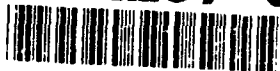


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# NAVAL POSTGRADUATE SCHOOL

## Monterey, California

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# THESIS

NAVAL POSTGRADUATE SCHOOL  
SCHEDULING SYSTEM (NPS<sup>3</sup>)

by

Richard C. Dowler

September, 1992

Thesis Co-Advisors:

Daniel R. Dolk  
David A. Erickson

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Naval Postgraduate School Scheduling System (NPS<sup>3</sup>)

by

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Captain, United States Marine Corps  
B.S., University of Missouri-Columbia, 1986

Submitted in partial fulfillment  
of the requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

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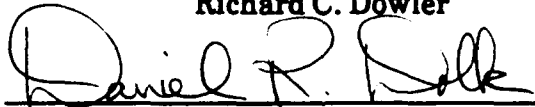
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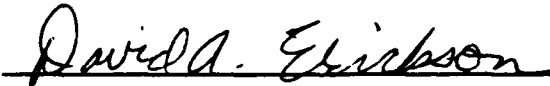


Richard C. Dowler

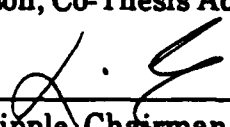
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## ABSTRACT

A database management system, the Naval Postgraduate School Scheduling System (NPS<sup>3</sup>), is proposed to support the Naval Postgraduate School schedulers in scheduling academic events and courses for students, instructors and classrooms during an academic quarter. NPS<sup>3</sup> is designed to assist schedulers in the scheduling process by presenting courses to be scheduled based on scheduling priorities. Semi-permanent events are automatically scheduled and entered in relevant student, instructor and room schedules based on predetermined entries in the NPS<sup>3</sup> database. Schedulers are allowed to assign time periods and classrooms to each subsequent course. NPS<sup>3</sup> then enters the scheduling information in the appropriate student, instructor and room schedules before the next course is scheduled. This process continues until the lowest priority course is scheduled. Structured Systems Analysis and Design Methods are used to present NPS<sup>3</sup>. High-level design specifications are detailed with data flow diagrams, entity relationship diagrams and structure charts.

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## I. INTRODUCTION

In March of 1992, two Naval Postgraduate School (NPS) students, Nolan J.S. and Youngblood P.D., proposed a decision support system (DSS), "NAVAL POSTGRADUATE SCHOOL SCHEDULING SUPPORT SYSTEM (NPS<sup>4</sup>)", to assist the NPS course schedulers in developing student, instructor, room and final exam schedules for an academic quarter. (Nolan, 1992)

Their thesis research consisted of an extensive systems analysis which included an historical study of the evolution of the NPS scheduling process and an examination of every detail of the current scheduling system. They provided a definition of scheduling needs and requirements, some database specifications, proposals and recommendations to develop a DSS and the evaluation of alternative solutions. Additionally, a user interface prototype was presented. (Nolan, 1992)

In NPS<sup>4</sup>, Nolan and Youngblood presented a number of alternative solutions for the NPS scheduling process. An analysis of their research reveals the following recommendations common to the majority of the alternative solutions:

- augmentation of parts of the existing system is presumably the most prudent option in terms of maintaining the human element in the scheduling process, easing user transition into a new system and holding down implementation costs;

- any automated portion of the current scheduling system should have the capability to accommodate at least two course schedulers, offering concurrent access and use of the scheduling data and partially completed schedules; and
- a dedicated relational database is needed in almost all alternative solutions to store the huge amount of important information (much of which resides on the NPS mainframe computer) required to construct student course group, instructor and room schedules. (Nolan, 1992)

#### **A. PROBLEM**

As previously mentioned, Nolan and Youngblood (1992) presented a user interface prototype to validate the course scheduler's requirements. This was accomplished using a rapid prototyping methodology as a tool for software development. However, there is a need for multiple methodologies in developing large systems such as that presented by the NPS scheduling process (Keyes, 1992). In today's changing world of software development, structured analysis and design methods can be integrated with prototyping techniques (Keuffel, March 1992), "...coming together in a combination that is better than any of the parts...." (Keyes, 1992) in order to shorten the system development life cycle.

The purpose and goal of this thesis research is to provide a more detailed systems analysis and design specifications of the current NPS scheduling process and the target system presented and proposed respectively by Nolan and Youngblood in NPS<sup>4</sup>. We envision that these specifications will be used by computer programmers for eventual systems implementation of a

computer based solution/enhancement to the current scheduling system or to NPS<sup>4</sup>. Structured Systems Analysis and Design methodologies will be used with emphasis on database design.

## **B. METHODOLOGY**

Semi-formal analysis and design specifications will be developed using dataflow diagrams, structure charts and module specifications, complemented by database specifications consisting of entity relationship diagrams and entity and attribute definitions.

## **C. STRUCTURE OF THIS THESIS**

Chapter II provides a brief discussion of the organization of the Naval Postgraduate School and the background of the current NPS course scheduling process.

Chapter III presents a concise overview of dataflow diagrams, entity relationship diagrams, structure charts and module specifications.

Chapter IV summarizes the conclusions and recommendations for follow-on steps required to implement the design generated in this thesis.

Appendices A, B, C, D and E contain the physical dataflow diagrams of the current NPS scheduling system, the entity relationship diagrams with related entity and attribute definitions, the logical dataflow diagrams of the target scheduling system, the target system structure charts, and the module specifications, respectively.

## **II. BACKGROUND ON NPS SCHEDULING**

### **A. NAVAL POSTGRADUATE SCHOOL (NPS)**

The Naval Postgraduate School is atypical compared to most public and private academic institutions with respect to its course scheduling process. For the sake of clarity, a brief description of the NPS scheduling process summarized from Nolan and Youngblood (1992) is presented below:

Under the auspices of the Chief of Naval Operations, the Naval Postgraduate School located at Monterey, California, is an academic institution of higher learning and research with the primary purpose to increase the combat effectiveness of U.S. and allied armed forces by providing graduate degree programs to qualified students in areas not usually available through other educational institutions, and by conducting research that actively supports U.S. armed forces operations. (Nolan, 1992)

The student body at NPS is composed of U.S. military officers from all branches of the service, foreign national officers from almost 30 allied countries, and some U.S. military enlisted personnel and federal civilian employees. Most study and research programs pursued satisfy both Masters or Doctorate degree requirements and fulfil requirements that

earn a military occupational specialty (MOS) code for service members. (Nolan, 1992)

The NPS administration of learning and research is a cooperative effort between military and civilian personnel. Academic departments, with a majority of their faculty members being civilians with Doctorate degrees, prepare and offer courses. Curricular programs of study are developed by military Curricular Officers, who direct students through chosen programs to ensure students complete both degree and MOS requirements. Civilian Academic Associates work with Curricular Officers to ensure that each curricular program is academically sound. A civilian Management Analyst manages the collection of Departmental and Curricular Officer data used in the scheduling process, and the NPS Class Schedulers construct course schedules from this collected data. (Nolan, 1992)

#### **B. CURRENT NPS COURSE SCHEDULING**

The academic year at NPS is divided into four quarters, Fall, Winter, Spring and Summer. The scheduling process consists of four phases and requires a joint effort from several groups of people in order to construct schedules during each quarter. An excerpt from NPS<sup>4</sup> (Nolan, 1992) summarizes the four phases of the scheduling process at NPS:

### **1. Forecasting**

Up to a year or more in advance, departmental schedulers and the Management Analyst forecast probable quarterly student course demands and Instructor workloads necessary to meet these demands. A Tentative Course Schedule is produced indicating which courses are expected to be taught by each academic department during each quarter. (Nolan, 1992)

### **2. Pre-Scheduling**

Pre-Scheduling is a quarterly process. Curricular Officers, via the Management Analyst, give departmental schedulers information about which courses their students are requesting for that quarter. Departments then determine which courses will actually be taught that quarter. If there are requested courses that will not be taught, students replace these with ones that will be. After receiving this updated information, departments divide courses that are too large into segments and assign instructors to teach each course. (Nolan, 1992)

### **3. Scheduling**

Pre-Scheduling information is given to the Class Schedulers, who use it to construct a Master Instruction Schedule and individual schedules for students, instructors

and classrooms. Schedules for the upcoming quarter are then distributed to applicable offices and individuals. (Nolan, 1992)

#### **4. Post-Scheduling**

After all the schedules are constructed including the Master Instruction Schedule, and throughout the scheduled quarter, changes may be made to the student, Instructor or room schedules. Student schedule changes are approved by their Curricular Officer and Academic Associate. Instructor schedule changes to a course's room or time periods are coordinated by the Class Schedulers and the changes are registered and maintained by them. (Nolan, 1992)

#### **5. Synopsis of the Present Situation**

Each quarter during the scheduling phase, course scheduling is done entirely by manual manipulation of information from Department Chairmen and Curricular Officers by two Class Schedulers. The Schedulers, with pencil and 5" x 8" schedule cards use "time-proven heuristics," (Nolan, 1992) to assign time periods and rooms literally by hand to hundreds of courses and course segments offered during a quarter. These courses and course segments are then matched to approximately 300 Instructor schedules and 1100 student course group schedules. Additionally each quarter, room schedules for each academic room used for instruction at NPS, are manually generated. (Nolan, 1992)

Course Schedulers use a set of scheduling priority guidelines, as well as Instructor preferences taken from Department Chairman Reports, to help minimize scheduling conflicts. However, when conflicts do occur, such as time period and/or room conflicts, or changes in course scheduling are requested, each conflict or change request is manually resolved, subsequently changing each schedule card affected. (Nolan, 1992)

In addition to the original schedule cards that are constructed each quarter, each original schedule is photocopied multiple times and distributed to their respective recipients.

After regular course scheduling is completed, final exam schedules must be constructed for each course that requires a final exam, assigning rooms and time periods to each final exam. As with regular course scheduling, conflicts must be minimized, resolved and avoided.

The present scheduling process at the time of this thesis research is seen as being vastly inefficient in regard to spending valuable man-hours making tedious manual entries and erasures to schedules and their related schedules, and photocopying thousands of schedule cards for distribution.

## **6. Most Pressing Concerns**

Thesis research done by Nolan and Youngblood (1992) in "The Naval Postgraduate School Scheduling Support System,"

identified the most pressing concerns regarding the current NPS scheduling process:

- "...constantly having to locate, retrieve, and replace physical schedule cards...." (Nolan 1992) related to each scheduled course and course segment in order to add, modify or delete schedule information;
- "...lack of standardization in department entries to the [final] iteration of the Department Chairman Report...." (Nolan, 1992) indicating whether time periods and rooms are required or preferred by instructors; and
- lack of proper documentation methodology for changes to schedules during the Post-Scheduling phase. (Nolan, 1992)

In their analysis, Nolan and Youngblood, emphasized the need to maintain the human element required in the complex scheduling construction at NPS, and allowing the continuation of the freedoms of choice enjoyed in the present scheduling process. Since maintaining the human element is paramount in any given solution to meet the scheduling system requirements at NPS, Nolan and Youngblood proposed a partly automated decision support system, extending the present scheduling system capacity and creating more system capabilities. (Nolan, 1992)

### **C. NAVAL POSTGRADUATE SCHOOL SCHEDULING SYSTEM (NPS<sup>3</sup>)**

#### **1. Function**

A database management system, the Naval Postgraduate School Scheduling System (NPS<sup>3</sup>) is proposed to support the NPS course schedulers in scheduling academic events and courses for students, instructors and classrooms during an academic

quarter. NPS<sup>3</sup> is designed to assist schedulers in the scheduling process by presenting courses to be scheduled based on scheduling priorities (Nolan, 1992). Semi-permanent events are automatically scheduled and entered in relevant student, instructor and room schedules based on predetermined entries in the NPS<sup>3</sup> database. Schedulers are allowed to assign time periods and classrooms to each subsequent course, course segment or laboratory. After resolving any scheduling conflicts, NPS<sup>3</sup> then enters the scheduling information in the appropriate student, instructor and room schedules before the next course, course segment or laboratory is scheduled. This process continues until the lowest priority course is scheduled. (Interview, Schedulers, April 13, 1992)

## **2. Extending NPS<sup>4</sup>**

Nolan and Youngblood (1992) used a rapid prototyping strategy during the analysis phase of system development demonstrating a user interface prototype "...to validate the analyst's view of what the user's want and need...." (Keuffel, October 1991). This user interface prototype was developed "...using Hypercard 2.0 on an Apple Macintosh IIci personal computer with 8MB of RAM and a 64K cache card under the System 7 operating system." (Nolan, 1992)

There are limitations to using rapid prototyping in systems development: it is "...hard to control, and has no overall plan, intermediate deliverables, 'audit trail,' or certainty about the result". (Gardner, 1991)

Furthermore, using Apple Macintosh's Hypercard environment to develop a scheduling system for the NPS course schedulers presents a dilemma. Currently, NPS course schedulers operate in an IBM compatible PC environment, making the use of Hypercard for continuation in system development questionable.

Given the limitations of rapid prototyping, the incompatibility dilemma that Hypercard presents, and the enormity of the NPS scheduling process, a need exists for structured analysis and design documentation of the Naval Postgraduate School Scheduling System (NPS<sup>3</sup>).

Structured methodologies provide "...guidance in completing complex tasks as well as providing a medium for consistent communication...." (Gardner, 1991) between analysts, designers and programmers. "Methodologies are based on theory and have been tested many times, so that they've acquired formal rigor." (Gardner, 1991) In addition, structured methodology offers an historical record of the system under development (Keuffel, March 1992).

NPS<sup>3</sup> is not intended to replace the work done by Nolan and Youngblood (1992), but to be used to complement their work in an integrated and interactive approach to the system

development. NPS<sup>3</sup> will facilitate communication between system development team members by partitioning the scheduling process "...into manageable chunks...." (Plauser, 1992). The scheduling process problem is "...decomposed into parts...." showing the "...modularity of design...." presenting "...a logical design before one tries the physical design." (Gardner, 1991). NPS<sup>3</sup> will answer questions such as:

- Where is the development process now?,
- What development has been accomplished to date?, and
- Where is the development process going next?

Moreover, addressing the Hypercard dilemma, NPS<sup>3</sup> structured analysis and design specifications will be developed "...to achieve hardware and software independence...." (Wetherbe, 1984). In doing so, NPS<sup>3</sup> allows future system implementors the freedom to choose the appropriate hardware and software for system implementation.

### **3. Concurrent Access of Data**

An issue not addressed in the NPS<sup>3</sup> design specifications, but certainly important in developing a multiuser database scheduling system, is the need for concurrent access and use of scheduling data and partially completed schedules.

When the situation arises where two or more schedulers are using the same scheduling data and/or partially completed

schedules (e.g., two different schedulers are scheduling two different courses to the same instructor schedule), a certain degree of data and record locking is needed while at the same time allowing for the 'refreshing' of the concurrent scheduler's screen as one scheduler manipulates data shared by both schedulers.

Care must be taken to ensure that there is not too little data or record locking which may cause integrity problems, nor too much data or record locking which may result in delays or deadlock. (PC User, June 17, 1992) Furthermore, the time taken to 'refresh' a scheduler's screen is a critical factor in the efficiency of the scheduling system. If not done properly, one scheduler could effectively update/erase another scheduler's recent changes to the concurrent data and/or schedule.

To account for 'refreshing' a scheduler's screen, NPS<sup>3</sup> structure charts would have to be modified. The most logical place to 'refresh' a scheduler's screen is during the procedure for resolving schedule record conflicts, Appendix D, Figure D-22. When the system determines schedule conflicts, searches for alternative schedule selections, or puts alternative selection to the schedule record, multiuser screens accessing concurrent data and/or schedules can be checked and 'refreshed' with the relevant scheduling data where appropriate.

### **III. STRUCTURED METHODOLOGY**

Structured methods provide an effective "...communication vehicle...." (Keyes, 1992) for analysts to capture the system requirements from its end users (Keuffel, March 1992) and provide traceability and maintainability to programmers during system design and implementation (Riehle, 1991). The structured methodologies used in this thesis are structured analysis, entity relationship diagrams and structured design. The structured analysis includes physical and logical data flow diagrams. Entity and attribute definitions are included with the entity relationship diagrams. The structured design includes structure charts and module specifications.

#### **A. DATA FLOW DIAGRAMS**

Dataflow diagrams (DFD) are models used widely in structured analysis. They are not flow charts and thus do not explicitly show the flow of control through a system. However, dataflow diagrams do show flow of data, storage of data, and the processes that respond to and change data. (Whitten, 1989)

Different language and symbol sets have been developed to illustrate dataflow diagrams. For the purposes of this thesis, and illustrated in Figure 3.1, the Demarco-Yourdon

symbol set, "...perhaps the most well known...." (Keyes, 1992), will be used where:

- A circle represents a process that transforms inputs into outputs. The details of the process are not known.
- A rectangle depicts a source/destination name that defines the boundaries of the system. Source/destinations provide the net inputs to and receive the net outputs from the system.
- Data stores are depicted as open-ended boxes.
- Named arrows are depicted as data flows, representing inputs or outputs.
- A slash in the lower right-hand corner of a source/destination indicates a repetition of a source/destination within the given data flow diagram.
- A double line to the left of a data store indicates that a data store is repeated within the given data flow diagram.

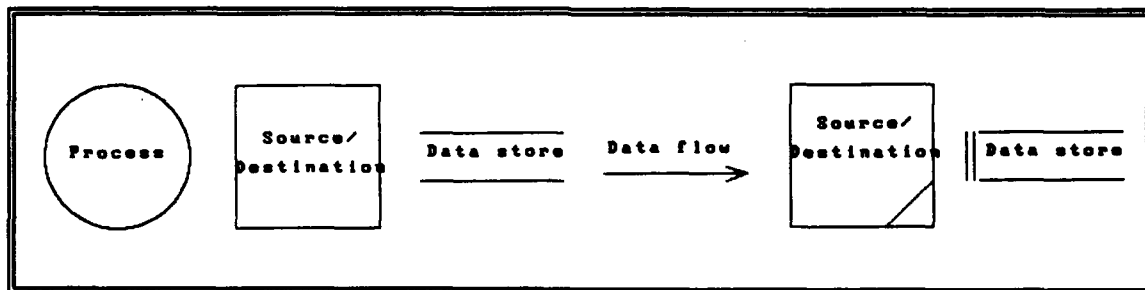


Figure 3.1 Data flow diagram notation

Several sets of dataflow diagrams are produced during structured analysis and include DFD's that:

- Model the current system and the target system to be built.

- Model the physical implementation details of the system, called the physical system, or model the essential characteristics of the system, called the logical system. (Whitten, 1989)

In Appendix A, the physical context data flow diagrams and the physical systems level data flow diagrams for the current NPS scheduling process are presented to detail the current scheduling system implementation.

In an attempt to gain a more detailed description of the NPS scheduling process user requirements presented by Nolan and Youngblood (1992), and to enhance possible alternative implementation solutions, the logical data flow diagrams are displayed in Appendix C. The logical data flow diagrams model the essential processing requirements of the system independent of any technology that might be used to implement those requirements (Whitten, 1989).

