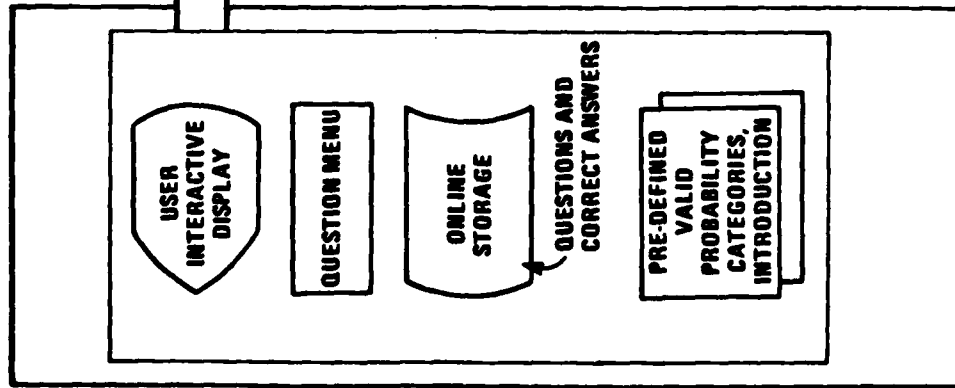
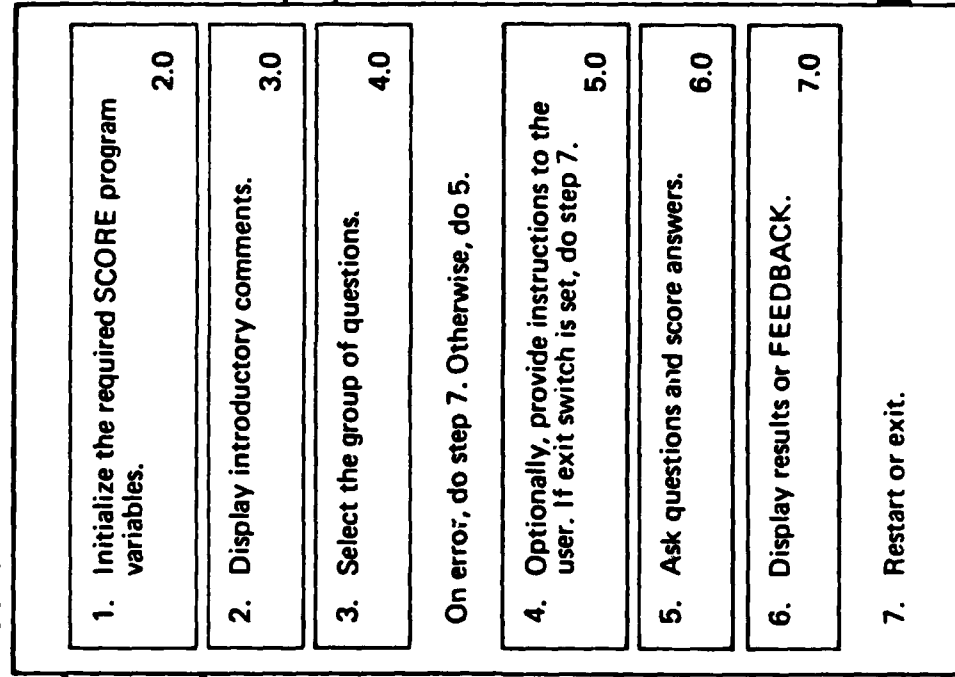


Figure 2-2  
SCORE OVERVIEW AND VISUAL TABLE OF CONTENTS

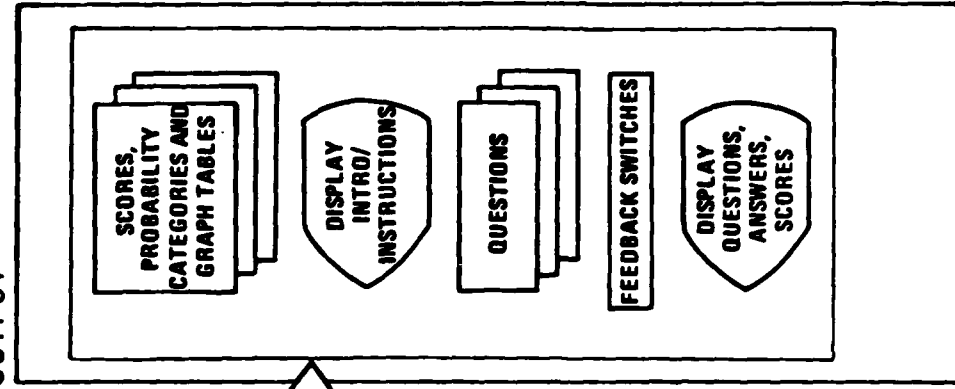
## INPUT



## PROCESS



## OUTPUT



## Extended Description

The SCORE program session begins with step 1 and proceeds through step 3. Steps 5 and 6 will normally follow the step 3 procedure unless the user enters a command request via the interactive terminal display. A command request is made by user response input of special characters to denote the following:

- HELP: provide instructions to the user on the use of commands
- FEEDBACK: provide results based on the current number of answered questions

or • STOP: exit from the program entirely.  
These commands are processed in step 4.

2. Introductory comments are displayed so that the user is informed about the SCORE program and its operation.

3. The actual questions to be asked reside on an auxiliary storage medium along with the correct answers for each question. Several sets of questions with different degrees of difficulty may be available. The user is allowed to select the desired questions to be asked.

4. This procedure is invoked when the user enters a command for HELP, FEEDBACK, or STOP or when a routine exits to display an error message with extended explanation.