## **B. ENTITY RELATIONSHIP DIAGRAMS**

An Entity Relationship Diagram (ERD) is a logical systems analysis technique of data modeling that illustrates "...data at rest...." (Whitten, 1989). An ERD is a very detailed picture of data storage independent of the processing performed with those data stores. Therefore ERD's do not depict flow or processing of data and should not be read like data flow diagrams or flow charts. Because entity relationship diagrams depict data at rest or data being

stored, they do not imply how data is implemented, created, modified, used or deleted. (Whitten, 1989)

An ERD is made up of entities and the relationships between those entities. An entity is anything real or abstract that can be described by a set of common characteristics that are called data elements or attributes. Usually, at least one of the entity's data elements uniquely identifies one and only one occurrence of the entity. This data element or elements is referred to as the key. (Whitten, 1989)

A relationship is a natural association between one or more entities. Relationships usually exist between two different entities, but may also exist between different occurrences of the same entity. Furthermore, relationships may be dependent on other relationships. (Whitten, 1989)

As with data flow diagrams, various language and symbology is used to illustrate entity relationship diagrams, see Figure 3.2. Normally a rectangle represents an entity while a diamond represents a relationship. Because of the complexity of the NPS scheduling process and its many entities and relationships, the diamond is omitted to save space in the NPS Scheduling System ERD. (Whitten, 1989)

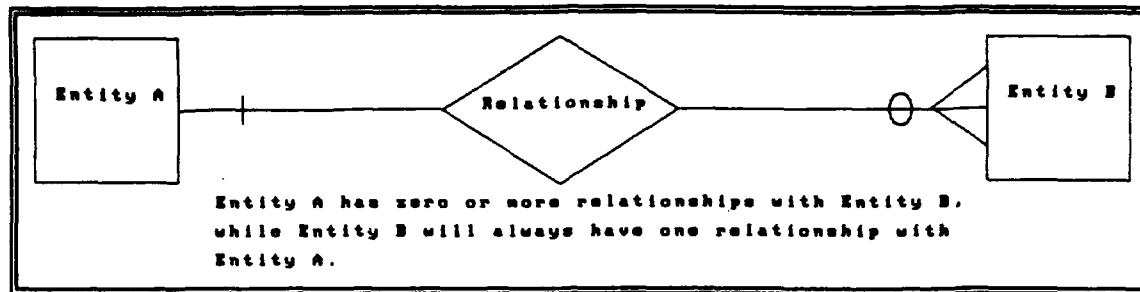


Figure 3.2 One-to-many entity relationship diagram notation

The NPS Scheduling System entity relationships are described by words and symbols that indicate the number of occurrences of one entity that can exist for a single occurrence of the related entity, and vice versa. Three general possibilities of occurrences exist:

- One-to-one (1:1) --for one occurrence of the first entity there can exist only one related occurrence of the second entity and vice versa;
- One-to-many (1:M or M:1) --for one occurrence of one entity there can exist many related occurrences of a second entity; it doesn't matter which is first or second;
- Many-to-many (M:M) --for one occurrence of the first entity there exists many related occurrences of the second entity, and for one occurrence of the second entity there exists many occurrences of the first entity. Many-to many relationships are transformed into one-to-many relationships creating an intersection between the many-to-many relationship. (Whitten, 1989)

Furthermore, the hash marks on the line between a relationship represent a mandatory relationship while a circle represents an optional relationship (Kroenke, 1988). A "...crow's foot...." (Haas, 1991) on a line between a relationship represents many occurrences of that relationship

while the absence of a "...crow's foot...." (Haas, 1991) represents one occurrence of that relationship.

Appendix B presents the Entity Relationship Diagrams and the entity and attribute definitions for the proposed NPS Scheduling System.

### **C. STRUCTURED DESIGN USING STRUCTURE CHARTS**

Structured design is considered a disciplined approach to computer design that:

- develops "...a blueprint of a computer system solution to a problem that has the same components and interrelationships among the components as the original problem...."
- "...seeks to conquer the complexity of large systems by means of partitioning the system into 'black boxes', and by organizing the black boxes into hierarchies suitable for computer implementation...."
- [and] "...uses tools, especially graphic ones, to render systems readily understandable." (Page-Jones, 1988)

In Structured Design, structure charts are used to illustrate the partitioning of a system into modules, or 'black boxes', and show their hierarchy, organization and communication. The concern is almost entirely with what a module does rather than how it does it. This form of documentation actually helps the designers during the design effort. (Page-Jones, 1988) Structure charts present a "...template for coding....a plan of attack...." (Keuffel, October 1991), bridging the gap between the analysis and the

design of a system. Furthermore, structure charts are flexible enough to remain current with modification to the system over its lifetime. (Page-Jones, 1988)

In addition, these structure charts serve as a 'road map' for maintainers to use to quickly track down defects or implement user modifications. (Page-Jones, 1988)

Figure 3.3 illustrates structure chart notation. Modules are shown as rectangular boxes, with their names inside. The name is a statement of the module's function, what it does to completion each time it is called. Pre-defined modules are graphically illustrated by adding lines parallel to its vertical sides. Pre-defined modules already exist in a system or application library, operating system or database management system. Communication from one module to another, referred to as a 'call', is indicated by an arrow. Data that flows between modules is illustrated by using a circle with an arrow attached. (Page-Jones, 1988)

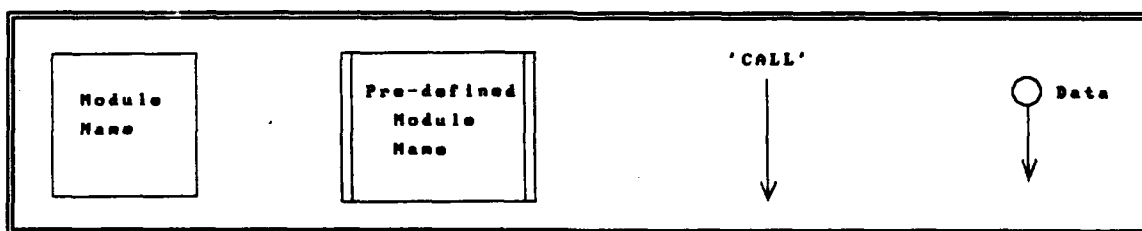


Figure 3.3 Structure chart notation

By using the scheduling system requirements detailed by Nolan and Youngblood (1992), and the specifications from Appendix C, Appendix D presents the NPS<sup>3</sup> structure charts illustrating the use of a database management system:

- to automatically import data from files downloaded from the NPS mainframe computer,
- to allow the user to update existing NPS<sup>3</sup> database files,
- to create NPS schedules by allowing users to schedule courses based on scheduling priorities, and
- to review and update existing schedule files.

#### **D. MODULE SPECIFICATIONS**

Like structure charts, module specifications are used as a communication tool to bridge the gap between design and programming, giving a potential programmer information on the procedural details of each module. The programmer is told what inputs the module uses when called, what outputs the module returns and the function the module is expected to carry out. (Page-Jones, 1988)

Two types of specifications are offered: interface specifications and specification by pseudocode. Interface specifications use structured English, providing "...a minimal amount of procedural detail to accompany the structure chart." (Page-Jones, 1988) This allows the programmer the freedom to program in what ever way he/she pleases.

Specification by pseudocode is a more detailed description of a module's internal procedure. Pseudocode simulates actual code and therefore presents less work for the programmer to attain the final code. (Page-Jones, 1988)

Appendix E provides the module specifications for the NPS<sup>3</sup> modules illustrated in Appendix D.

#### IV. CONCLUSION/RECOMMENDATION

##### A. WHY STRUCTURED METHODOLOGY?

The Naval Postgraduate School Scheduling System (NPS<sup>3</sup>) detailed in this thesis does not pretend to offer a fool proof analysis and design solution to the NPS course scheduling process. However, NPS<sup>3</sup> is presented to reinforce and complement the work done by Nolan and Youngblood (1992) by suggesting a structured rational design approach.

A structured rational design approach to system development will offer understanding and guidance to potential programmers, facilitate control of the project rather than proceed in an adhoc manner, present a standard procedure for system implementation, make measuring the progress of a system easier and enhance good overall management of the system development. (Keuffel, September 1991)

To expedite the growth of the scheduling system, NPS<sup>3</sup> structured analysis and design specifications and Nolan and Youngblood's (1992) user interface prototype "...can be integrated into a new development life cycle that combines the benefits of both approaches...." (Plauger, 1992).

"From structured methods, we gain the abstract representation of the system and the documentation that provides the historical record of the project. From rapid prototyping we gain the ability to quickly put before our users a concrete representation of user interfaces, which

iteratively evolves into the completed system." (Keuffel, March 1992)

## **B. IMPLEMENTATION**

A system with the size and complexity of the Naval Postgraduate School Scheduling System can be implemented in a number of different ways.

The first step that should be taken for implementation is to build the relational database management system given the specifications in Appendix B. Once the relational database is built, integration with Nolan and Youngblood's user interface prototype should be investigated to incorporate the relational database and the user interface prototype into a "...functional prototype...." (The Computer Conference Analysis Newsletter, April 15, 1992). This would entail actually building part of the scheduling system. It is important to keep in mind that the NPS course schedulers should be included early and continually in the implementation and testing of the scheduling system.

The next step of implementation would be to divide the design presented in this thesis into logical components to be developed incrementally. Possible divisions of the system are:

- a component to read files downloaded from the NPS mainframe and import the data into the NPS<sup>3</sup> database files;

- a component that automatically schedules semi-permanent events to the appropriate schedules;
- a component that allows scheduling of courses based on a particular course scheduling priority, after which subsequent priorities could easily be implemented;
- a component that determines and resolves any scheduling conflicts that may occur;
- a component that 'refreshes' multiuser screens when concurrent access and use of scheduling data and partially completed schedules is taking place; and
- although not addressed in this thesis except to show their organization in the overall system, components for the Final Exam Scheduling, Master Instruction Schedule and Scheduling Data Graph applications, respectively.

### C. SOFTWARE

There are a number of PC-based multiuser relational database management systems (RDBMS) on the market today that would be possible candidates for use in NPS<sup>3</sup>:

- Borland International Inc.'s dBase IV 1.5
- Borland International Inc.'s Paradox 4.0;
- Fox Software's FoxPro LAN 2.0;
- DataEase International Inc.'s DataEase 4.5;
- Microrim Inc.'s R:BASE 3.1c;
- Oracle Corp.'s Oracle 7.0; and
- Blyth Software Inc.'s Omnis 7.

Each of the RDBMS's listed above has its strengths and weaknesses relative to the other software packages. Although this is valuable information when presenting alternatives, to give a detailed analysis of the strengths and weaknesses of

each RDBMS would be a thesis in itself. Instead, the following major considerations are provided for selecting a multiuser RDBMS:

- Ready-to-use-tools--can a non-programmer produce adhoc queries and reports, create and maintain tables and indexes, and enter and edit data without custom coding?;
- Database maintenance--can the data be stored and accessed independent of any application?;
- Environment--does the RDBMS offer the development environment with the capability to produce the application needed to use the RDBMS in an effective manner?;
- Database structure--significant restrictions on the number of records or fields or the size of records or fields should be evaluated; are null values represented correctly and can they be tested for in the database?; is the data stored in one large repository which would cause efficiency problems or are the tables stored as separate files which would speed data access;
- Referential integrity--does the RDBMS automatically prevent erroneous data entries to records that don't exist or prevent deletion of an entity record without deleting it from its related entities; or does this function have to be programmed in by the user?;
- Data security and access control--what degree of security and access control is offered?; is it at the level needed?; will you have to write code to get it to the level you desire?;
- Record locking--this was addressed in Chapter II under Concurrent Access of Data;
- Data loading--can the RDBMS import data from other files or databases?; What file formats can it read and how many?; is the data validated before or after loading?;
- Structured Query Language supportability--does the RDBMS support embedded SQL for executing non-procedural operations on the data for ease-of-access, scalability and optimization;

- Programming--how easy is it to customize the code to meet the requirements of specific applications? (PC User, June 17, 1992); and
- Hypercard interface--the RDBMS must have the capability to either provide a graphical user interface (GUI) as proposed by Nolan and Youngblood (1992), or else be able to connect to the Hypercard GUI developed in NPS<sup>4</sup>.

#### D. OMNIS 7

In the author's view, Blyth Software Inc.'s Omnis 7 is a particularly desirable candidate for a relational database management system to be used in NPS<sup>3</sup>.

Although relatively high priced (\$1,250), Blyth Software's Omnis 7 offers a powerful relational database management system for single users or for multiusers of complex networked database systems. Specifically marketed for developers, Omnis 7 is easy-to-use and robust providing abundant features for beginners such as quick prototyping, a short popup menu mode that "...generates entry screens, reports, and menus at the click of a mouse...." (Miley, 1992), and "...online context sensitive help...." (Fogel, 1992).

Written in a high level procedural language, C++, Omnis 7 lets the developer/user take care of several discrete steps by issuing a single command. In short, Omnis 7 offers "...a sophisticated integrated development environment for creating database applications...." (Anderson, 1992).

One of the features that make Omnis 7 a true integrated development environment is its cross-platform architecture.

#### Omnis 7

"...offers seamless portability between Mac database applications created for use in the Mac environment and applications meant for one of the competing PC-based graphical user environments, Microsoft Windows or IBM's Presentation Manager. Applications written for Omnis Seven on any of these platforms can be moved to the other without modification." (Miley, 1992)

This cross-platform portability makes Omnis 7 a perfect candidate to be integrated with Nolan and Youngblood's (1992) user interface prototype. Alternatively, Omnis 7 can be developed as a file server based data manager in a LAN environment or "...as a front end to a Structured Query Language based server...." (Fogel, 1992). Omnis 7 has the capability to read several different file formats facilitating the importation of data from other programs, foreign files or databases (Blyth Software, 1990).

Omnis 7's database engine allows dozens of files to be open simultaneously, can display fields from multiple files on a single window and can update all open files with a single command. In addition, Omnis 7 offers

"...one of the most powerful GUI builders in the industry. To create a data entry window, the developer paints it in design mode, and Omnis 7 makes it come alive in execute mode. Aside from data-entry fields, virtually any standard GUI element, such as push buttons, check boxes, and scrolling lists, can be incorporated into an Omnis 7 window. What's more, multiple windows can be open simultaneously, each one movable, scrollable and sizeable, and each operating independently or in sync with the others." (Fogel, 1992)

For the potential programmer/implementor, Blyth Software Inc.'s Omnis 7 presents speed and virtually unlimited flexibility in the possible implementation of the Naval Postgraduate School Scheduling System. Furthermore, Omnis 7 can be found in the NPS software inventory which may preclude its purchase for any follow-on work to NPS<sup>3</sup> (Ragan, 1992).

## **APPENDIX A: CURRENT NPS<sup>3</sup> PHYSICAL DATA FLOW DIAGRAMS**

In the following figures, FIG. A-1 thru FIG. A-6, the physical context data flow diagrams and the physical systems level data flow diagrams for the current NPS Scheduling System are presented so that the reader may obtain a more detailed understanding of what the current system does and how the current system is implemented.

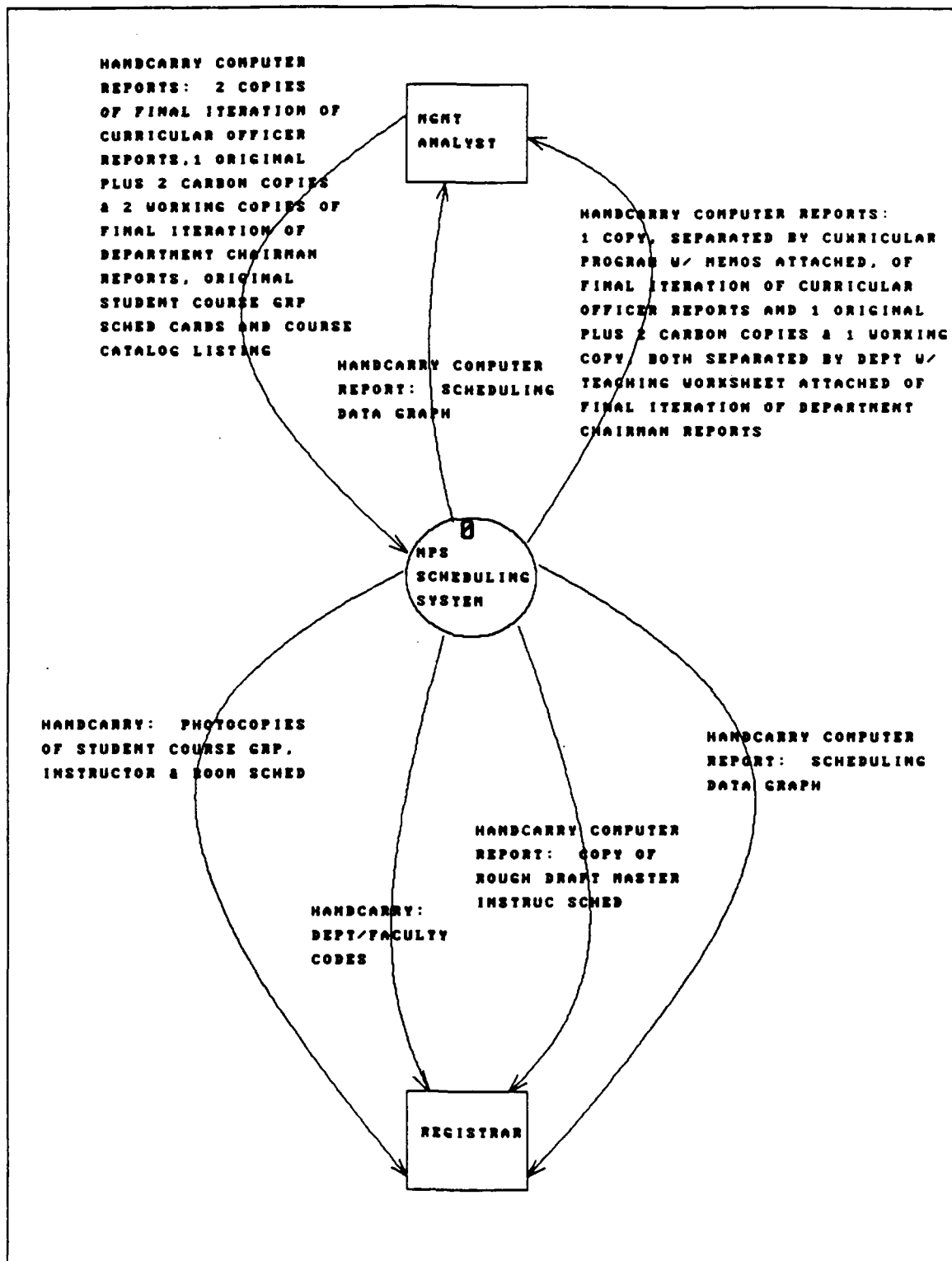


**FIG. A-1, Physical Context Dataflow Diagram of the current NPS Scheduling System.**

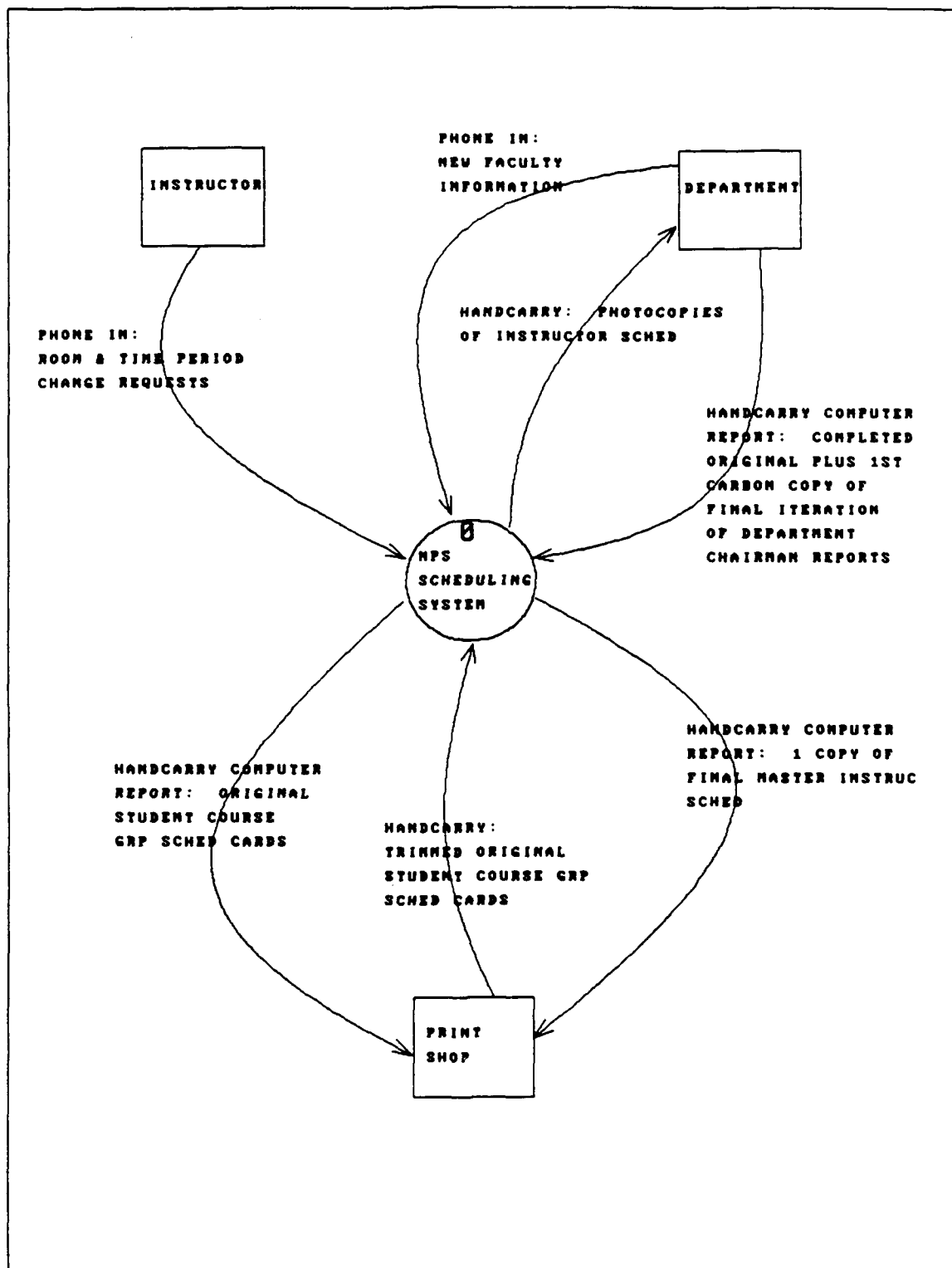


FIG. A-2, Physical Context Dataflow Diagram of the current NPS Scheduling System, cont'd.

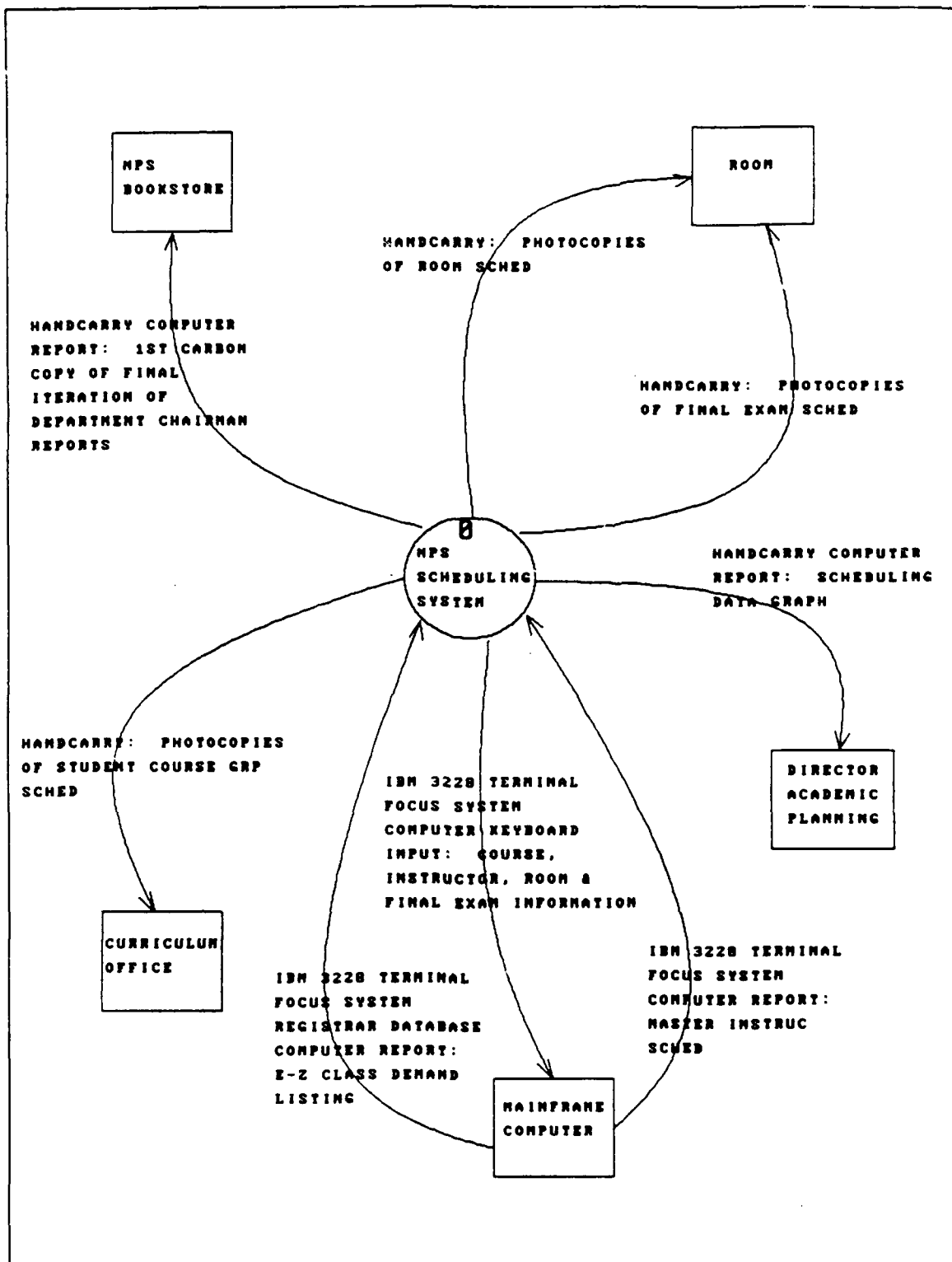


FIG. A-3, Physical Context Dataflow Diagram of the current NPS Scheduling System, cont'd.

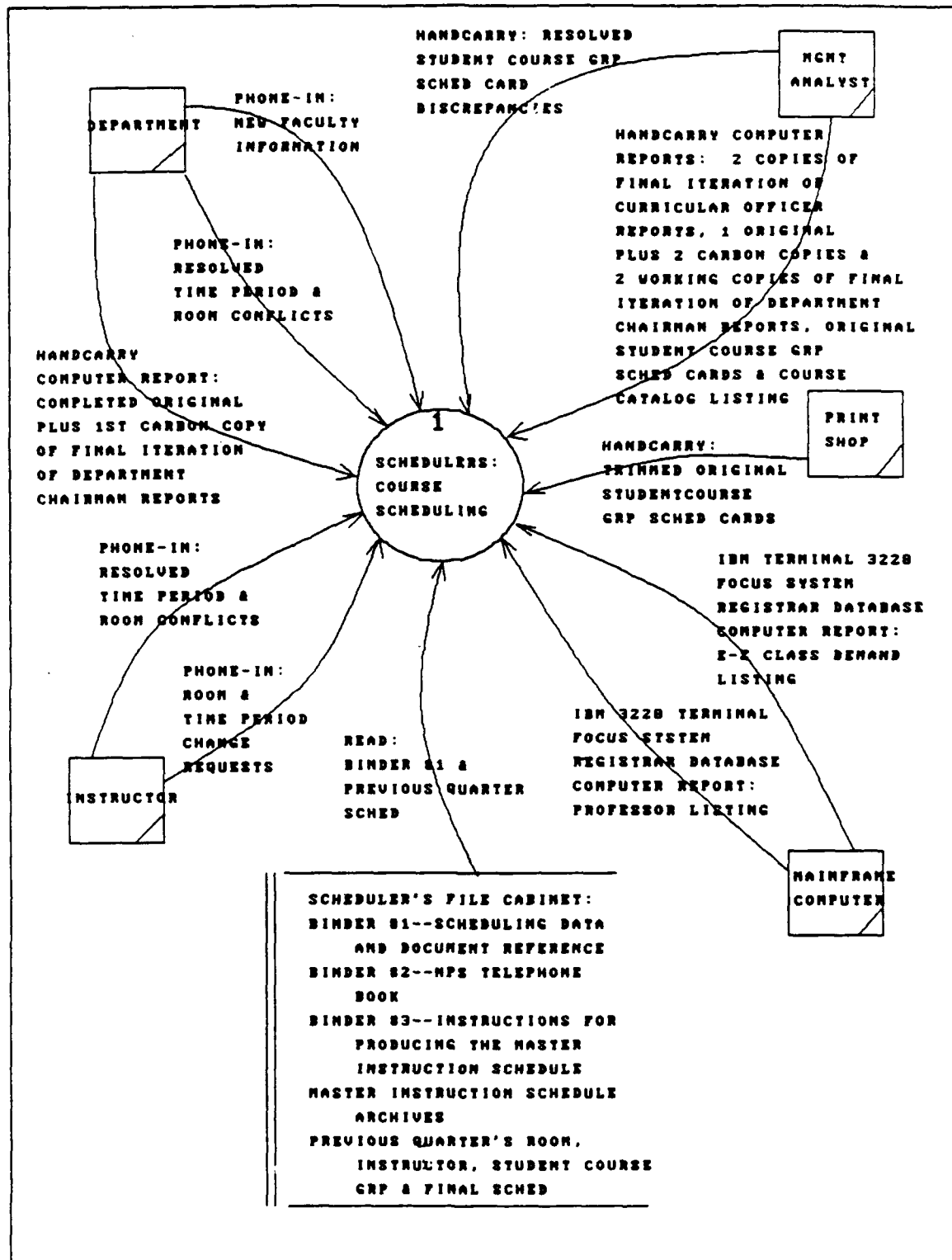


**FIG. A-4, Physical Systems Dataflow Diagram of inputs to the Course Scheduling Process.**

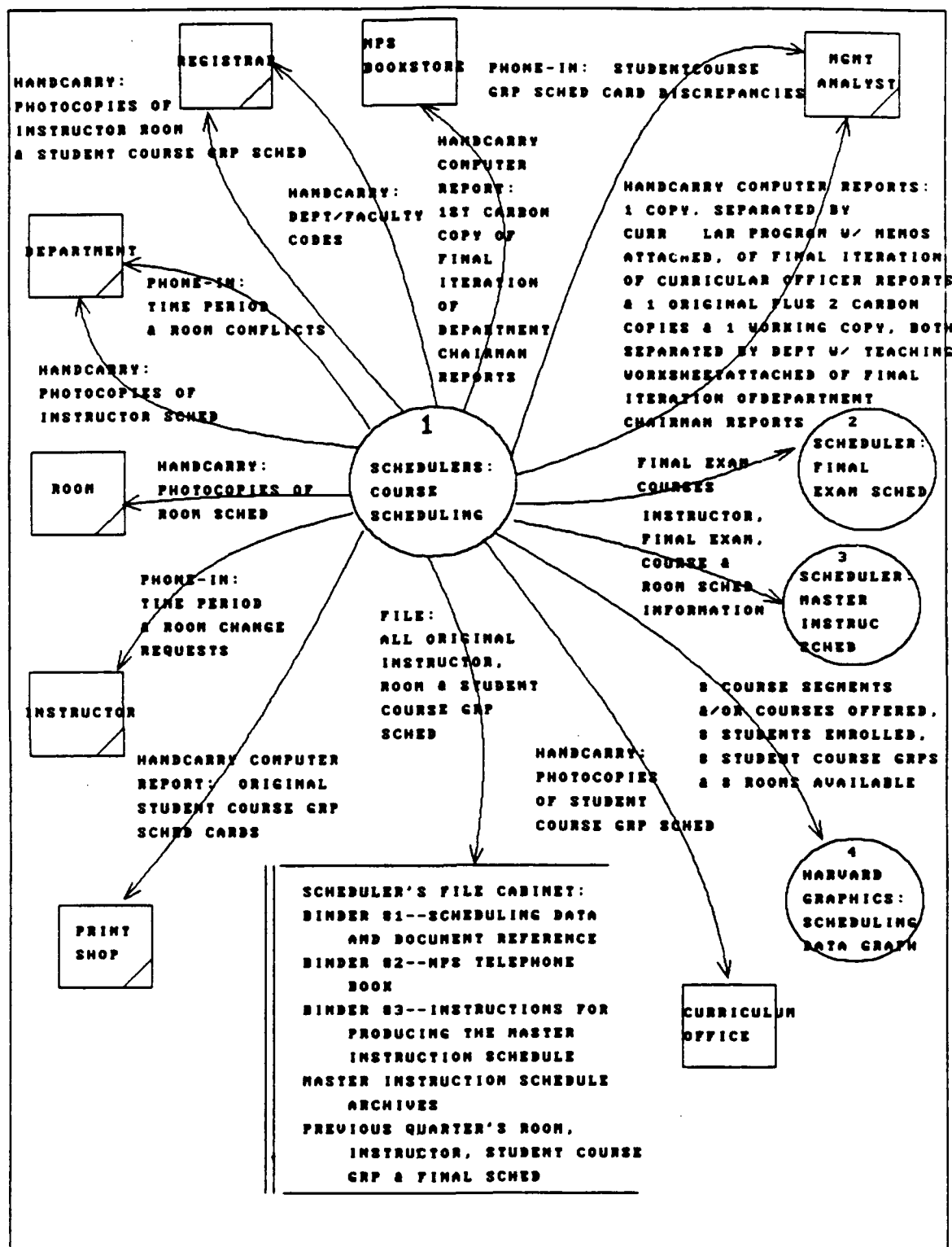
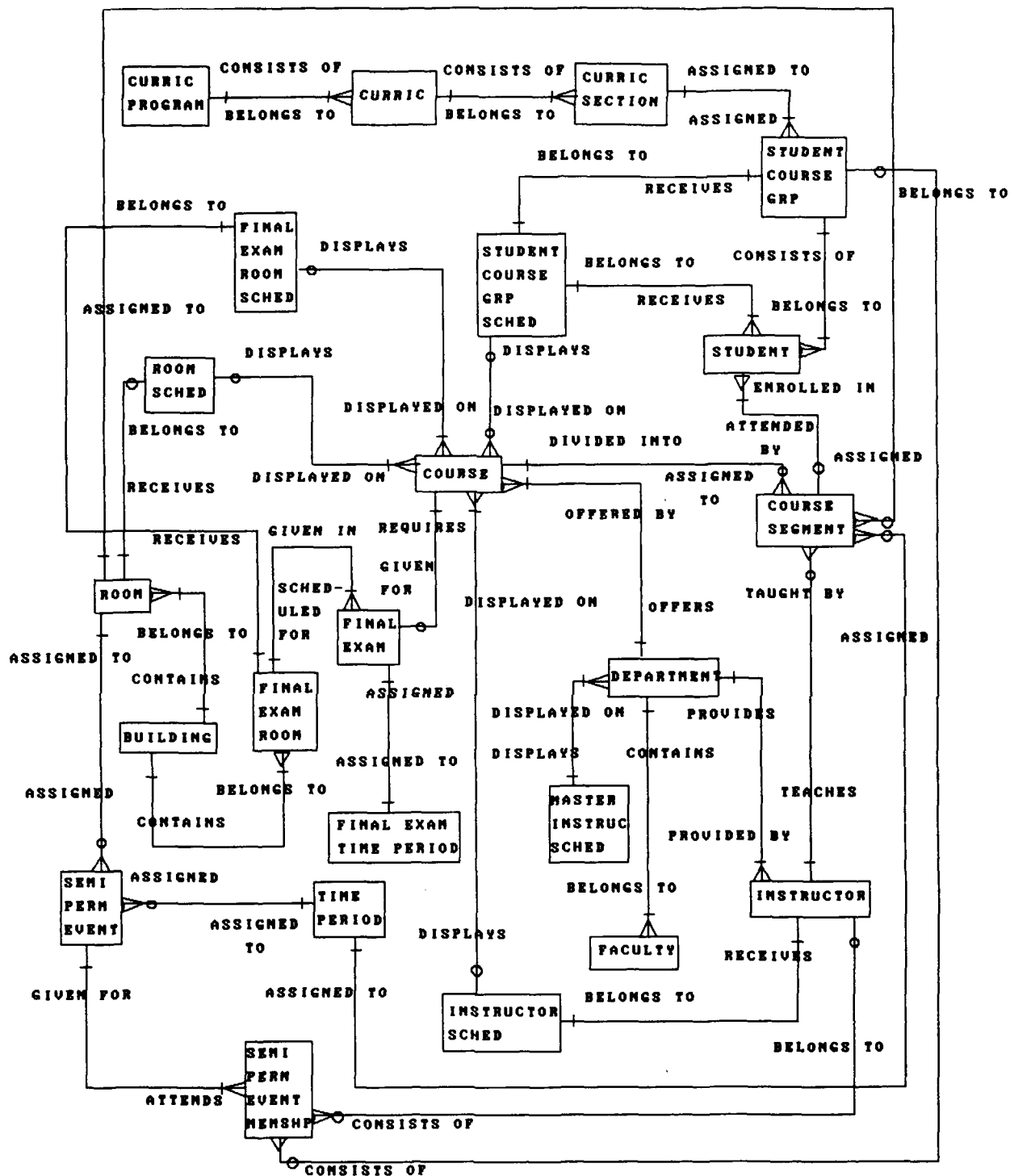


**FIG. A-5, Physical Systems Dataflow Diagram of outputs from the Course Scheduling Process.**



## **APPENDIX B: NPS<sup>3</sup> ENTITY RELATIONSHIP DIAGRAMS**

The following report presents the Entity Relationship Diagrams, FIG. B-1, for the proposed Naval Postgraduate School Scheduling System (NPS<sup>3</sup>). Following FIG. B-1 are the Entity definitions followed with the definitions for each of the Entity Attributes.



## ENTITY DEFINITION

**Entity:** BUILDING

**Description:** This identifies the building of which classrooms, laboratories and final exam rooms are located in during an academic quarter at NPS.