1. The variables needed to properly compute and display results by the scoring rule are initialized.

|                 |             |                    |             |
|-----------------|-------------|--------------------|-------------|
| System Program  | SCORE       | Name               | SCORE       |
| Diagram ID: 1.0 | Description | SCORE Main Routine | Page 2 of 2 |

## INPUT

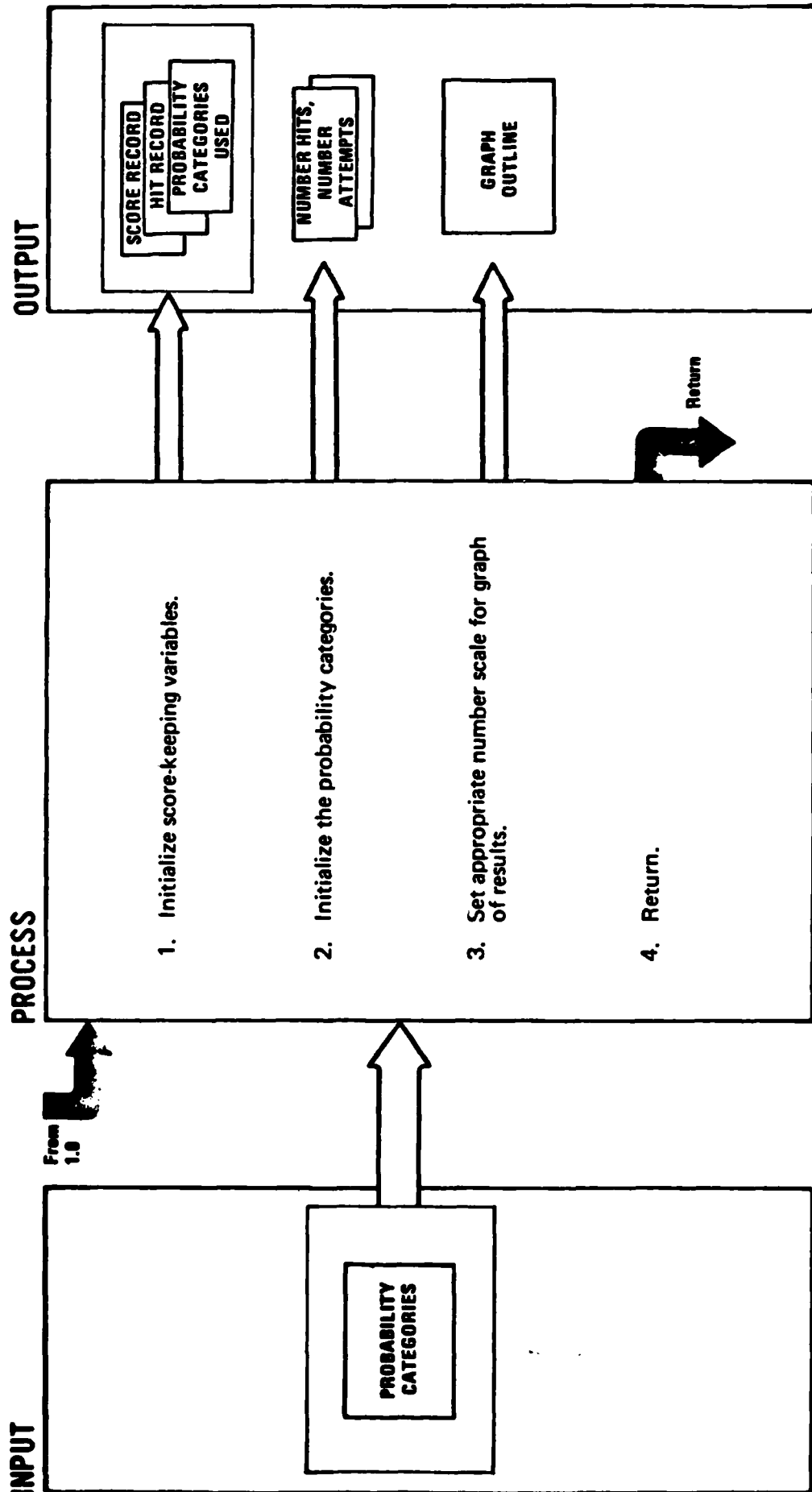
## PROCESS

## OUTPUT

### Extended Description

5. The computer displays a question with two answer choices. The user is prompted for an answer to the question (numerical choice) and a probability assessment for the correctness of the choice. Scores and score records are computed.

6. A graphic display of results by probability category is given as well as an overall performance score.



#### Extended Description

- The predefined categories that are used as input to this routine represent probabilities on a scale from 0.5 to 1.0. An example of such categories would be the following set: 0.5-.54, .55-.59, .60-.64, . . ., .95-1.0.
1. The score-keeping variables are initially null or blank vectors which are added to whenever another question is answered by the user. When the results are computed, there exists an element in each vector for every answered question.
  2. The number of correct answers in each probability category group and the number of answers attempted in the category group are initialized to zero for each category.