**Key  
Attributes:** BUILDING\_CODE; Building\_letter\_code

**Other  
Attributes:** BUILDING\_NAME; Building\_name

**Relationships:** Always CONTAINS many ROOMs.  
Always CONTAINS many FINAL\_EXAM\_ROOMs.

### ENTITY DEFINITION

Entity: COURSE

**Description:** This identifies the entire list of courses available at NPS based on the E-Z Demand List.

### Key Attributes:

COURSE\_TYPE; Course\_type  
COURSE\_NUMBER; Course number code

**Other  
Attributes:**

```

FINAL_EXAM; Final_exam_indicator
REFRESHER COURSE; Refresher_course_indicator
NO_OF_SEGMENTS; Total_number_of_course
                        segments
LECT_HRS; Course_lecture_credit_hours
LAB_HRS; Course_lab_credit_hours
COURSE_REQUIRED_TIME; Scheduled_required
                        timeperiod_for_course_indicator
INSTRUC_REQUIRED_TIME; Scheduled_required
                        timeperiod_for_instructor_indicator
DIVERSITY_OF_MAJORS; Diversity_of_majors
                        indicator
TECH_LAB; Technical_lab_indicator
SIMULTANEOUS_SCHED_COURSE; Simultaneously_
                        scheduled_course
ACCELERATED_COURSE; Accelerated_course_
                        indicator
SPECIAL_ROOM_REQUIREMENT; Special_room_
                        requirements
REQUIRED_LAB_ROOM; Required_laboratory_room
DEPT_LTR_CODEFK; Department_letter_code
FIN_EX_RM_CARD_NUMBERFK; Final_exam_room
                        schedule_card_number
SCG_CARD_NUMBERFK; Student_course_group_
                        schedule_card_number
INSTRUC_CARD_NUMBERFK; Instructor_schedule_
                        card_number
ROOM_CARD_NUMBERFK; Room_schedule_card_number
QTR_NUMBERFK; Schedule_quarter_number
YEARFK; Schedule_year
COMMENTS; Scheduler_course_comments
STATUS; Course_schedule_status

```

**Relationship:** Sometimes DIVIDED INTO many COURSE\_SEGMENTS.  
Always OFFERED BY one DEPARTMENT.  
Sometimes DISPLAYED ON one INSTRUCTOR\_SCHED.  
Sometimes REQUIRES one FINAL\_EXAM.  
Sometimes DISPLAYED ON one ROOM\_SCHED.  
Sometimes DISPLAYED ON one  
FINAL\_EXAM ROOM SCHED.  
Sometimes DISPLAYED ON one  
STUDENT\_COURSE\_GRP\_SCHED.

## ENTITY DEFINITION

**Entity:** COURSE\_SEGMENT

**Description:** This identifies all courses and their corresponding course segments.

**Key  
Attributes:**

COURSE\_TYPE<sup>FK</sup>; Course\_type  
COURSE\_NUMBER<sup>FK</sup>; Course\_number\_code  
SEGMENT\_NUMBER; Course\_segment\_number

**Other  
Attributes:**

SEGMENT\_STUDENTS; Course\_segment\_number\_of\_students  
LAB; Lab\_indicator  
TEACHING\_TEAM; Teaching\_team\_indicator  
DESIGNATED\_STUDENT\_COURSE\_GRP; Designated\_student\_course\_group\_for\_course\_segment  
BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
ROOM\_NUMBER<sup>FK</sup>; Room\_number\_in\_building  
DAY<sup>FK</sup>; Academic\_day  
PERIOD<sup>FK</sup>; Academic\_hour  
FACULTY\_CODE<sup>FK</sup>; Department\_faculty\_code  
DEPT\_LTR\_CODE<sup>FK</sup>; Department\_letter\_code  
STATUS; Course\_schedule\_status

**Relationships:** Always ASSIGNED\_TO one COURSE.  
Always ASSIGNED one ROOM.  
Always ASSIGNED one TIME\_PERIOD.  
Always TAUGHT\_BY one INSTRUCTOR.  
Always ATTENDED\_BY many STUDENTS.

### ENTITY DEFINITION

**Entity:** CURRIC

**Description:** Uniquely identifies a specific area of study,  
at NPS, within a curriculum program.

**Key  
Attributes:** CURRIC\_LTR\_CODE; Curriculum\_letter\_code

**Other  
Attributes:** PROGRAM\_LTR\_CODE<sup>FK</sup>; Curriculum\_program\_letter  
\_code

**Relationships:** Always CONSISTS\_OF many CURRIC\_SECTIONS.  
Always BELONGS\_TO one CURRIC\_PROGRAM.

### ENTITY DEFINITION

**Entity:** CURRIC\_PROGRAM

**Description:** Uniquely identifies an overall area study, at NPS, that may encompass many curriculums.

**Key Attributes:** PROGRAM\_LTR\_CODE; Curriculum\_program\_letter\_code

**Other Attributes:**

**Relationships:** Always CONSISTS\_OF many CURRICulums.

### ENTITY DEFINITION

**Entity:** CURRIC\_SECTION

**Description:** Uniquely identifies a section of students assigned to the same curriculum.

**Key**

**Attributes:**

CURRIC\_LTR\_CODE<sup>FK</sup>; Curriculum\_letter\_code  
SECTION\_NUMBER; Curriculum\_section\_number

**Other**

**Attributes:**

**Relationships:** Always BELONGS\_TO one CURRICulum.  
Always ASSIGNED\_TO many STUDENT\_COURSE\_GRPs.

## ENTITY DEFINITION

**Entity:** DEPARTMENT

**Description:** This identifies the research/teaching organizational unit at NPS.

**Key Attributes:** DEPT\_LTR\_CODE; Department\_letter\_code

**Other Attributes:**  
DEPT\_NAME; Department\_name  
MSTR\_INSTR\_SCHD\_QTR\_NAME<sup>FK</sup>;  
Master\_instruction\_schedule\_quarter\_name  
MSTR\_INSTR\_SCHD\_YEAR<sup>FK</sup>;  
Master\_instruction\_schedule\_year

**Relationships:** Always OFFERS many COURSES.  
Always PROVIDES many INSTRUCTORS.  
Always CONTAINS many FACULTY.  
Always DISPLAYED\_ON one MASTER\_INSTRUC\_SCHED.

## ENTITY DEFINITION

**Entity:** FACULTY

**Description:** This identifies the members of a particular department.

**Key**

**Attributes:**

DEPT\_LTR\_CODE<sup>FK</sup>; Department\_letter\_code  
FACULTY\_CODE; Department\_faculty\_code

**Other**

**Attributes:**

FACULTY\_NAME; Faculty\_name  
ACAD\_COUNCIL\_MBRSHIP; Academic\_council  
membership\_indicator  
FAC\_COUNCIL\_OFF\_LIST; Faculty\_council\_officers  
listing\_indicator  
ASW\_MBRSHIP; ASW\_academic\_group\_indicator  
EW\_MBRSHIP; EW\_academic\_group\_indicator  
C3\_MBRSHIP; C3\_academic\_group\_indicator  
SSAG\_MBRSHIP; Space\_systems\_academic  
\_group\_indicator

**Relationships:** Always BELONGS\_TO one DEPARTMENT.

### ENTITY DEFINITION

Entity: FINAL\_EXAM

**Description:** This identifies a course and/or course segment that requires a final exam.

**Key**  
**Attributes:** COURSE\_TYPE<sup>FK</sup>; Course\_type  
COURSE\_NUMBER<sup>FK</sup>; Course\_number\_code  
SEGMENT\_NUMBER<sup>FK</sup>; Course\_segment\_number

**Other Attributes:**

- BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code
- FINAL\_EXAM\_ROOM\_NUMBER<sup>FK</sup>; Final\_exam\_room  
number\_in\_building
- FINAL\_EXAM\_DAY<sup>FK</sup>; Final\_exam\_academic\_day
- FINAL\_EXAM\_PERIOD<sup>FK</sup>; Final\_exam\_academic\_hour

**Relationships:** Always GIVEN\_IN one FINAL\_EXAM\_ROOM.  
Always GIVEN\_FOR one COURSE.  
Always ASSIGNED one FINAL\_EXAM\_TIME\_PERIOD.

## ENTITY DEFINITION

**Entity:** FINAL\_EXAM\_ROOM

**Description:** This identifies the building and room in which a final exam for a course and/or course segment is given in.

**Key Attributes:** BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
FINAL\_EXAM\_ROOM\_NUMBER; Final\_exam\_room  
\_number\_in\_building

**Other Attributes:** CAPACITY; Room\_seating\_capacity  
ARRANGEMENT; Room\_seating\_arrangements  
FEATURES; Room\_features\_or\_equipment  
TYPE; Room\_type  
FIN\_EX\_RM\_CARD\_NUMBER<sup>FK</sup>; Final\_exam\_room  
\_schedule\_card\_number

**Relationships:** Always SCHEDULED\_FOR many FINAL\_EXAMS.  
Always BELONGS\_TO one BUILDING.  
Always RECEIVES one FINAL\_EXAM\_ROOM\_SCHED.

### ENTITY DEFINITION

**Entity:** FINAL\_EXAM\_ROOM\_SCHED

**Description:** This identifies the final exam schedule for a final exam room.

**Key  
Attributes:**

FIN\_EX\_RM\_CARD\_NUMBER; Final\_exam\_room  
\_schedule\_card\_number  
QTR\_NUMBER; Schedule\_quarter\_number  
YEAR; Schedule\_year

**Other  
Attributes:**

BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
FINAL\_EXAM\_ROOM\_NUMBER<sup>FK</sup>; Final\_exam\_room  
\_number\_in\_building

**Relationships:** Always DISPLAYS many COURSEs.  
Always BELONGS\_TO one FINAL\_EXAM\_ROOM.

## ENTITY DEFINITION

**Entity:** FINAL\_EXAM\_TIME\_PERIOD

**Description:** This identifies the scheduled day and time that a final exam is given in a final exam room.

**Key**

**Attributes:** FINAL\_EXAM\_DAY; Final\_exam\_academic\_day  
FINAL\_EXAM\_PERIOD; Final\_exam\_academic\_hour

**Other**

**Attributes:** COURSE\_TYPE<sup>FK</sup>; Course\_type  
COURSE\_NUMBER<sup>FK</sup>; Course\_number\_code  
SEGMENT\_NUMBER<sup>FK</sup>; Course\_segment\_number

**Relationships:** Always ASSIGNED\_TO one FINAL\_EXAM.

### ENTITY DEFINITION

Entity: INSTRUCTOR

**Description:** This identifies the person who teaches a particular course and/or course segment.

**Key Attributes:**

DEPT\_LTR\_CODE<sup>FK</sup>; Department\_letter\_code  
FACULTY\_CODE; Department faculty code

**Other  
Attributes:**

```
INSTRUC_NAME; Instructor_name
DEPT_CHAIR_OR_DEAN; Department_chairman_or
                    dean_indicator
ACAD_COUNCIL_MBRSH; Academic_council
                    membership_indicator
FAC_COUNCIL_OFF_LIST; Faculty_council
                    officers_listing_indicator
ASW_MBRSH; ASW_academic_group_indicator
EW_MBRSH; EW_academic_group_indicator
C3_MBRSH; C3_academic_group_indicator
SSAG_MBRSH; Space_systems_academic
            group_indicator
INSTRUC_CARD_NUMBERFK; Instructor_schedule
                    card number
```

**Relationships:** Always PROVIDED\_BY one DEPARTMENT.  
Sometimes TEACHES many COURSE\_SEGMENTS.  
Sometimes BELONGS\_TO many  
SEMI\_PERM\_EVENT\_MEMSHPS.  
Always RECEIVES one INSTRUCTOR SCHED.

### ENTITY DEFINITION

**Entity:** INSTRUCTOR\_SCHED

**Description:** This identifies the schedule for an Instructor during a given quarter.

**Key  
Attributes:**

INSTRUC\_CARD\_NUMBER; Instructor\_schedule  
\_card\_number  
QTR\_NUMBER; Schedule\_quarter\_number  
YEAR; Schedule\_year

**Other  
Attributes:**

DEPT\_LTR\_CODE<sup>FK</sup>; Department\_letter\_code  
FACULTY\_CODE<sup>FK</sup>; Department\_faculty\_code  
INSTRUC\_NAME; Instructor\_name

**Relationships:** Always BELONGS\_TO one INSTRUCTOR.  
Always DISPLAYS many COURSES.

### ENTITY DEFINITION

**Entity:** MASTER\_INSTRUC\_SCHED

**Description:** This identifies the schedule for all courses offered during a given quarter.

**Key**

**Attributes:**

MSTR\_INSTR\_SCHED\_QTR\_NAME; Master\_instruction  
\_schedule\_quarter\_name  
MSTR\_INSTR\_SCHED\_YEAR; Master\_instruction  
\_schedule\_year

**Other**

**Attributes:**

**Relationships:** Always DISPLAYS many DEPARTMENTS.

### ENTITY DEFINITION

Entity: ROOM

**Description:** This identifies a classroom or a laboratory that a course or course segment is taught in.

## Key

**Attributes:**

BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
ROOM\_NUMBER; Room number in building

**Other**

**Attributes:**

```

CAPACITY; Room_seating_capacity
ARRANGEMENT; Room_seating_arrangements
FEATURES; Room_features_or_equipment
TYPE; Room_type
ROOM_CARD_NUMBER; Room_schedule
                        card number

```

**Relationships:** Sometimes ASSIGNED\_TO many COURSE\_SEGMENTS.  
Sometimes RECEIVES one ROOM\_SCHED.  
Always BELONGS\_TO one BUILDING.  
Sometimes ASSIGNED TO many SEMI PERM EVENTS.

### ENTITY DEFINITION

**Entity:** ROOM\_SCHED

**Description:** This identifies the schedule for a given classroom or laboratory.

**Key  
Attributes:**

ROOM\_CARD\_NUMBER; Room\_schedule\_card\_number  
QTR\_NUMBER; Schedule\_quarter\_number  
YEAR; Schedule\_year

**Other  
Attributes:**

BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
ROOM\_NUMBER<sup>FK</sup>; Room\_number\_in\_building

**Relationships:** Always BELONGS TO one ROOM.  
Always DISPLAYS many COURSES.

## ENTITY DEFINITION

**Entity:** SEMI\_PERM\_EVENT

**Description:** This identifies an event that is scheduled during the same time period every quarter.

**Key**

**Attributes:**

EVENT\_TYPE; Semi\_permanent\_event\_type  
EVENT\_NAME; Semi\_permanent\_event\_name

**Other**

**Attributes:**

BUILDING\_CODE<sup>FK</sup>; Building\_letter\_code  
ROOM\_NUMBER<sup>FK</sup>; Room\_number\_in\_building  
DAY<sup>FK</sup>; Academic\_day  
PERIOD<sup>FK</sup>; Academic\_hour

**Relationships:** Always ASSIGNED one ROOM.  
Always GIVEN\_FOR many  
SEMI\_PERM\_EVENT\_MEMSHPs.  
Always ASSIGNED one TIME\_PERIOD.

## ENTITY DEFINITION

**Entity:** SEMI\_PERM\_EVENT\_MEMSHIP

**Description:** This identifies the membership for a semi permanent event at NPS.

**Key**

**Attributes:**

EVENT\_TYPE<sup>FK</sup>; Semi\_permanent\_event\_type  
EVENT\_NAME<sup>FK</sup>; Semi\_permanent\_event\_name  
FACULTY\_CODE<sup>FK</sup>; Department\_faculty\_code  
DEPT\_LTR\_CODE<sup>FK</sup>; Department\_letter\_code  
CURRIC\_LTR\_CODE<sup>FK</sup>; Curriculum\_letter\_code  
SECTION\_NUMBER<sup>FK</sup>; Curriculum\_section\_number  
GROUP\_NUMBER<sup>FK</sup>; Curriculum\_student  
\_course\_group\_number

**Other**

**Attributes:**

**Relationships:** Always ATTENDS one SEMI\_PERM\_EVENT.  
Sometimes CONSISTS\_OF one INSTRUCTOR.  
Sometimes CONSISTS\_OF one  
STUDENT\_COURSE\_GRP.

### ENTITY DEFINITION

**Entity:** STUDENT

**Description:** This identifies a person attending a course of instruction at NPS.

**Key  
Attributes:**

STUD\_SSN; Student\_social\_security\_number

**Other  
Attributes:**

STUD\_NAME; Student\_name  
CURRIC\_LTR\_CODE<sup>FK</sup>; Curriculum\_letter\_code  
SECTION\_NUMBER<sup>FK</sup>; Curriculum\_section\_number  
GROUP\_NUMBER<sup>FK</sup>; Curriculum\_student  
course\_group\_number  
SCG\_CARD\_NUMBER<sup>FK</sup>; Student\_course  
group\_schedule\_card\_number  
QTR\_NUMBER<sup>FK</sup>; Schedule\_quarter\_number  
YEAR<sup>FK</sup>; Schedule\_year  
COURSE\_TYPE<sup>FK</sup>; Course\_type  
COURSE\_NUMBER<sup>FK</sup>; Course\_number\_code  
SEGMENT\_NUMBER<sup>FK</sup>; Course\_segment\_number

**Relationships:** Always BELONGS\_TO one STUDENT\_COURSE\_GRP.  
Always RECEIVES one STUDENT\_COURSE\_GRP\_SCHED.  
Sometimes ENROLLED\_IN one COURSE\_SEGMENT.

## ENTITY DEFINITION

**Entity:** STUDENT\_COURSE\_GRP

**Description:** This identifies the group of students taking the same courses during a quarter at NPS.

**Key**

**Attributes:**

CURRIC\_LTR\_CODE<sup>FK</sup>; Curriculum\_letter\_code  
SECTION\_NUMBER<sup>FK</sup>; Curriculum\_section\_number  
GROUP\_NUMBER; Curriculum\_student  
\_course\_group\_number

**Other**

**Attributes:**

GROUP\_STUDENTS; Curriculum\_student  
\_course\_group\_number\_of\_students  
UNUSUAL\_COURSE\_COMBINATION; Unusual\_course  
\_combination\_indicator

**Relationships:** Always ASSIGNED one CURRIC\_SECTION.  
Always CONSISTS\_OF many STUDENTS (may consist of one student).  
Sometimes BELONGS\_TO many SEMI\_PERM\_EVENT\_MEMSHPS.  
Always RECEIVES one STUDENT\_COURSE\_GRP\_SCHED.

### ENTITY DEFINITION

**Entity:** STUDENT\_COURSE\_GRP\_SCHED

**Description:** This identifies the schedule for students taking the same courses during a quarter at NPS.

**Key Attributes:** SCG\_CARD\_NUMBER; Student\_course\_group  
\_schedule\_card\_number  
QTR\_NUMBER; Schedule\_quarter\_number  
YEAR; Schedule\_year

**Other Attributes:** CURRIC\_LTR\_CODE<sup>FK</sup>; Curriculum\_letter\_code  
SECTION\_NUMBER<sup>FK</sup>; Curriculum\_section\_number  
GROUP\_NUMBER<sup>FK</sup>; Curriculum\_student  
\_course\_group\_number

**Relationships:** Always BELONGS\_TO many STUDENTS (may belong to one student).  
Sometimes DISPLAYS many COURSES.  
Always BELONGS\_TO one STUDENT\_COURSE\_GRP.

### ENTITY DEFINITION

**Entity:** TIME\_PERIOD

**Description:** This identifies the day and time that a course, course segment or semi permanent event is scheduled.

**Key  
Attributes:**  
DAY; Academic\_day  
PERIOD; Academic\_hour

**Other  
Attributes:**

**Relationships:** Sometimes ASSIGNED\_TO many SEMI\_PERM\_EVENTS.  
Sometimes ASSIGNED\_TO many COURSE\_SEGMENTS.

## ATTRIBUTE DEFINITIONS

Academic\_council\_membership\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in Academic Council

Academic\_day:

Text 9

Name of the day of the academic week

Academic\_hour:

Numeric 1

Hour-long period during the academic day

Accelerated\_course\_indicator:

Text 1, Mask X,

where X is Y or N

Indicates courses normally scheduled for double the  
course load

ASW\_academic\_group\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in ASW academic group

Building\_letter\_code:

Text 1

First letter of the name of a particular academic  
building

Building\_name:

Text 20

Name of an academic building

C3\_academic\_group\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in C3 academic group

Course\_lab\_credit\_hours:

Numeric 1

Number of credit hours assigned to the lab component  
of a course or its course segment

Course\_lecture\_credit\_hours:

Numeric 1

Number of credit hours assigned to the lecture component  
of a course or its course segment

Course\_number\_code:

Numeric 4, Mask NXXX

where N is 0-4, XXX is course code

Number code assigned to a course

Course\_schedule\_status\_code:

Text 4

Status of the scheduling of a course

Course\_segment\_number:

Numeric 2

Number of the segment into which a course has been divided

Course\_segment\_number\_of\_students:

Numeric 3

Number of students assigned to a course segment

Course\_type:

Text 2

Code for the type subject a course teaches

Curriculum\_letter\_code:

Text 2

Letter code for a curriculum within a curriculum program

Curriculum\_program\_letter\_code:

Text 2

Letter code for a curriculum program

Curriculum\_section\_number:

Numeric 2

Number code for a section within a curriculum

Curriculum\_student\_course\_group\_number:

Numeric 2

Number of a student course group within a curriculum section

Curriculum\_student\_course\_group\_number\_of\_students:

Numeric 2

Number of students in a student course group

Department\_chairman\_or\_dean\_indicator:

Text 1, Mask X

where X is Y of N

Indicates Instructor who is Department chairman of Dean

Department\_faculty\_code:

Text 2

Code used to identify each faculty member

Department\_letter\_code:

Text 2

Alpha code used to identify each department

Department\_name:

Text 25

Name of department

Designated\_student\_course\_group\_for\_course\_segment:

Text 6, Mask XX YY ZZ

where XX is curriculum letter code, YY is curriculum section number and ZZ is curriculum student course group number

Designates students to be placed in specific course segments

Diversity\_of\_majors\_indicator:

Text 1, Mask X

where X is Y or N

Indicates that the course has a diversity of majors in its enrollment

EW\_academic\_group\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in EW academic group

Faculty\_council\_officers\_listing\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in Provost and Superintendent council

Faculty\_name:

Text 15

First 13 letters of faculty member last name, 1st letter of faculty member first name and 1st letter of faculty member middle name

Name of faculty member

Final\_exam\_academic\_day:

Text 9

Name of the day of final's week

Final\_exam\_academic\_hour:

Text 1

Hour-long period during final's week

Final\_exam\_course\_indicator:

Text 1, Mask X

where X is Y or N

Indicates final exam requirement for course

Final\_exam\_room\_number\_in\_building:

Text 4, Mask NNNA

where NNA is the sequential number of a room and  
A is a letter designator for a subdivision of  
a room

Number assigned to a room in a building used for a final  
exam

Final\_exam\_room\_schedule\_card\_number:

Numeric 4

Sequential number of a final exam schedule card in a set  
of final exam schedule cards

Instructor\_name:

Text 15

First 13 letters of instructor last name, 1st letter  
of instructor first name and 1st letter of  
instructor middle name

Name of an instructor

Instructor\_schedule\_card\_number:

Numeric 4

Sequential number of an instructor schedule card in a  
set of instructor schedule cards

Lab\_indicator:

Text 1, Mask X

where X is Y or N

Indicates that the particular course segment is a  
laboratory

Master\_instruction\_schedule\_year:

Numeric 4

Year for which the Master Instruction schedule is  
written

Master\_instruction\_schedule\_quarter\_name:

Text 6

Name of the season at the beginning of the quarter of  
the academic year

Refresher\_course\_indicator:

Text 1, Mask X

where X is Y or N

Indicates a course is a refresher course

Required\_laboratory\_room:

Text 6, Mask X-NNNA

where X is first letter of building, NNN is  
sequential number of a room and A is letter  
designator for a room subdivision

Number assigned to a required laboratory room for a  
course lab

Room\_features\_or\_equipment

Text 20

Description of features of equipment about a room that distinguish it from other rooms

Room\_number\_in\_building:

Text 4, Mask NNNA

where NNN is sequential number of a room, A is letter designator for a room subdivision

Room\_schedule\_card\_number:

Numeric 4

Sequential number of a room schedule card in a set of room schedule cards

Room\_seating\_arrangements:

Text 1, Mask X

where X is values T (tables and chairs) or D (desks) seating arrangements for students taught in a room

Room\_seating\_capacity:

Numeric 3

Number of chairs with table space or desks or standing room; functional student capacity

Room\_type:

Text 2, Mask XX

where XX is values CR (classroom) or LB (laboratory) or SC (secure class) or SL (secure lab)

Specifies the type of room

Schedule\_quarter\_number:

Numeric 1

Sequential number of a quarter in a schedule year

Schedule\_year:

Numeric 4

Year for which a schedule is written

Scheduled\_required\_timeperiod\_for\_instructor\_indicator:

Text 1, Mask X

where X is Y or N

Indicates that course has a required timeperiod for the instructor

Scheduled\_required\_timeperiod\_for\_course\_indicator:

Text 1, Mask X

where X is Y or N

Indicates that course has a required timeperiod

Scheduler\_course\_comments:

Text 50

Comments from course schedulers regarding course

Semi\_permanent\_event\_name:

Text 10

First 10 letters of a semi permanent event name (e.g.  
Dept mtg)

Semi\_permanent\_event\_type:

Text 2

Code for the type semi permanent event schedule

Simultaneously\_scheduled\_course:

Text 7, Mask XX-NYY

where XX is course type, N is 0-4 and YYY is  
course code

Identifies a course that simultaneously scheduled with  
the course in question

Space\_systems\_academic\_indicator:

Text 1, Mask X

where X is Y or N

Indicates membership in Space systems academic group

Special\_room\_requirements:

Text 20

Special room features that a given course requires (eg  
computer terminals, classified rooms, NSA map rooms)

Student\_course\_group\_schedule\_card\_number:

Numeric 4

Sequential number of a student course group schedule  
card in a set of student course group schedule cards

Student\_name:

Text 15

First 13 letters of student last name, first letter of  
student first name, first letter of student middle  
name

Student\_social\_security\_number:

Numeric 9

Social security number of a person

Teaching\_team\_indicator:

Text 1, Mask X

where X is Y or N

Indicates a course is taught by a team of instructors

Technical\_lab\_indicator:

Text 1, Mask X

where X is Y or N

Indicates that a course laboratory is technical in nature

Total\_number\_of\_course\_segments:

Numeric 1

Total number of course segments a course is divided into

Unusual\_course\_combination\_indicator:

Text 1, Mask X

where X is Y or N

Indicates unusual course combinations for a student  
course group

## **APPENDIX C: NPS<sup>3</sup> LOGICAL DATA FLOW DIAGRAMS**

In an attempt to gain a more detailed description of the NPS Scheduling System user requirements presented by Nolan and Youngblood, and to enhance possible alternative implementation solutions, the logical dataflow diagrams for NPS<sup>3</sup> are presented in FIG. C-1 thru FIG. C-38. The Demarco-Yourdon system for dataflow diagrams is used.

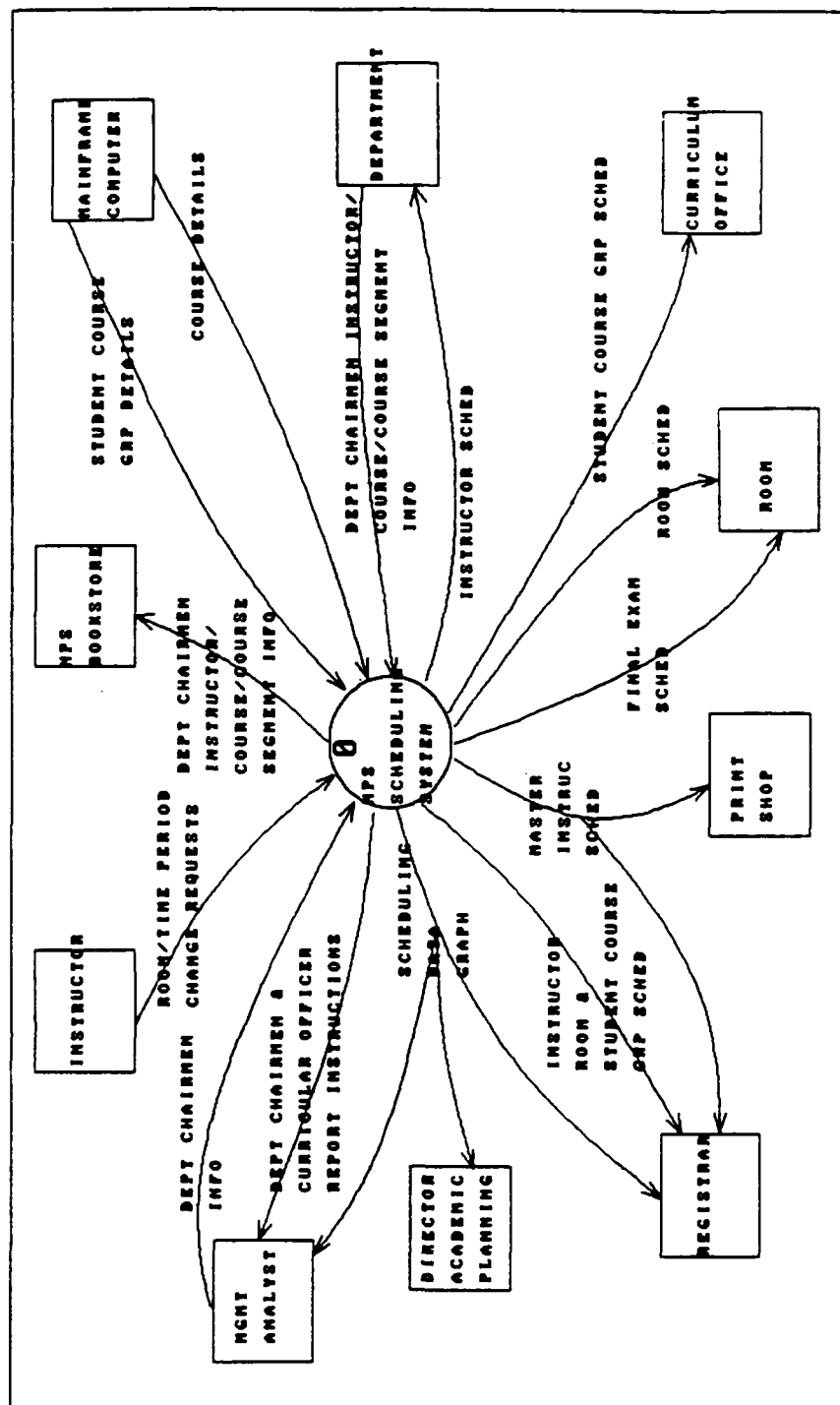


FIG. C-1, Logical Context Dataflow Diagram of the target NPS Scheduling System.



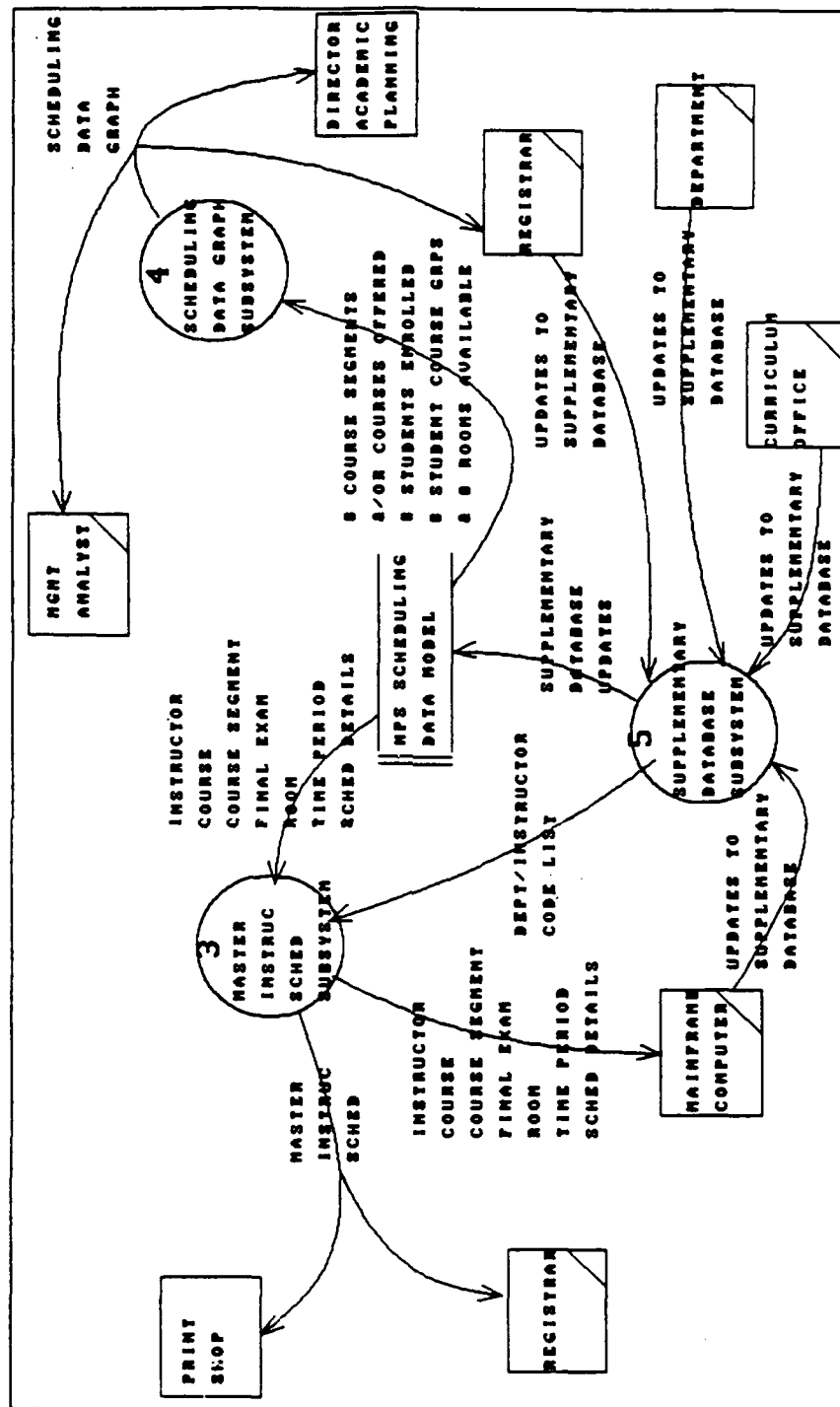


FIG. C-3, Logical Systems Dataflow Diagram of the target NPS Scheduling System, cont'd.

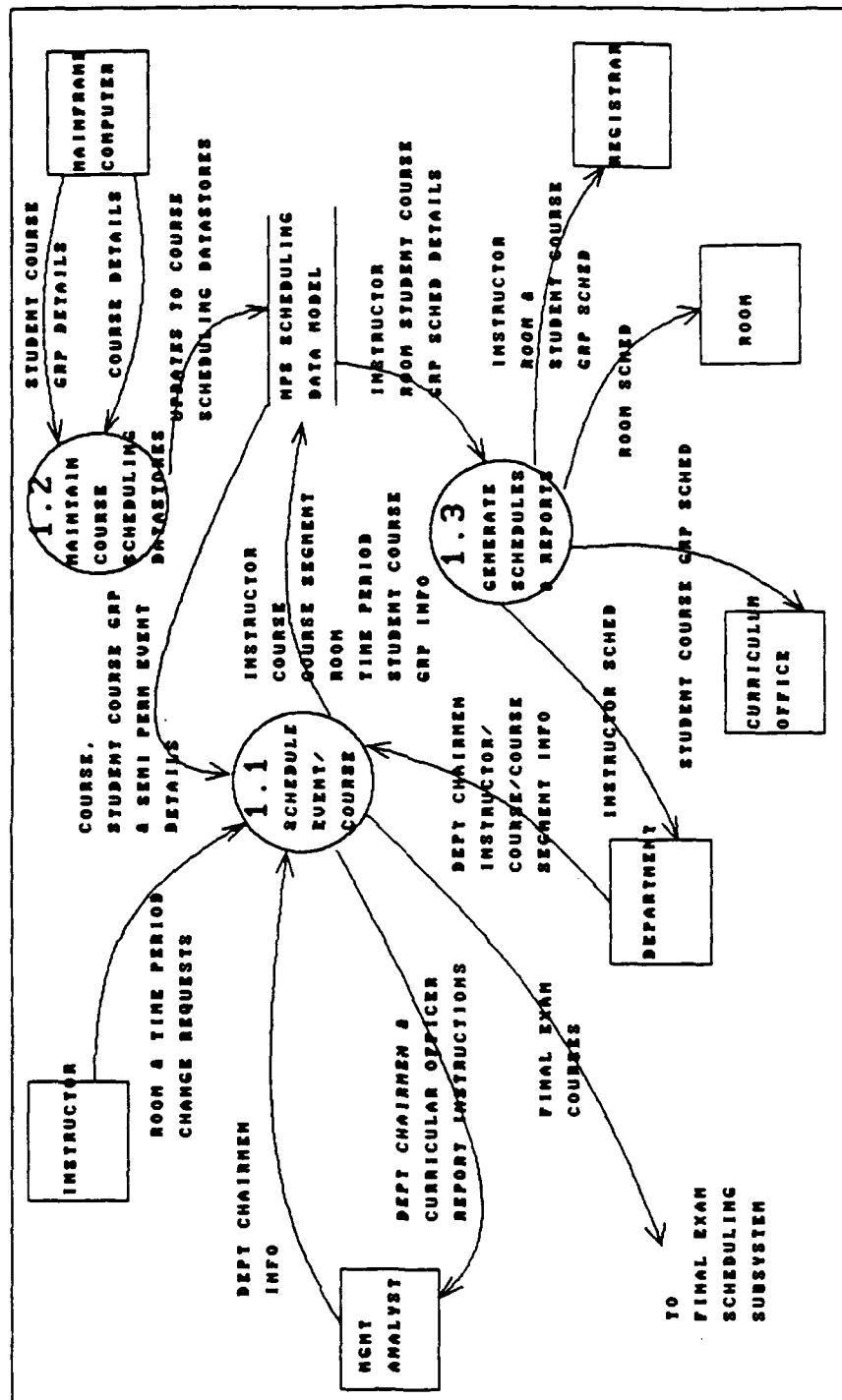


FIG. C-4, Logical Dataflow Diagram for the target Event/Course Scheduling Subsystem.