3. A graph outline is initialized so that the results may be displayed for the appropriate category groups.

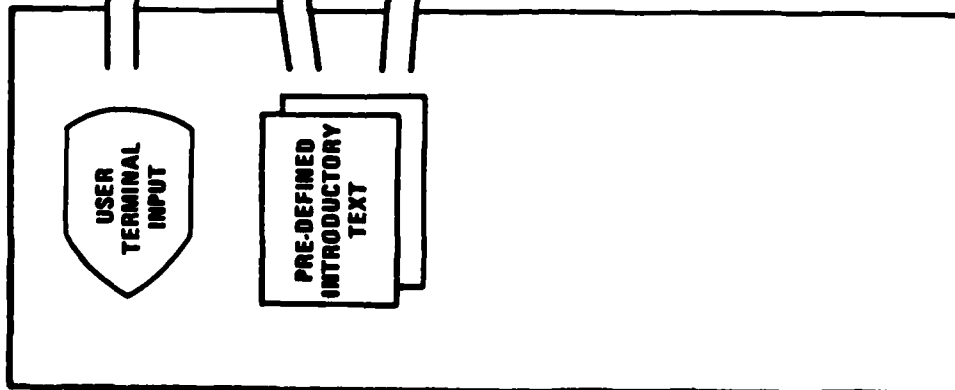
System/Program: **SCORE**

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

Diagram ID: **3.0** Description: **Display Introductory Comments**

Page: \_\_\_\_\_ of \_\_\_\_\_

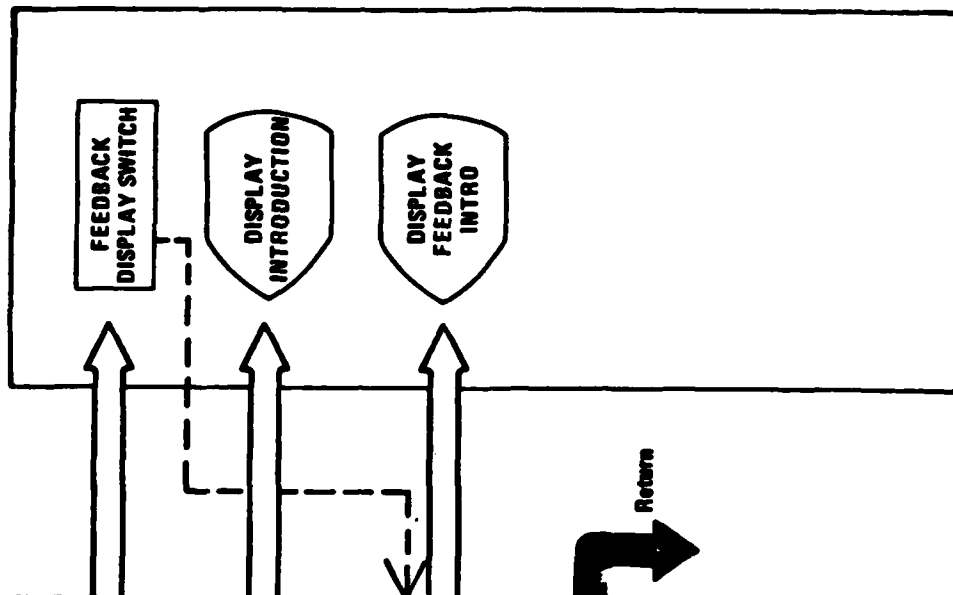
## INPUT



## PROCESS

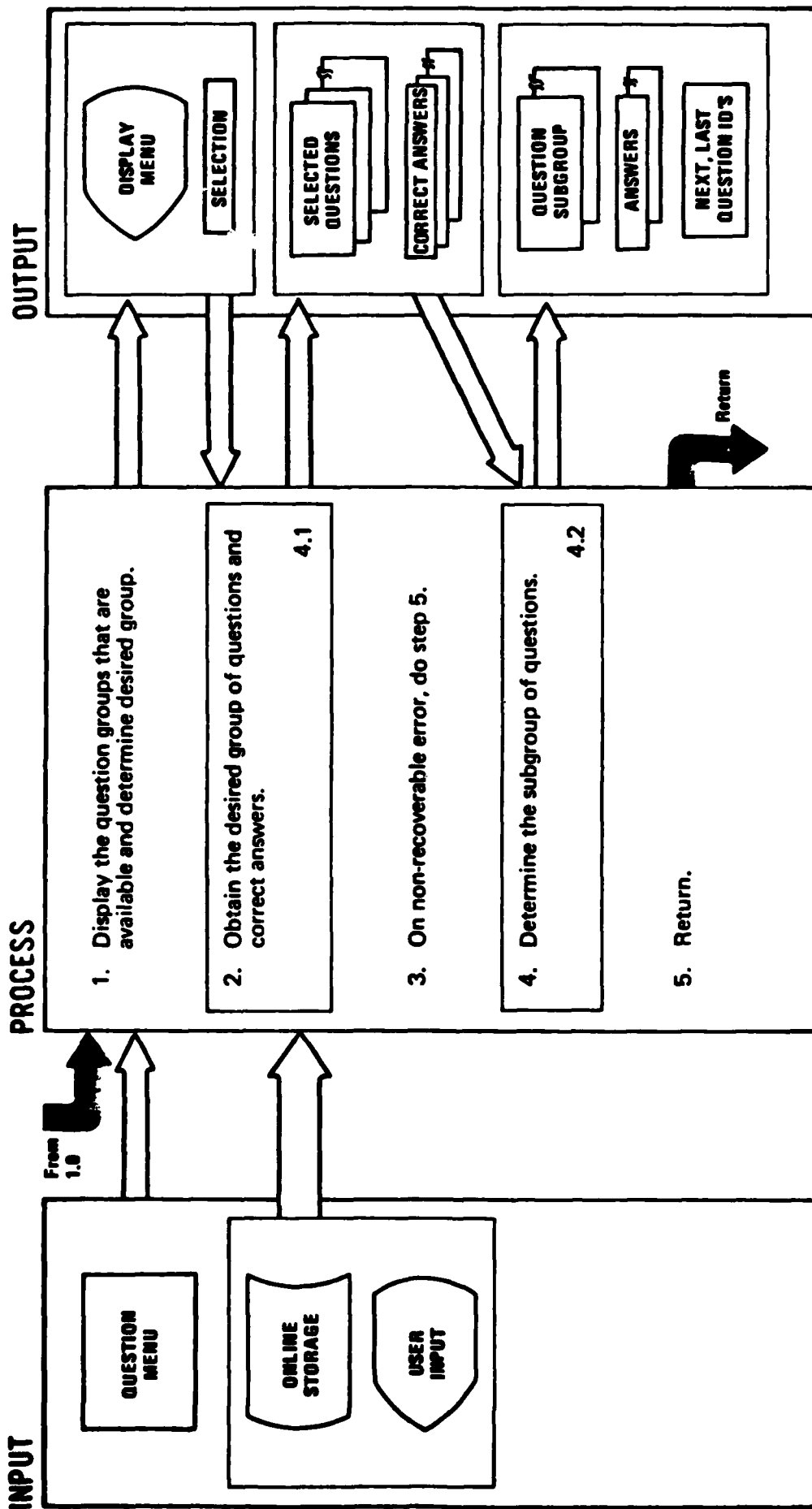
1. Determine if intermittent display of results is desired and set feedback switch.
2. Display overall introductory comments.
3. If the feedback display switch is set to one, display special introduction.
4. Return.