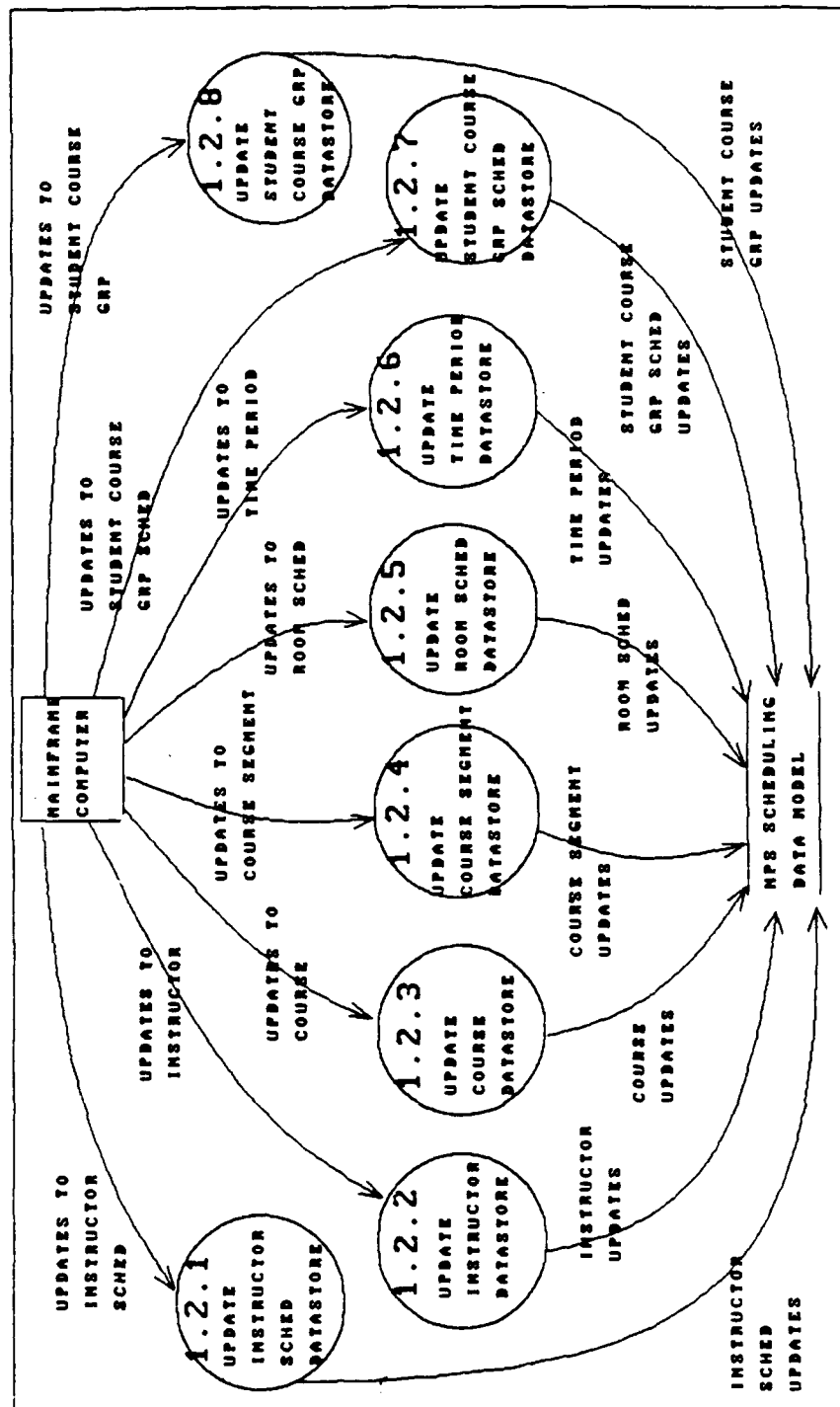


FIG. C-6, Logical Dataflow Diagram for Scheduling Data Maintenance.

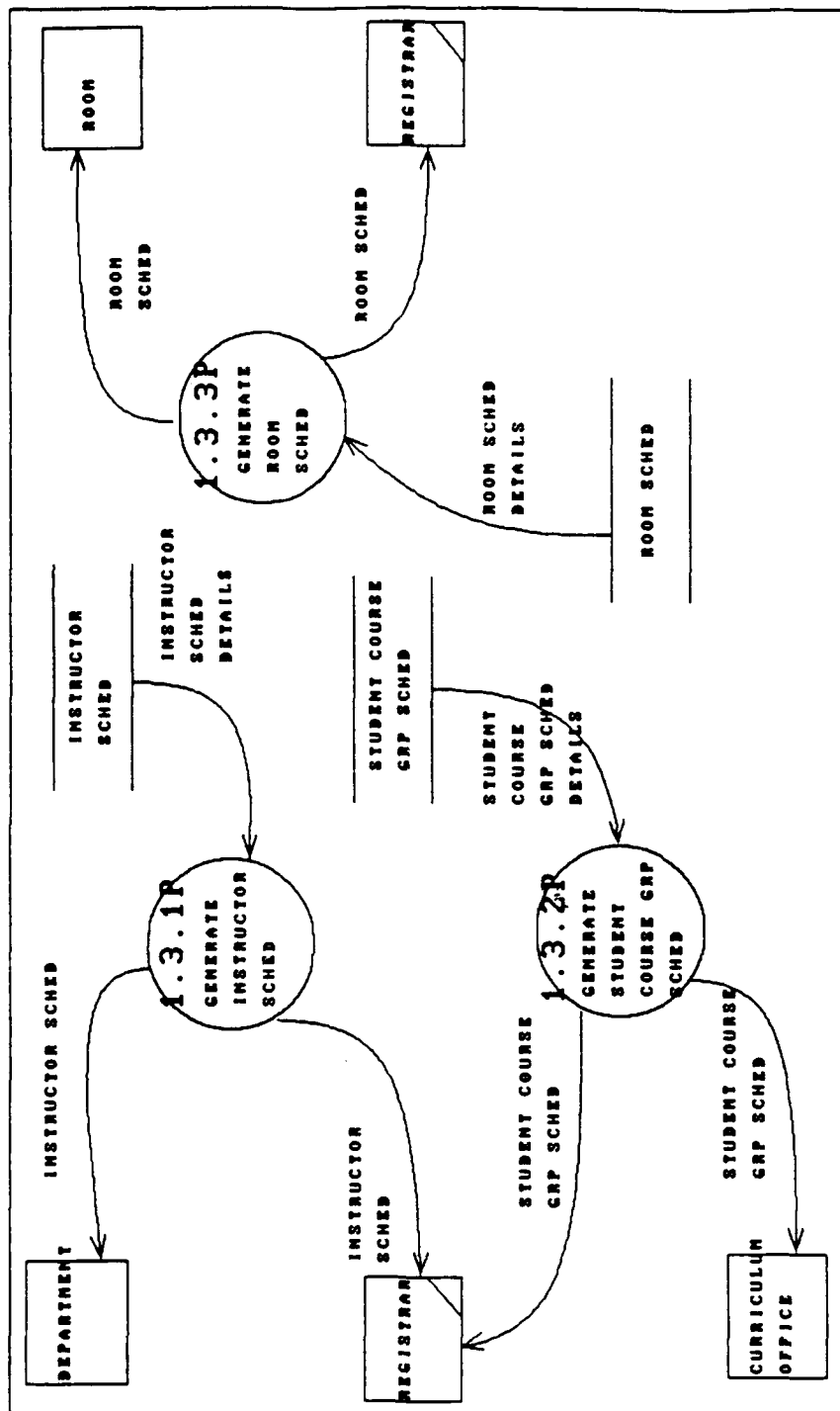


FIG. C-7, Logical Dataflow Diagram for the target Schedules and Reporting support.

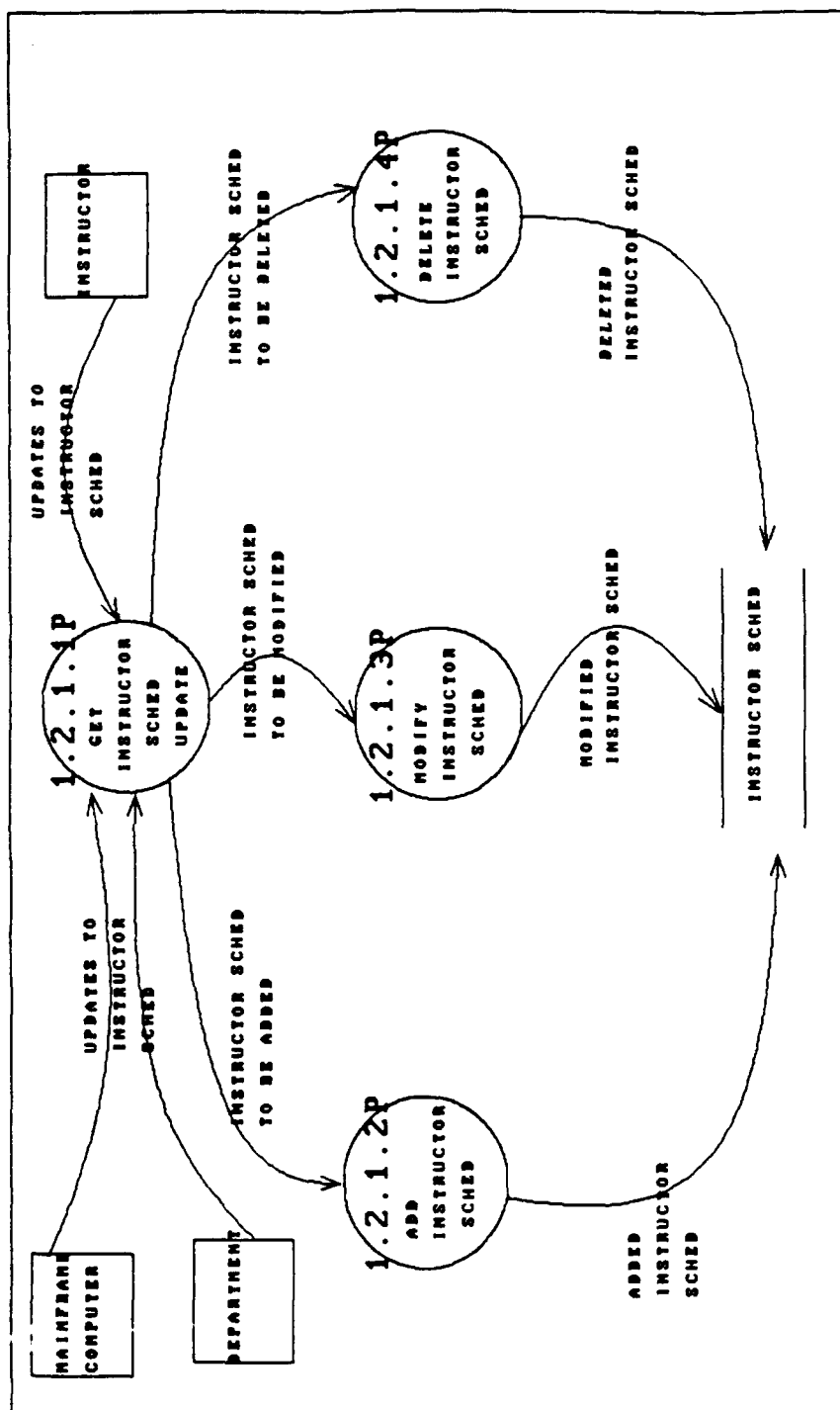


FIG. C-8, Logical Dataflow Diagram for INSTRUCTOR SCHED Data Store Maintenance.

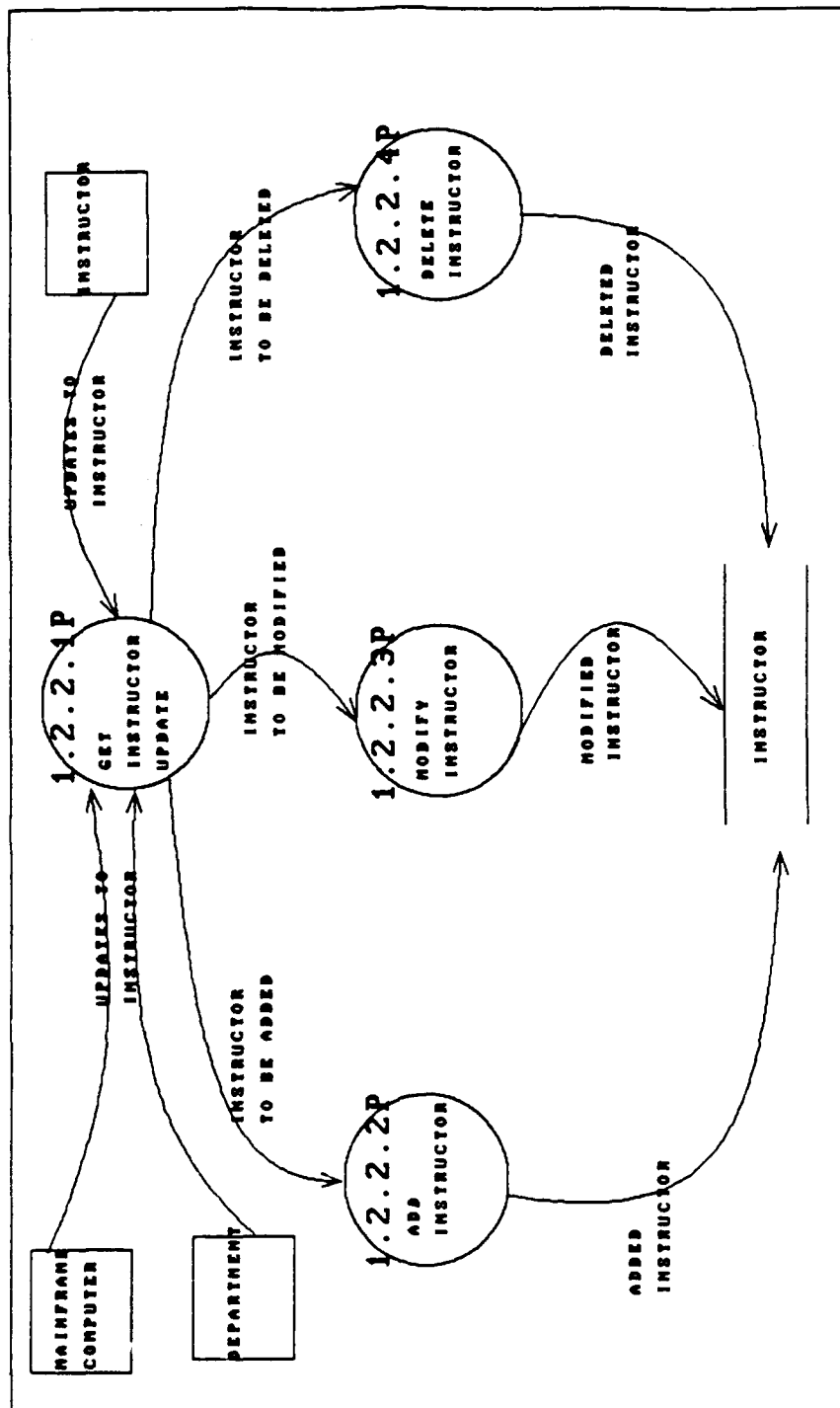


FIG. C-9, Logical Dataflow Diagram for INSTRUCTOR Data Store Maintenance.

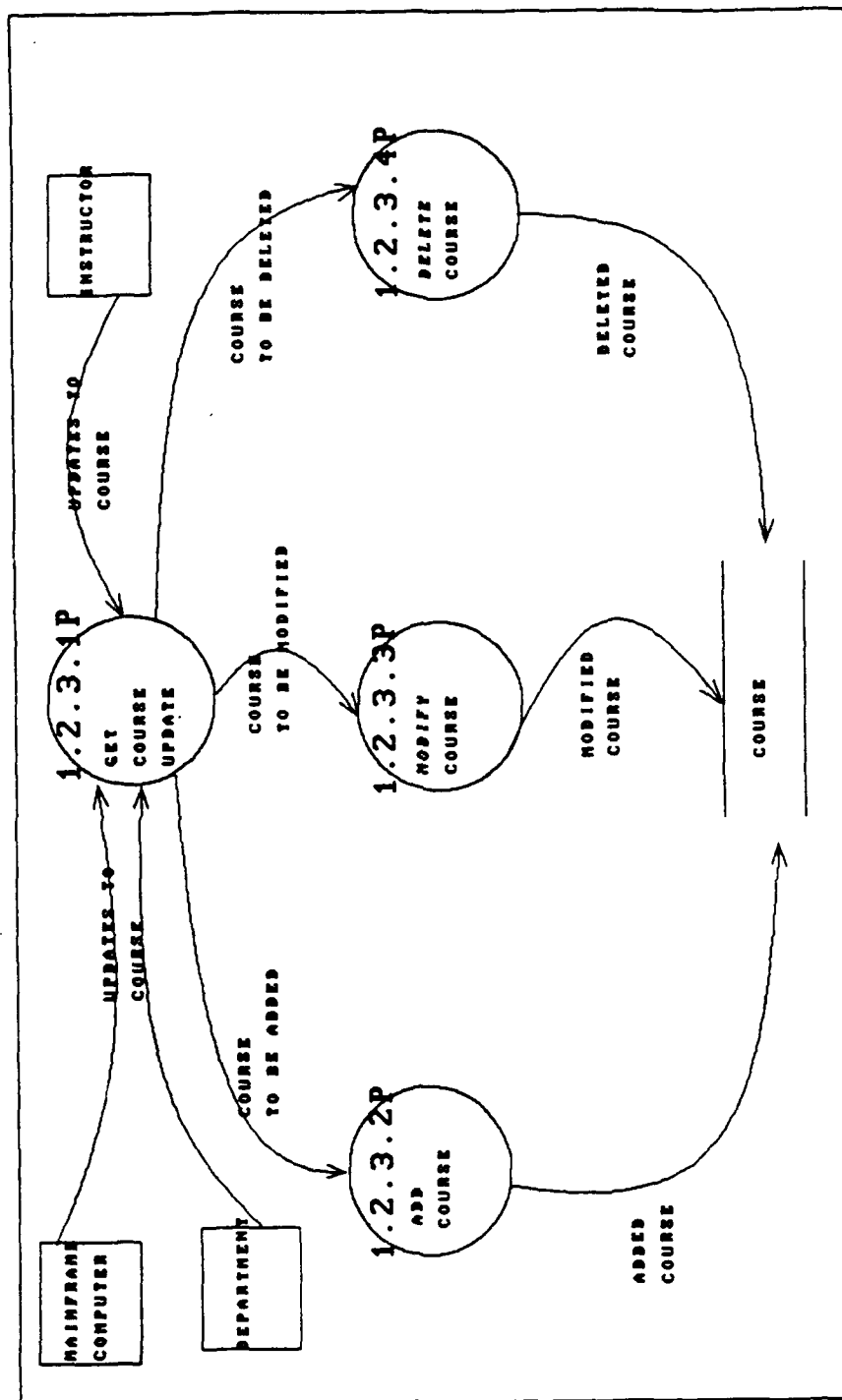


FIG. C-10, Logical Dataflow Diagram for COURSE Data Store Maintenance.

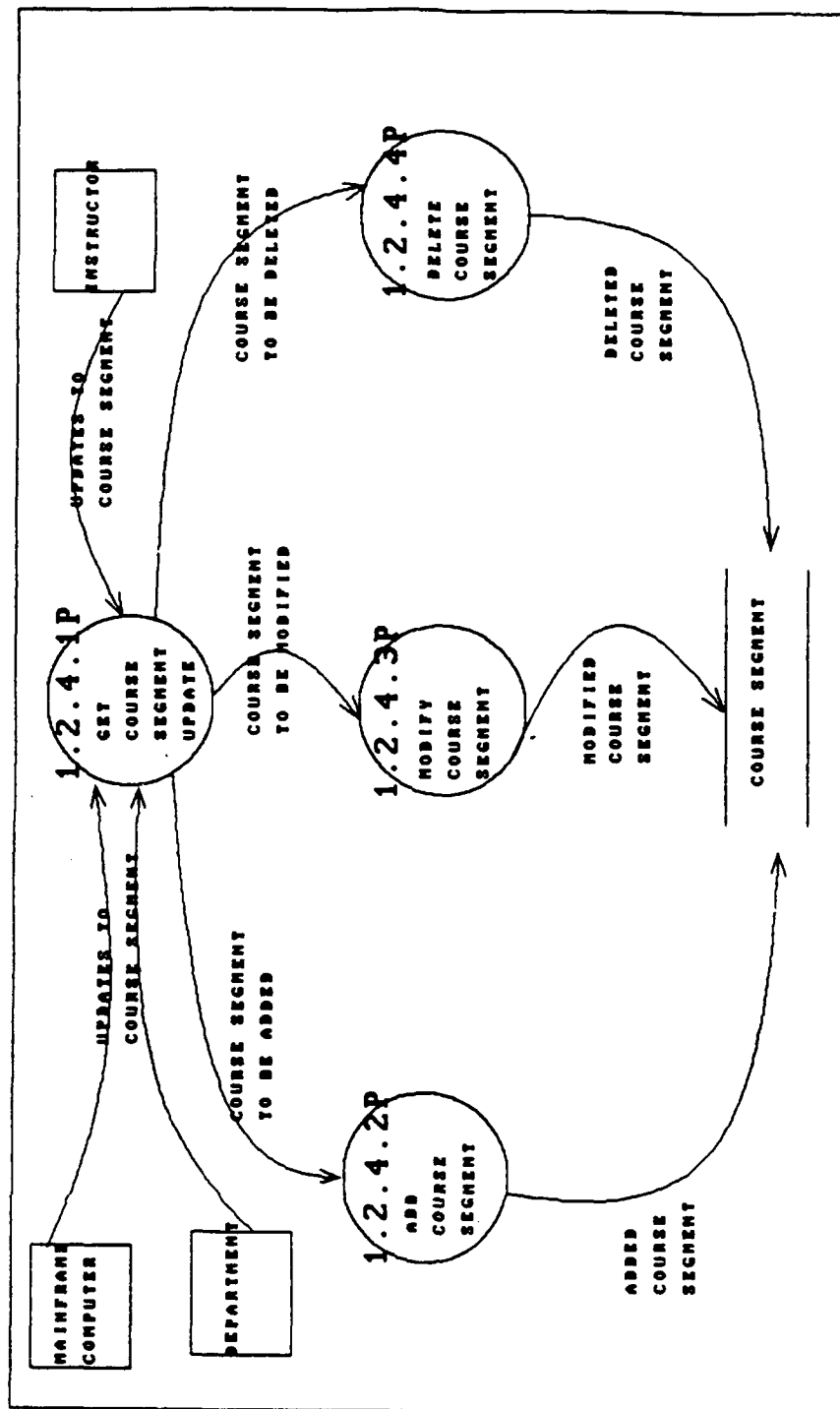


FIG. C-11, Logical Dataflow Diagram for COURSE SEGMENT Data Store Maintenance.

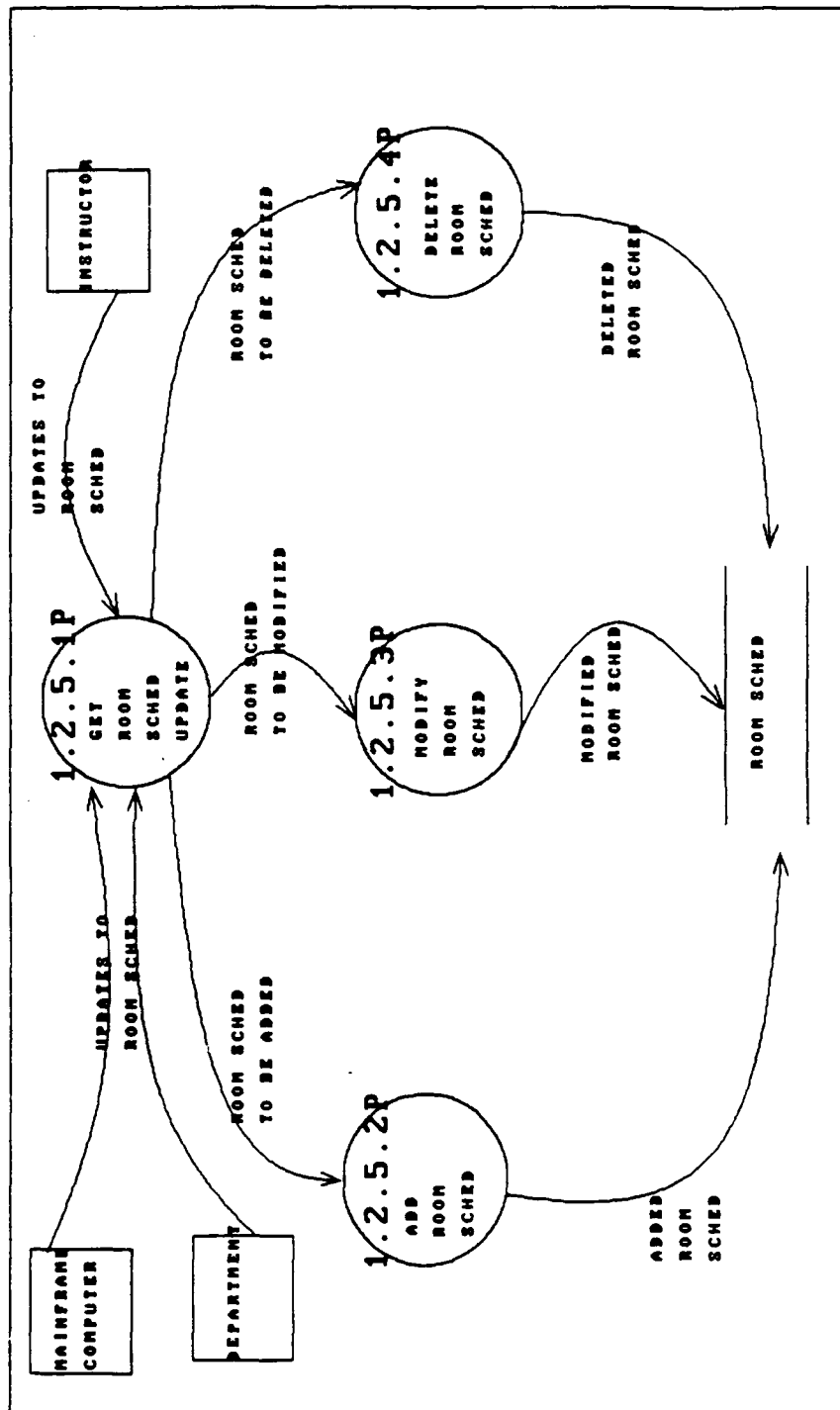


FIG. C-12, Logical Dataflow Diagram for ROOM SCHED Data Store Maintenance.

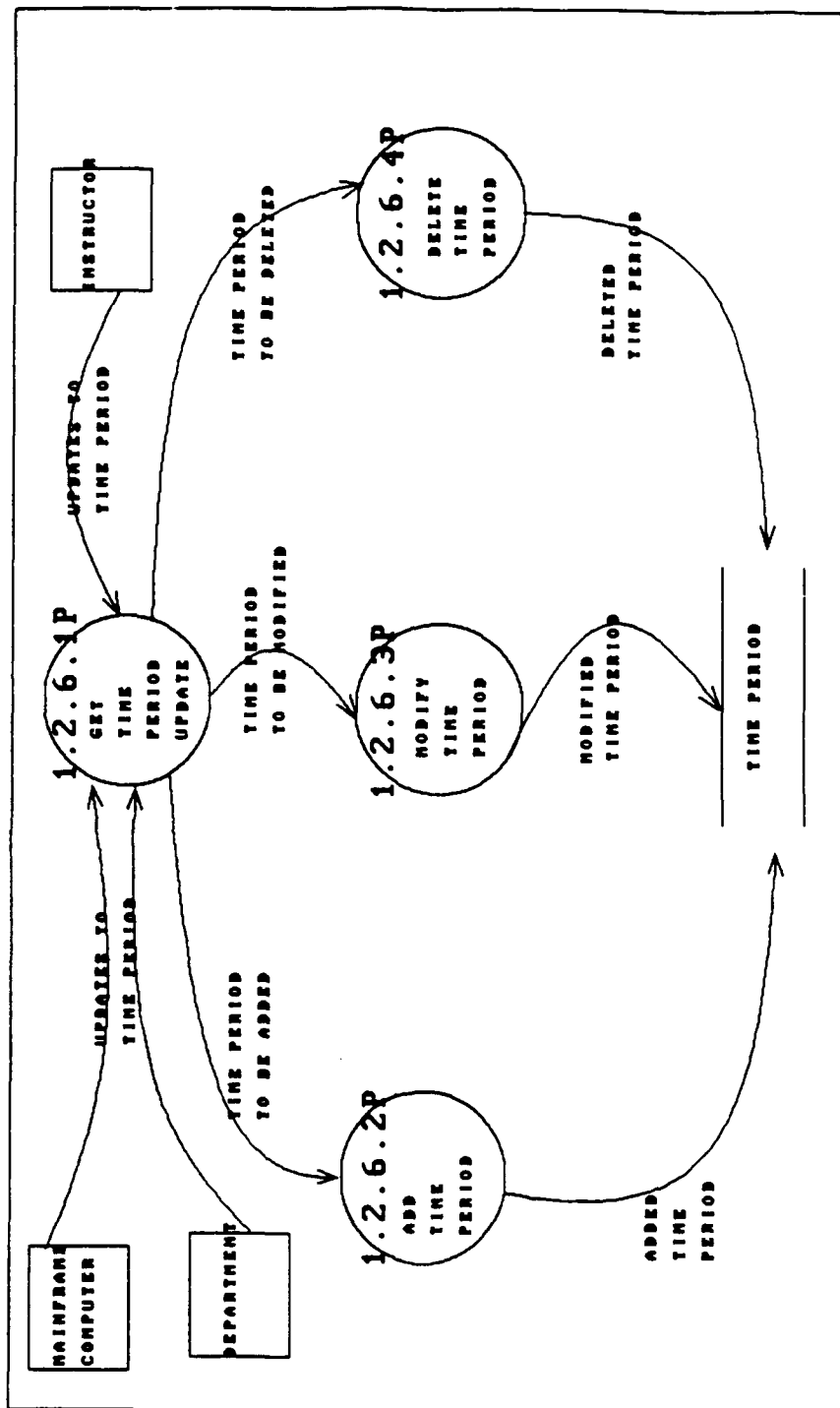


FIG. C-13, Logical Dataflow Diagram for  
TIME PERIOD Data Store Maintenance.

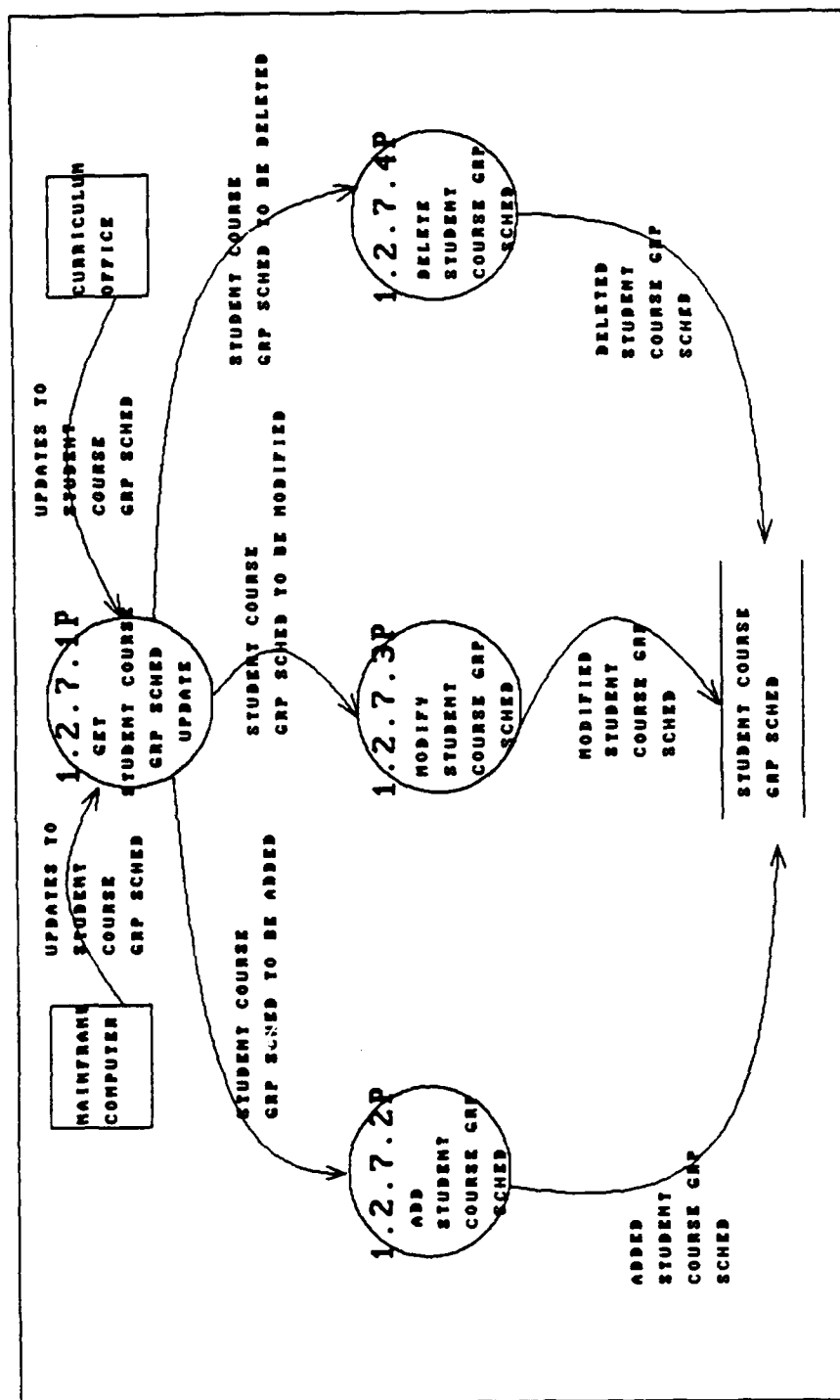


FIG. C-14, Logical Dataflow Diagram for STUDENT COURSE GRP SCHED Data Store Maintenance.

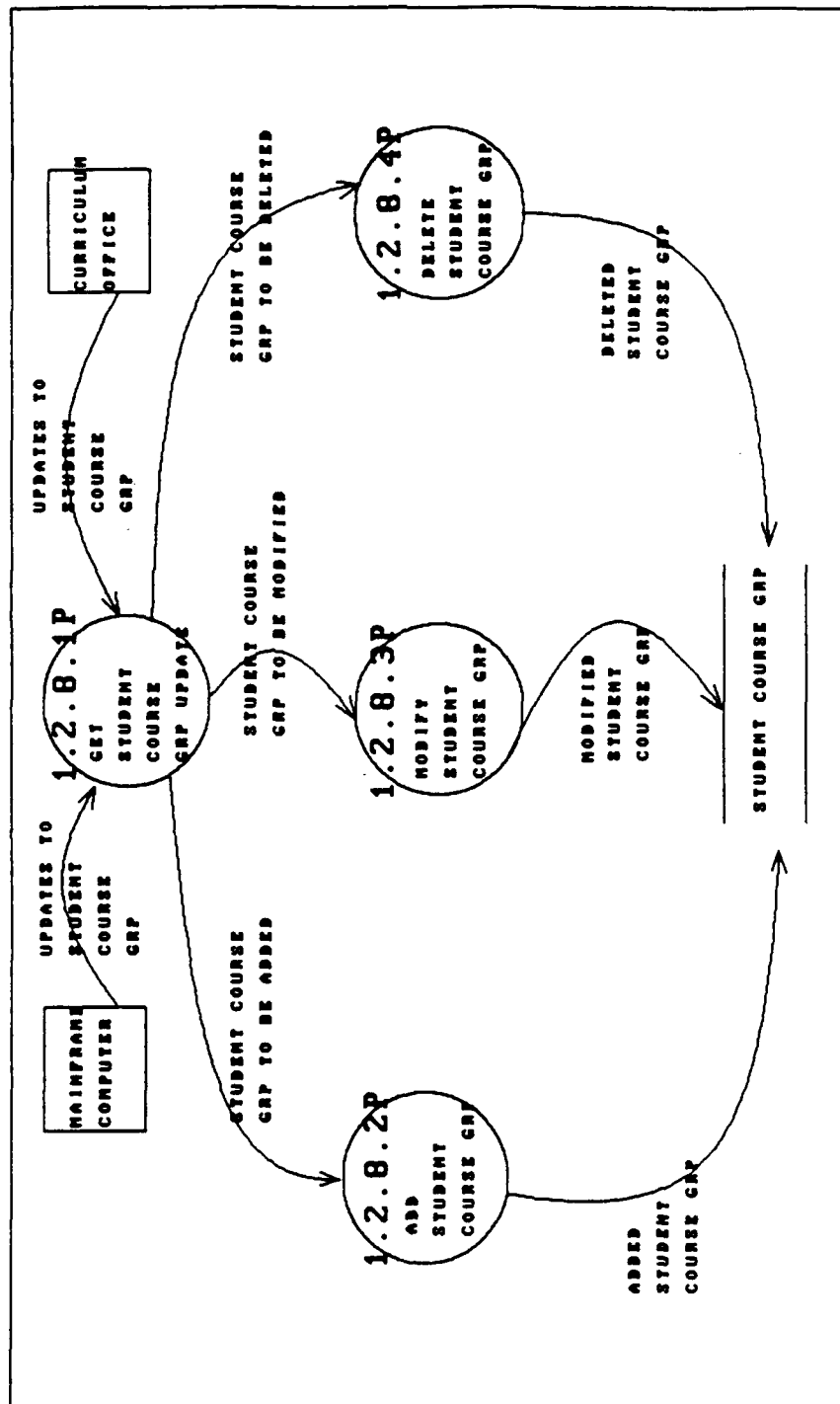


FIG. C-15, Logical Dataflow Diagram for STUDENT COURSE GRP Data Store Maintenance.