## OUTPUT



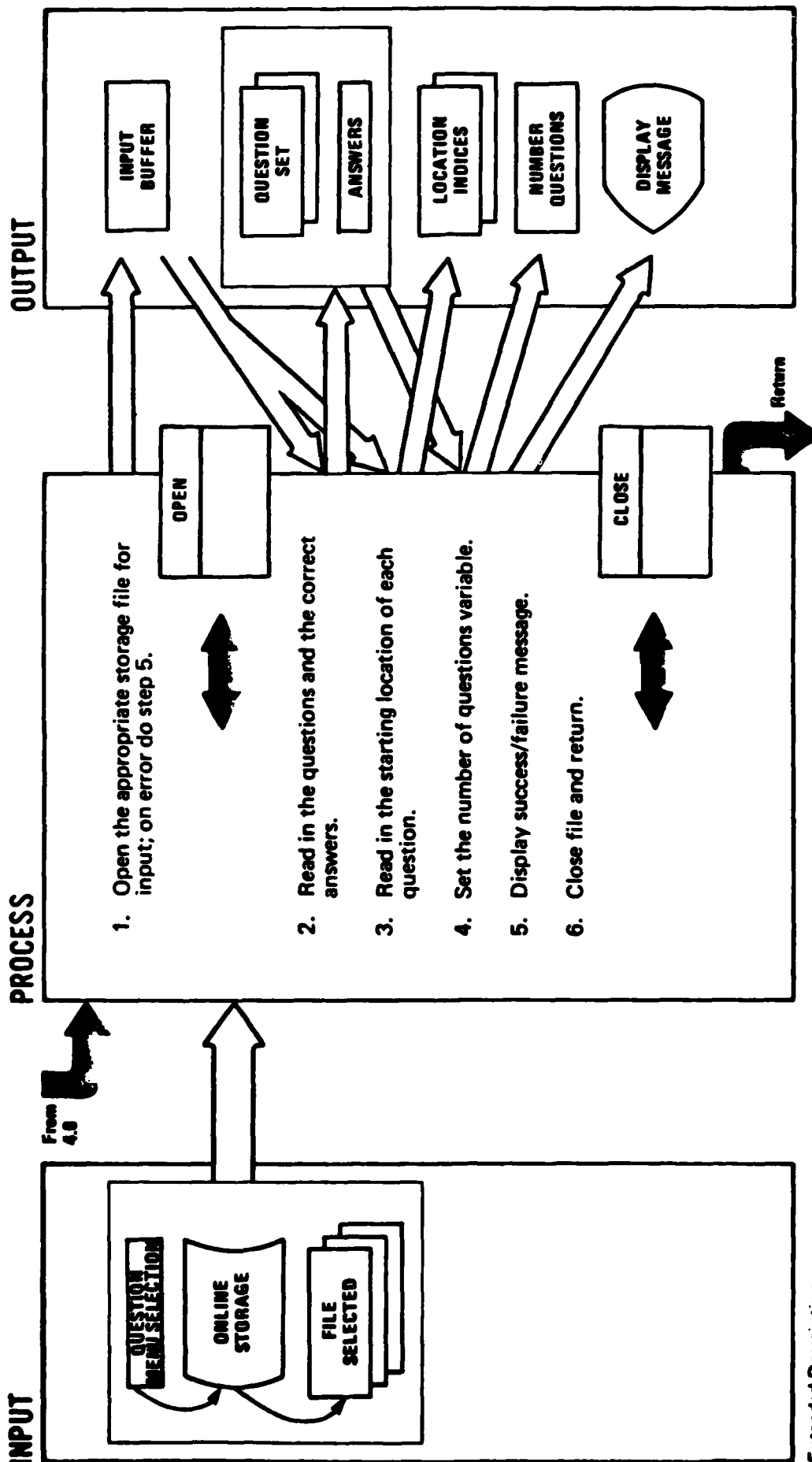
### Extended Description

Users may indicate that they want to know the probable points to win and lose on the score for each question by having a special FEEDBACK switch set at this point in the program.



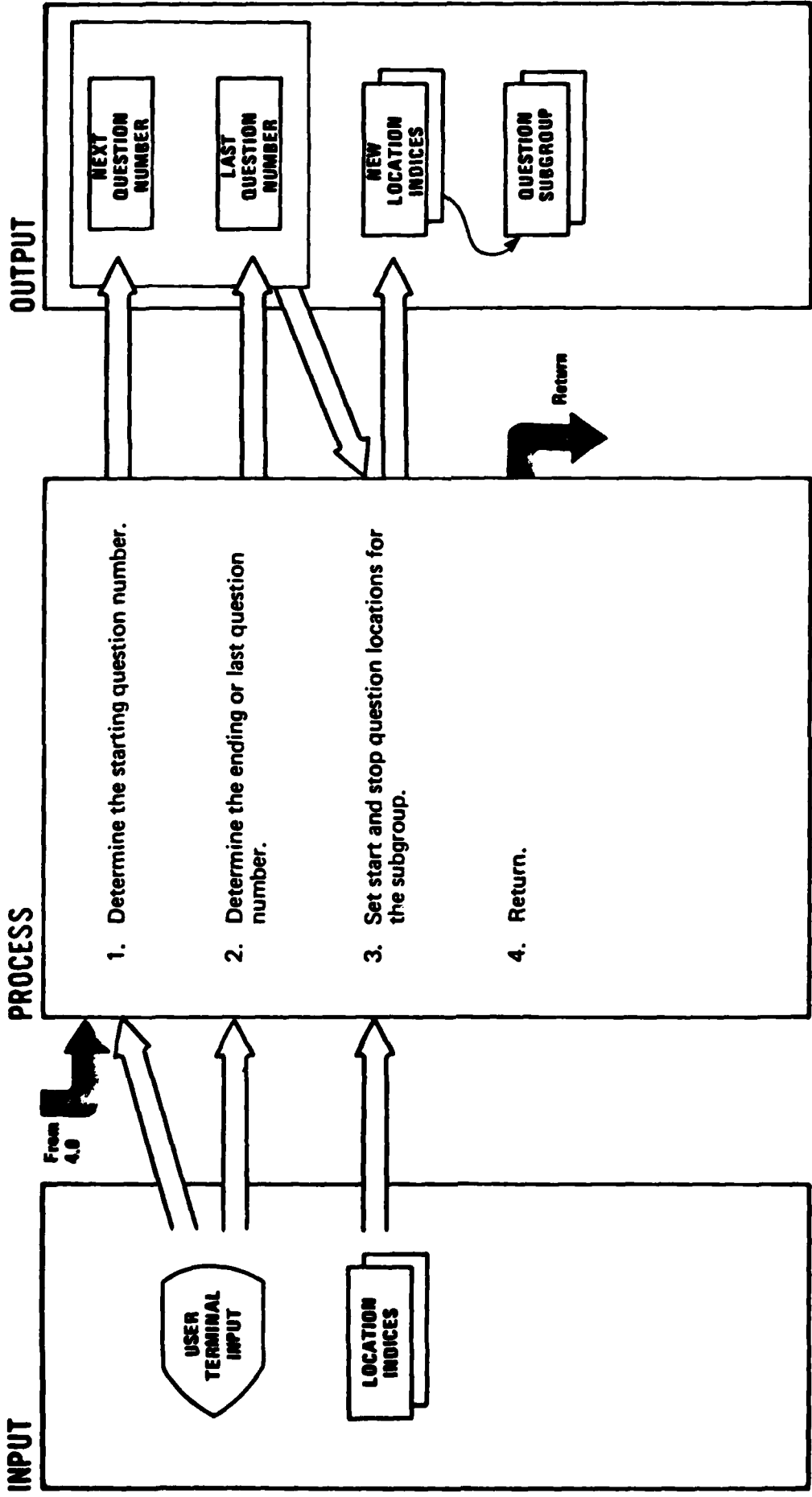
Extended Description

1. The available choices for question group selection are displayed in menu or item-list format. The user is prompted for the item number of the desired question set.
2. The question set number is used to access the appropriate group of questions and correct answers from a pre-determined storage medium.
3. If the program subroutines are unable to successfully perform input operations from the storage device, the routine is exited. The required variables would not be set in this case; hence the program must terminate.
4. The user may select a subset of the specified question set to answer during the particular session.



#### Extended Description

1. The correct file/device location for the question set and its associated variables is predefined by the menu selection process. A system OPEN routine is called to obtain access to the appropriate file.
- 2-3. Questions, the associated character starting location of each question in the set, and the correct answers are necessarily read in at this point.
6. A system routine is called to effect the freeing of the device or file for later use.



Extended Description

- 1-2. The user is prompted for the beginning and ending numbers of questions from the currently selected group that are to be asked during the program session.
3. A subgroup of questions to be asked is determined by including only those location indices of questions between (and inclusive of) the starting and ending numbers.

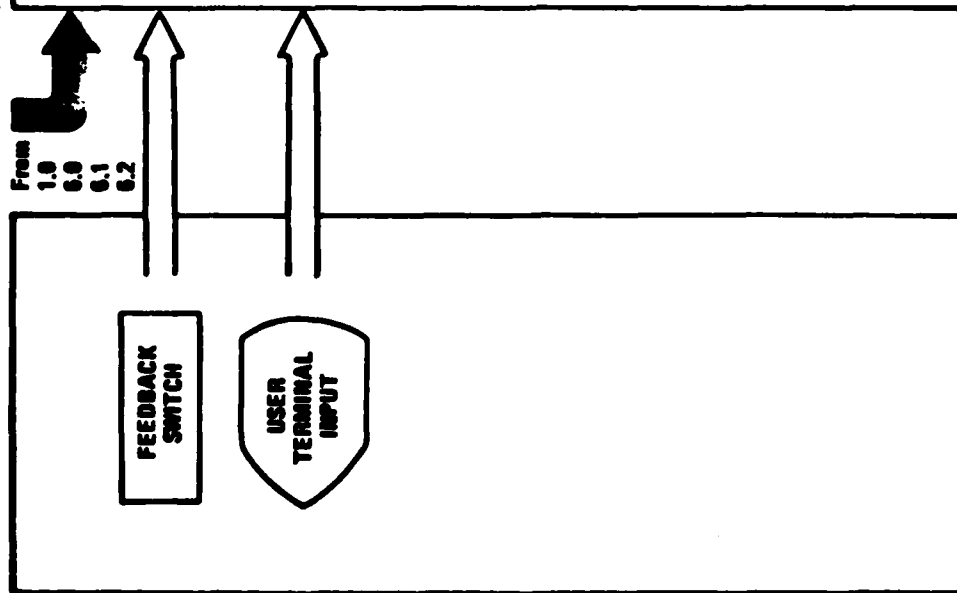
System/Program: SCORE

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

Diagram ID: 5.0 Description: Process User Commands

Page: \_\_\_\_\_ of \_\_\_\_\_

## INPUT



## PROCESS

Respond to the request by performing one of steps 1—4, then do step 5.

1. **HELP:** Display the special commands for stopping, help or feedback. Do step 5.

2. **STOP:** Determine if the user wants to see results before exiting

a. if results are desired



b. set exit switch, do 5.

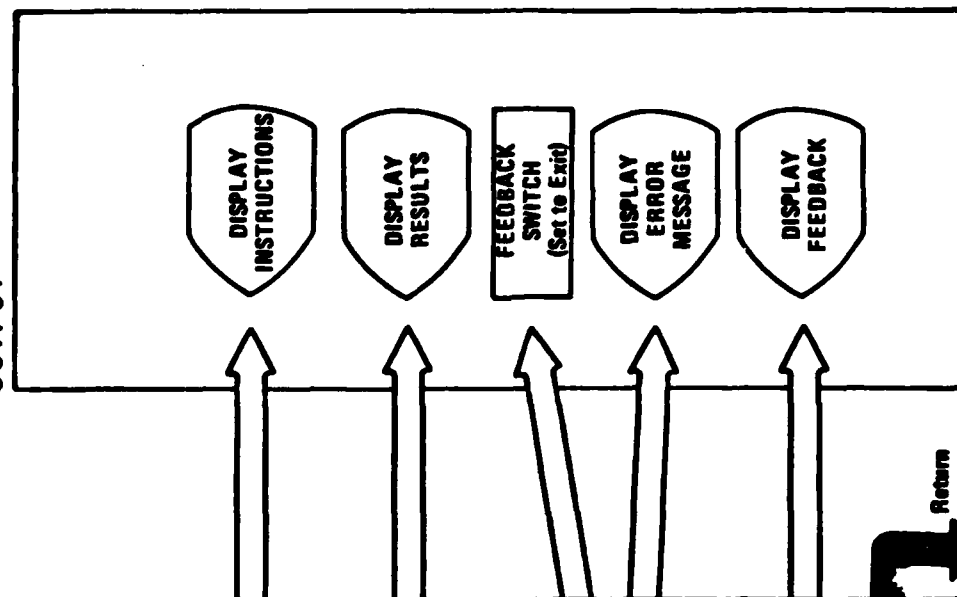
3. **ERROR:** Display error message then do 5.

4. **FEEDBACK:**



5. **Return.**

## OUTPUT



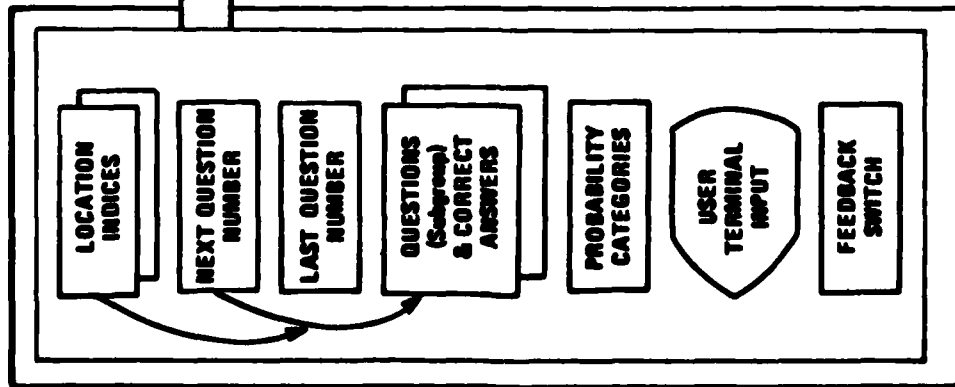
### Extended Description

The **FEEDBACK** switch has at least five settings. These settings correspond to the following options:

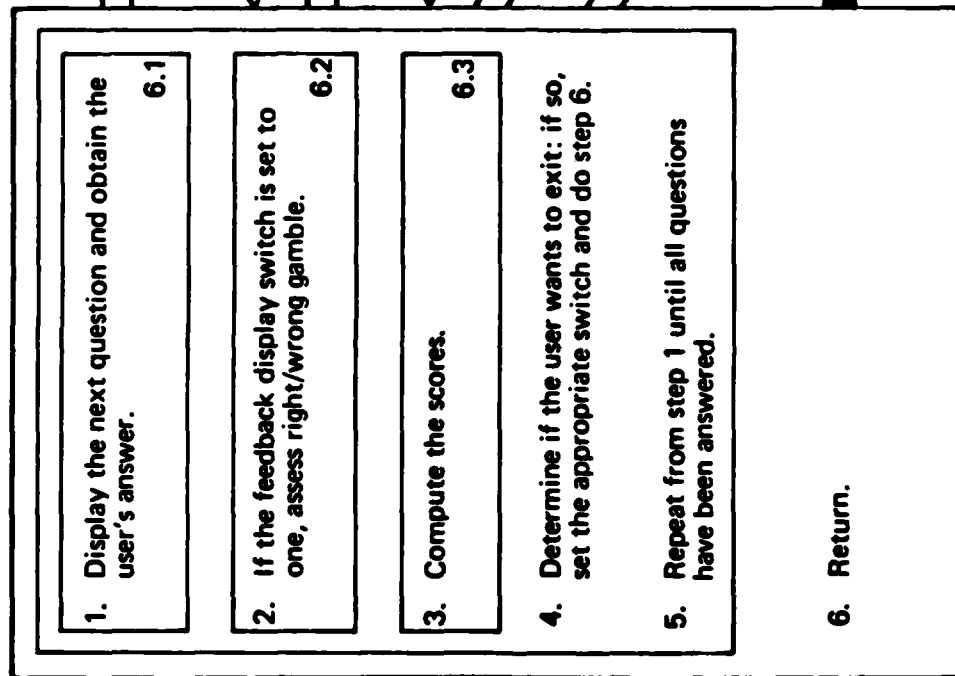
- request for **HELP** or instructions
- request to **STOP**, exit the program
- request for **FEEDBACK** or display of results based on the questions answered (probability assessments made).
- error message display to instruct the user
- request for the displaying of points in a **WIN** or **LOSE** gamble.

This routine handles all of the above options except the last one.

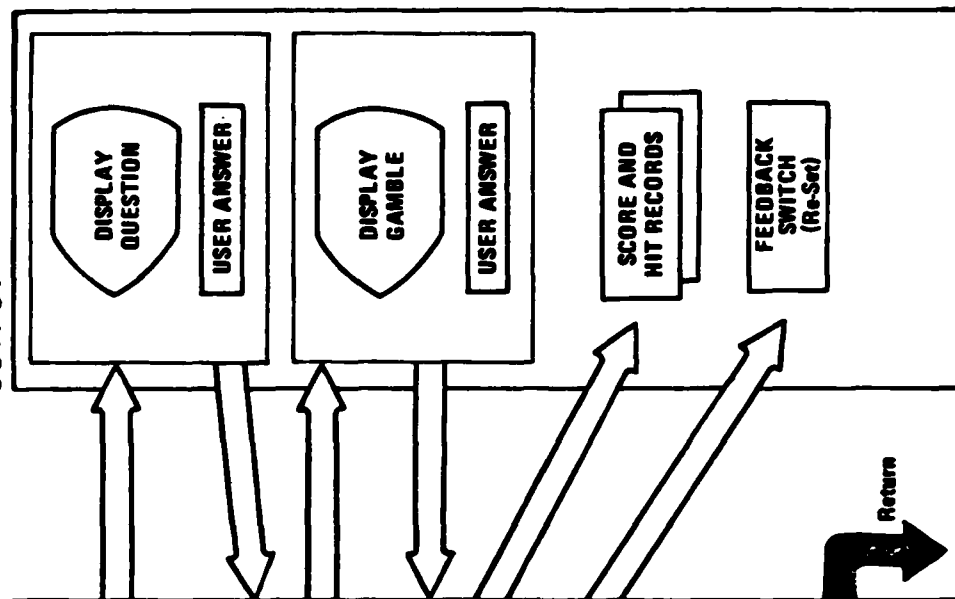
## INPUT



## PROCESS



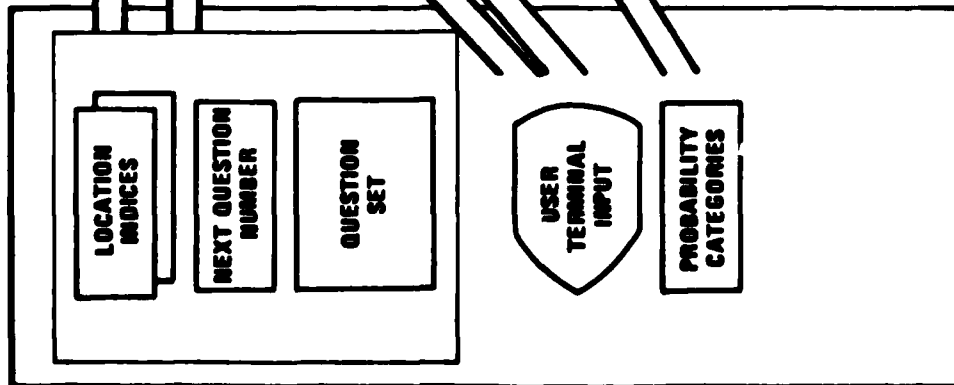
## OUTPUT



## Extended Description

3. The scores for questions and the hit records are computed by using the latest update of the user's response to answering the question and providing a probability assessment for the correctness of the given answer.

## INPUT

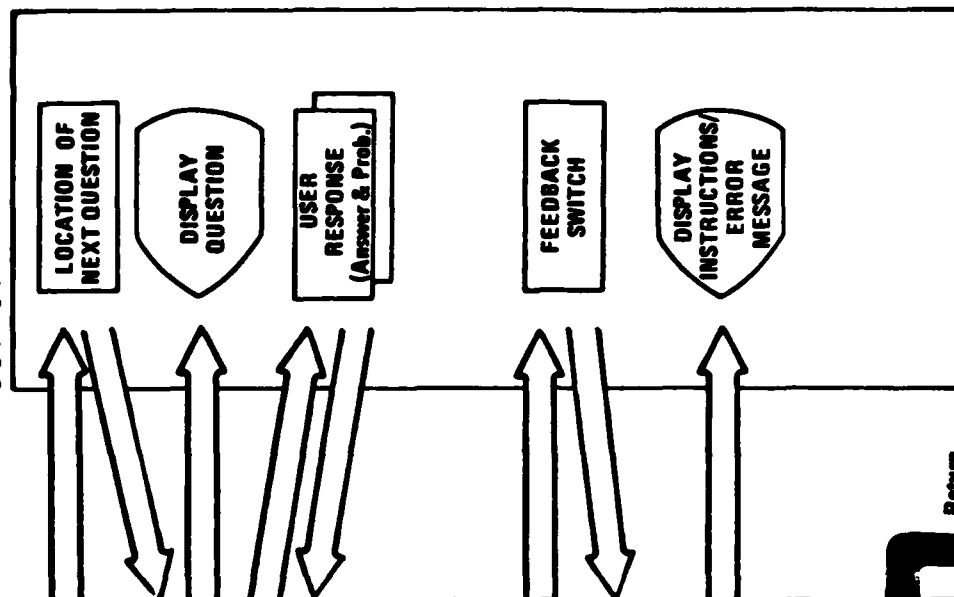


## PROCESS

1. Determine the location of the next question.
2. Display the next question.
3. Prompt the user for an answer.
4. Check the validity of the user response:
  - a. If command, do step 5.
  - b. Make sure answer is a multiple choice item; if not, do step 5.
  - c. Make certain the probability given by the user is in the valid category range; if not, do step 5.
5. If a command is entered, or error response,
 

PROCESS  
COMMANDS  
5.0
6. Return answer.

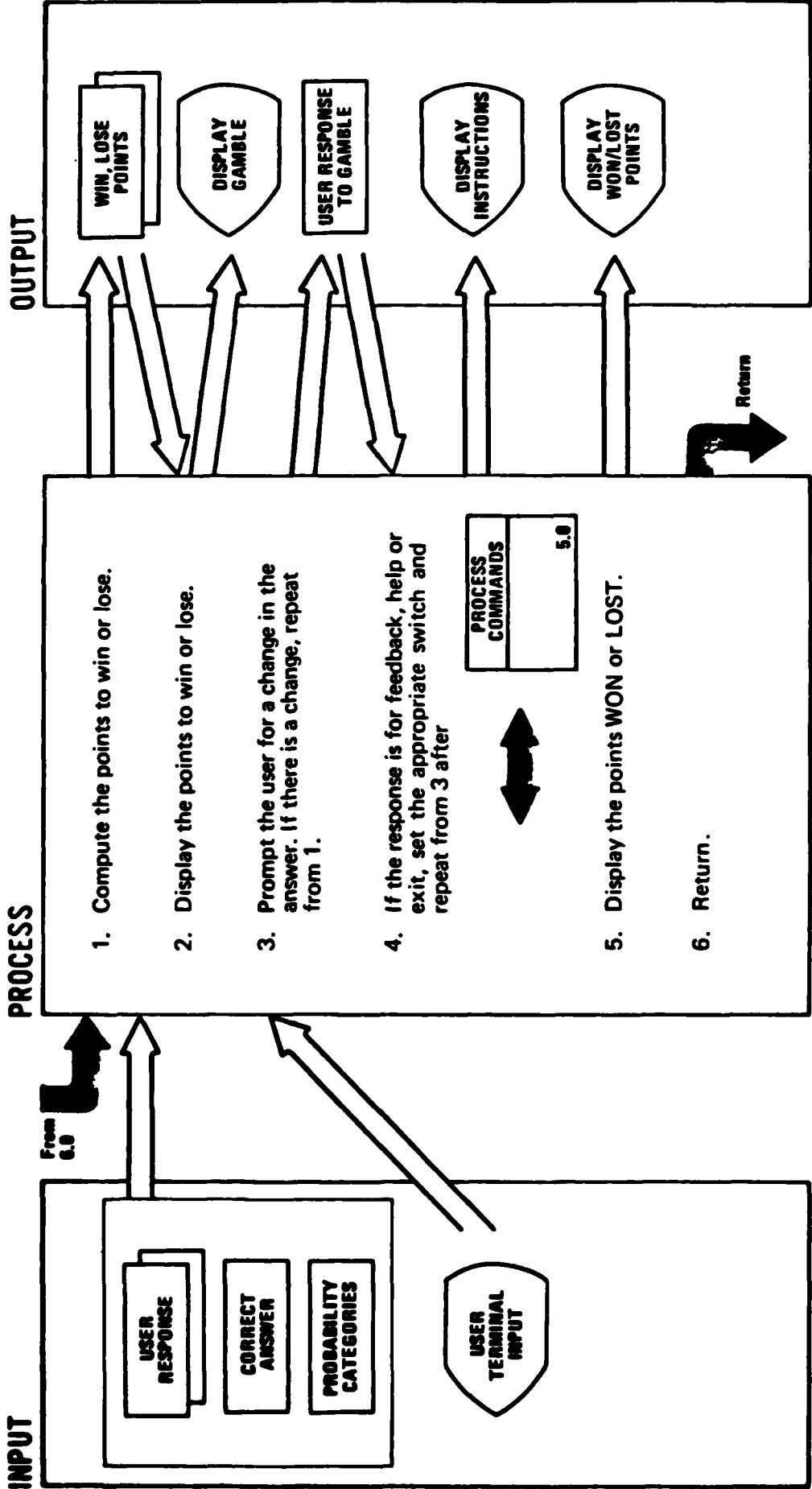
## OUTPUT



## Extended Description

1. Since different questions may be stored in texts of different sizes, the location indices provide an efficient way to index any given question number. The "next question number" is input to this routine.
2. Format the question text for the display screen and write/send to the terminal display.
3. The user is prompted for an answer selection (choice of two answers) and a probability assessment of its correctness.

4. In this step, the user's response is screened for valid input. The appropriate Feedback switch is set so that an exit to the command processor causes the correct instruction/error message to be displayed.



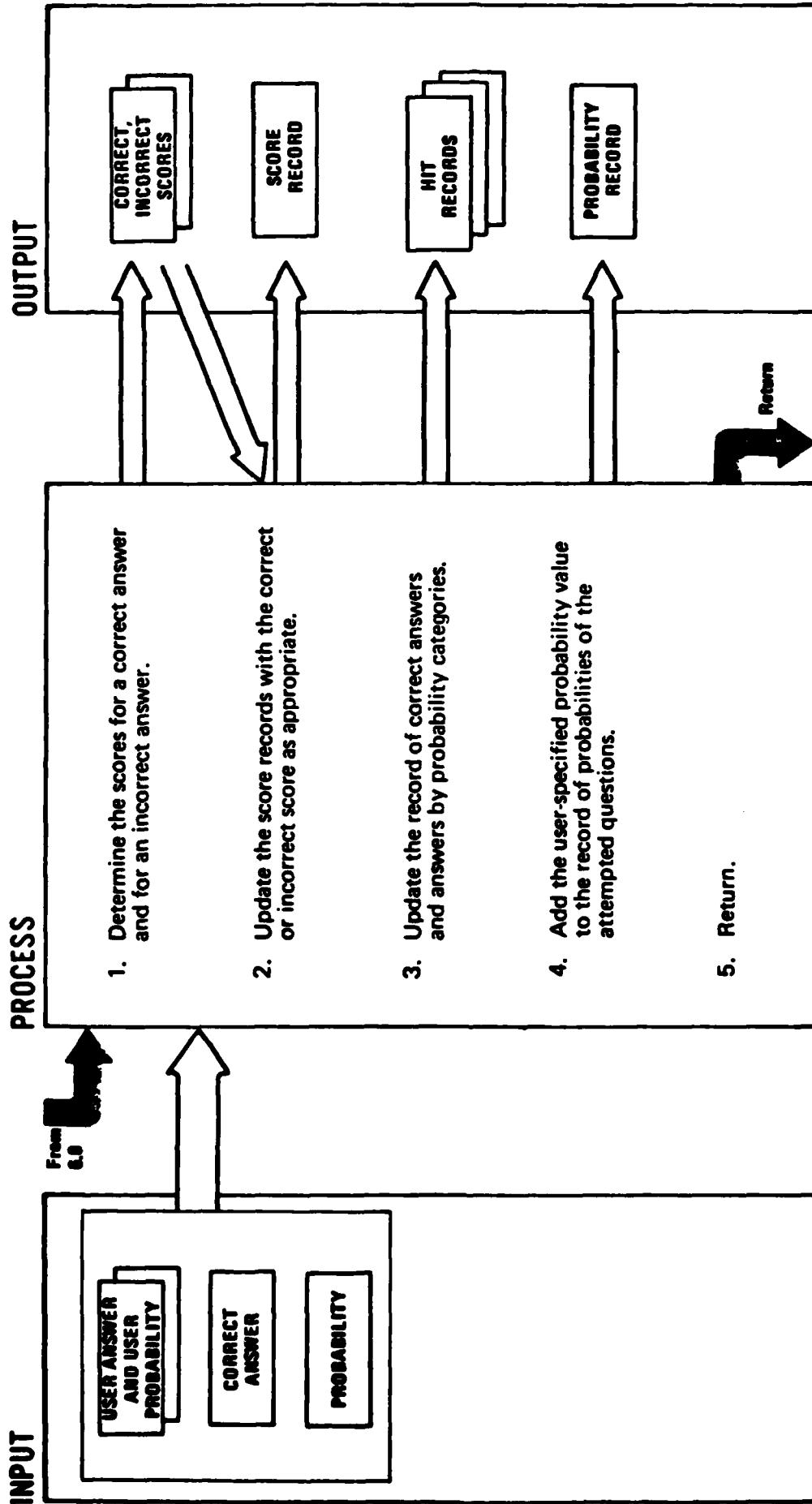
Extended Description

1. Win/Lose scores are computed for a correct answer and an incorrect answer based on the probability assessment: these scores are the points to win or points to lose, respectively.

The formulae for calculating the scores are given in the Scoring Rule Functional Description, Reference 1.2.2.

System Program SCORE Name \_\_\_\_\_

Diagram ID 6.3 Description Compute the Scores Page      of     



#### Extended Description

1. The scores for correct and incorrect answers, based on the user-specified probability, are computed (see Scoring Rule Functional Description, Reference 1.2.2, for formulae).
2. The user's answer is matched against the verified answer which has been read in from storage. The appropriate correct or incorrect score is added to the score record.
3. A record is kept of the correctness or incorrectness of the user's answer to each question attempted: this record is a vector of 1's and 0's in numerical sequence with the order of questions answered.

Also, a record is kept of the number of correct answers for each allowable category and a record is kept of the number of answers attempted in each category. The category is defined to be the one closest to the user-specified value.

4. The actual probability specified by the user is saved for later computations.