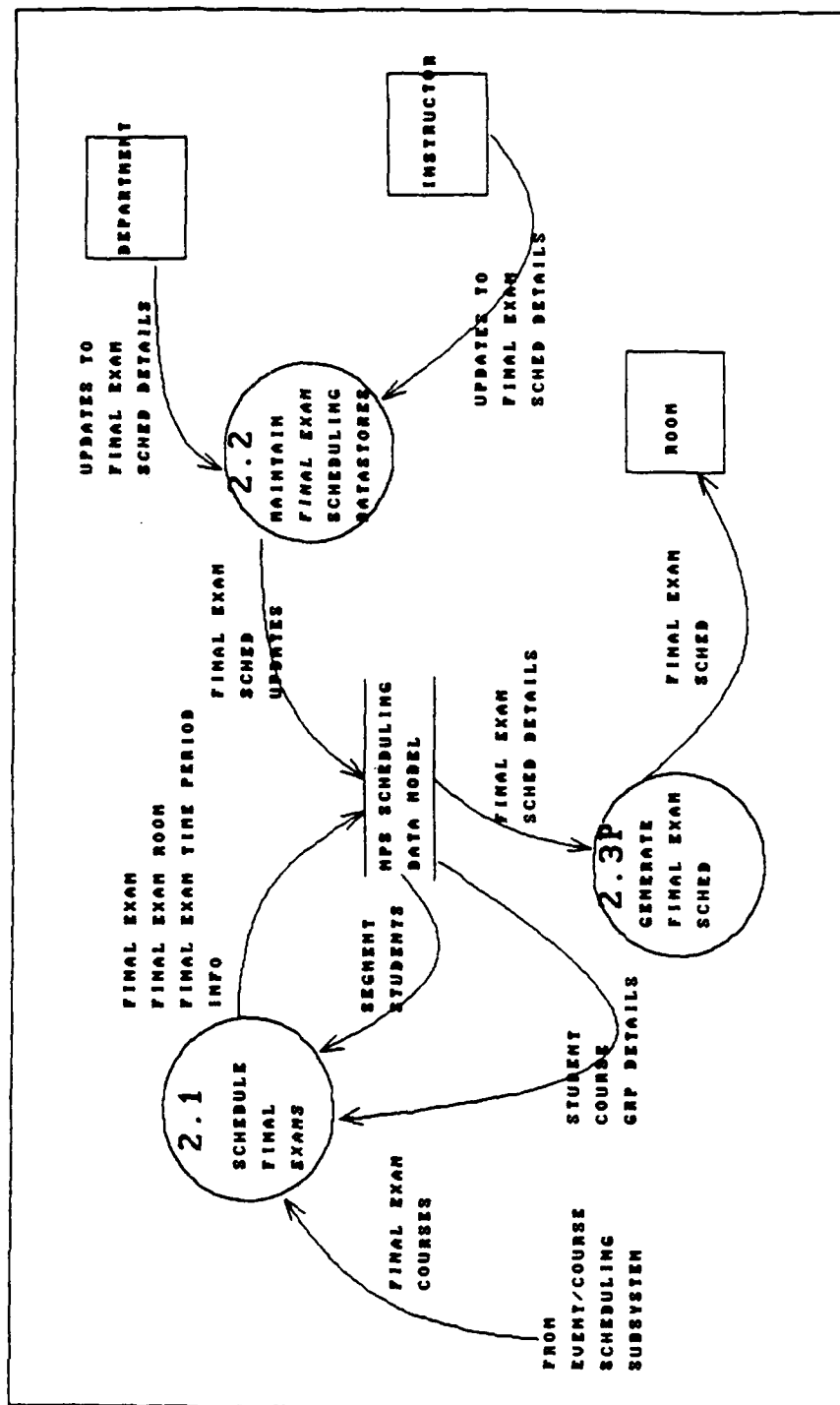


FIG. C-16, Logical Dataflow Diagram for the target Final Exam Scheduling Subsystem.

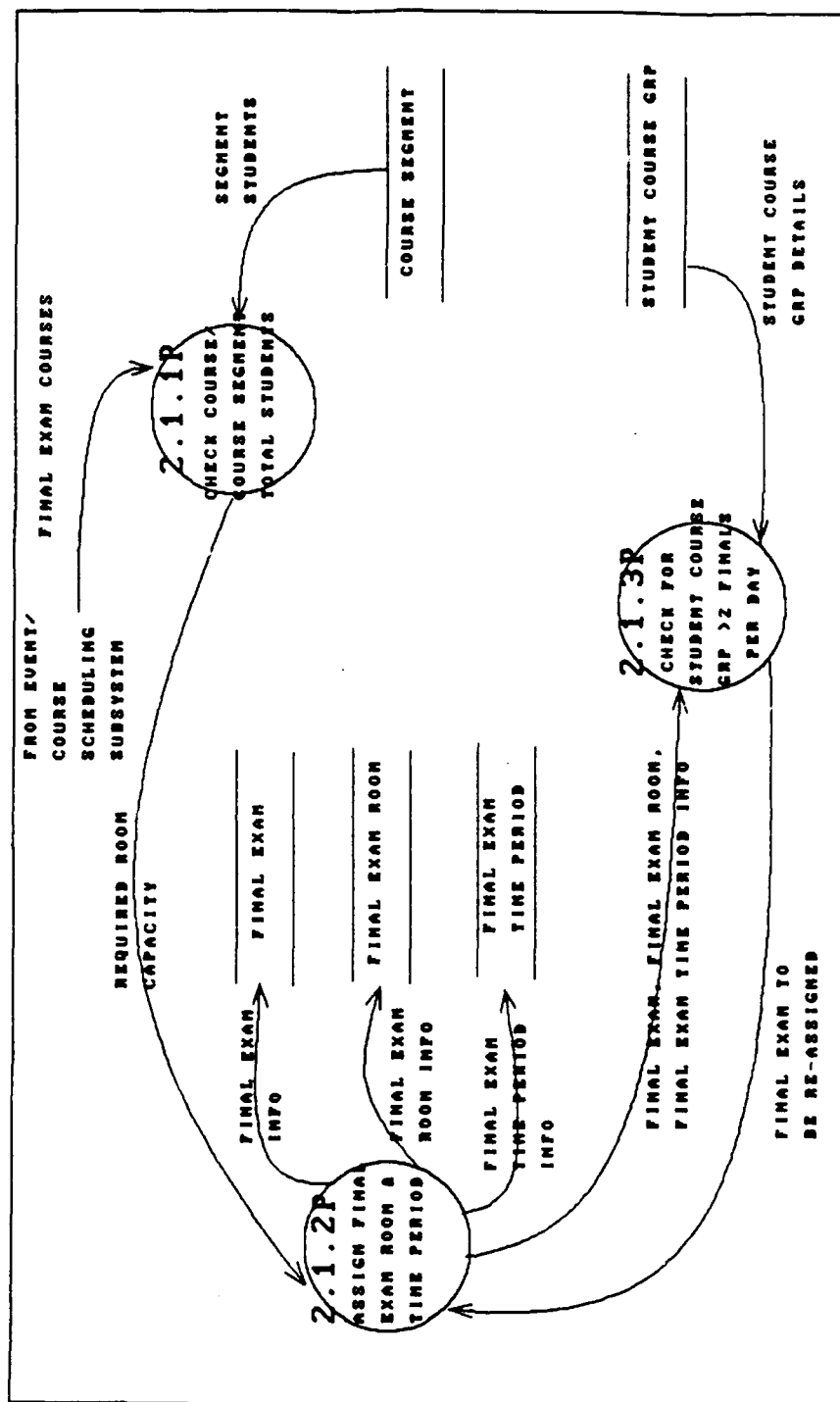


FIG. C-17, Logical Dataflow Diagram for the target Final Exam Scheduling.

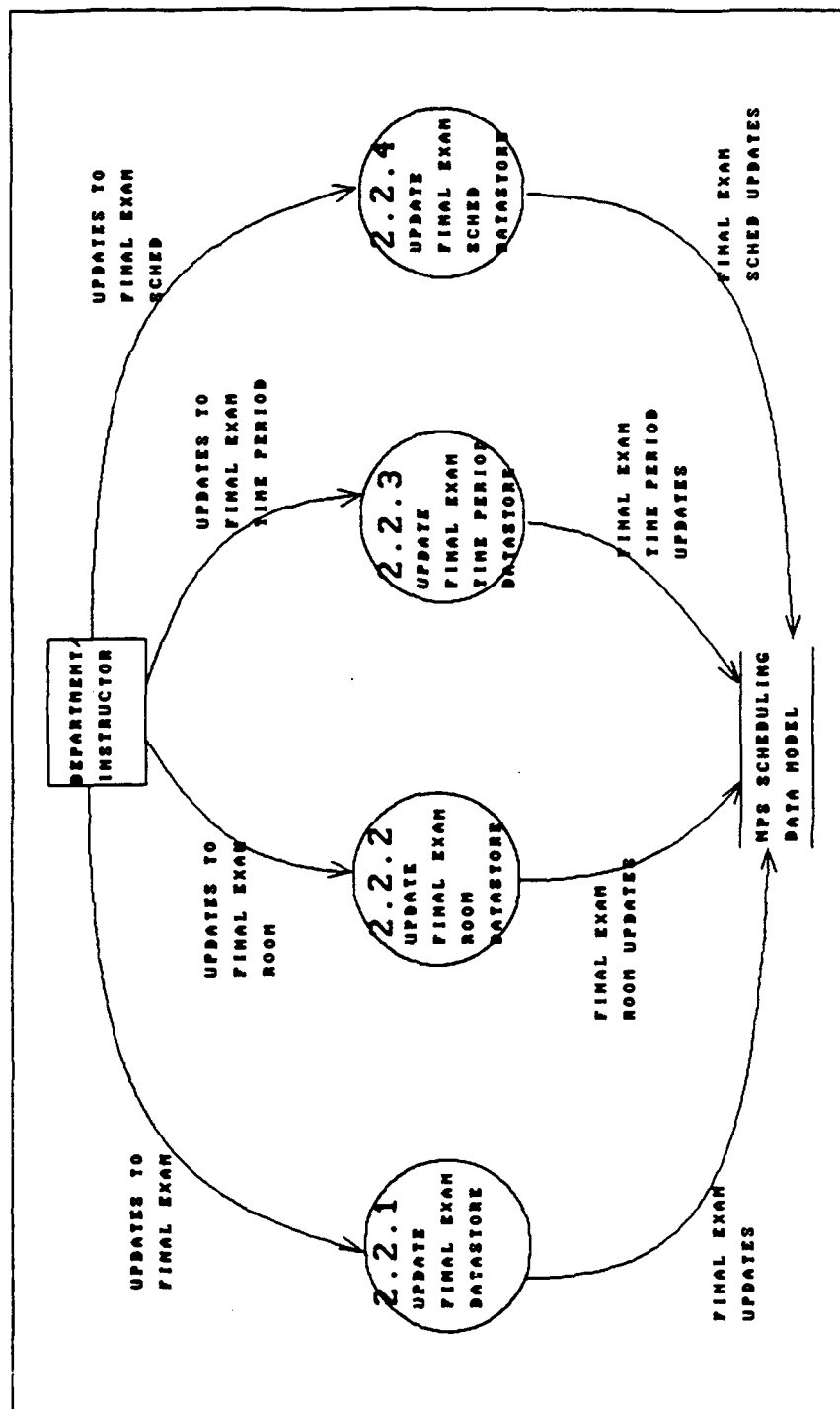


FIG. C-18, Logical Dataflow Diagram for the target Final Exam Data Maintenance.

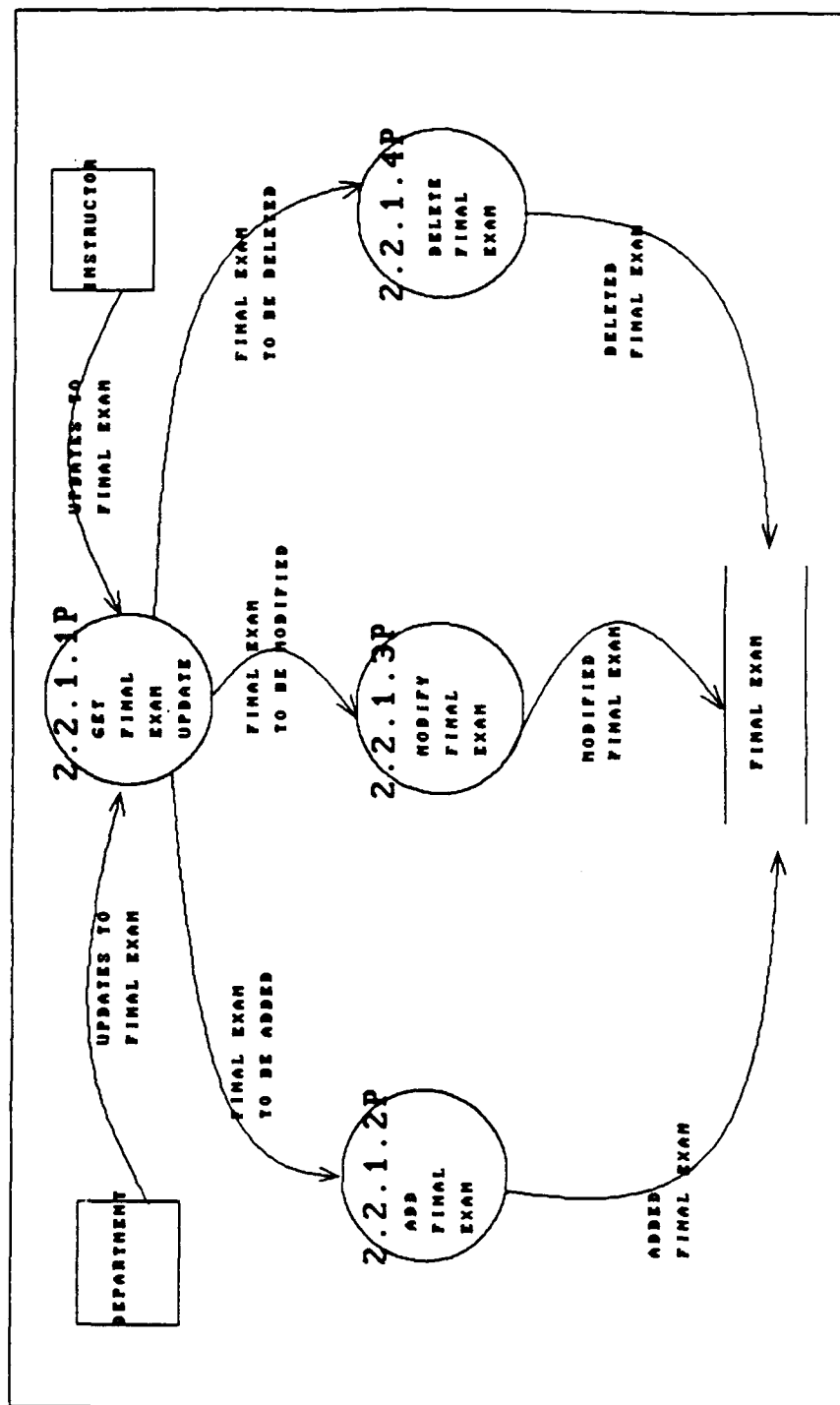


FIG. C-19, Logical Dataflow Diagram for FINAL EXAM Data Store Maintenance.

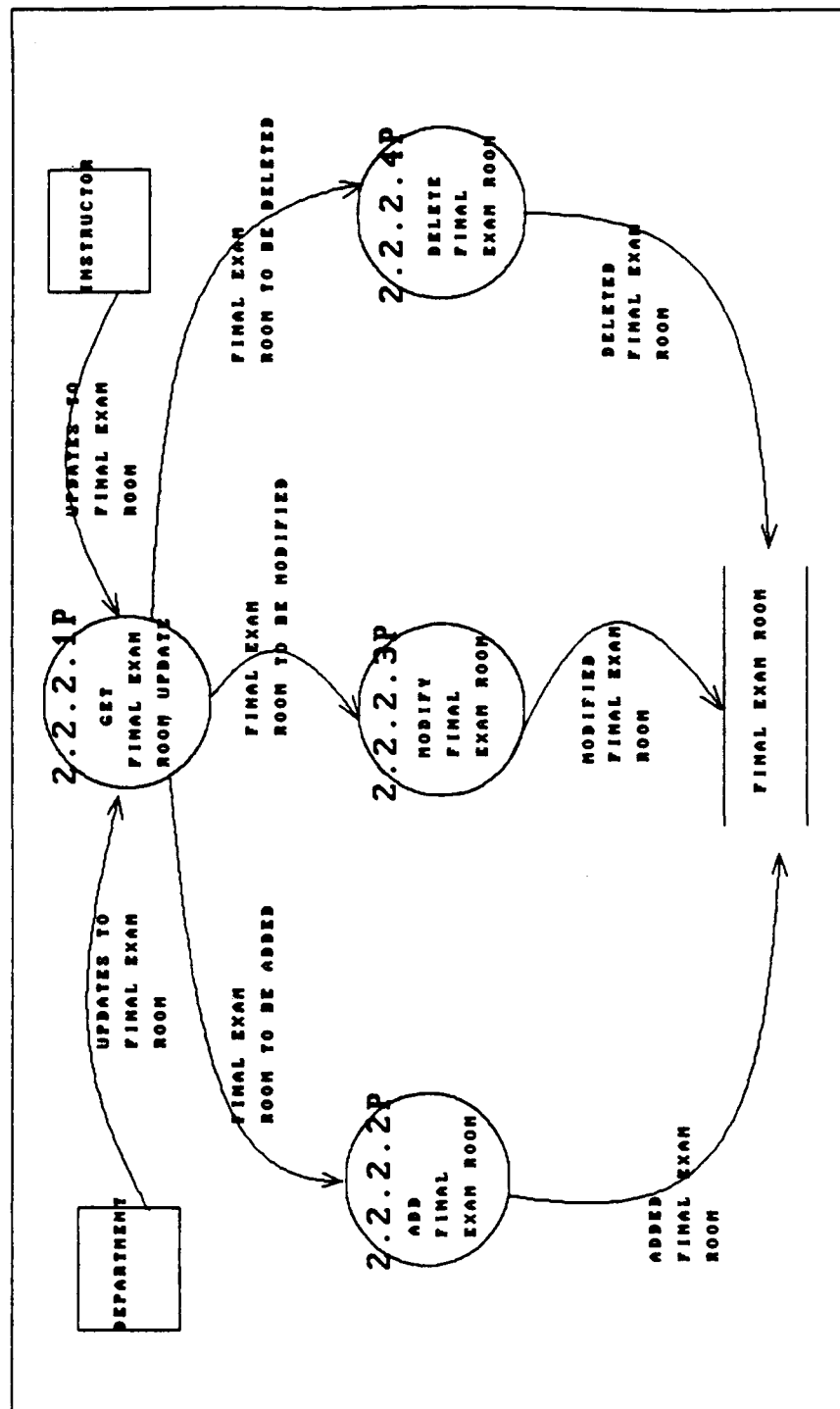


FIG. C-20, Logical Dataflow Diagram for FINAL EXAM ROOM Data Store Maintenance.

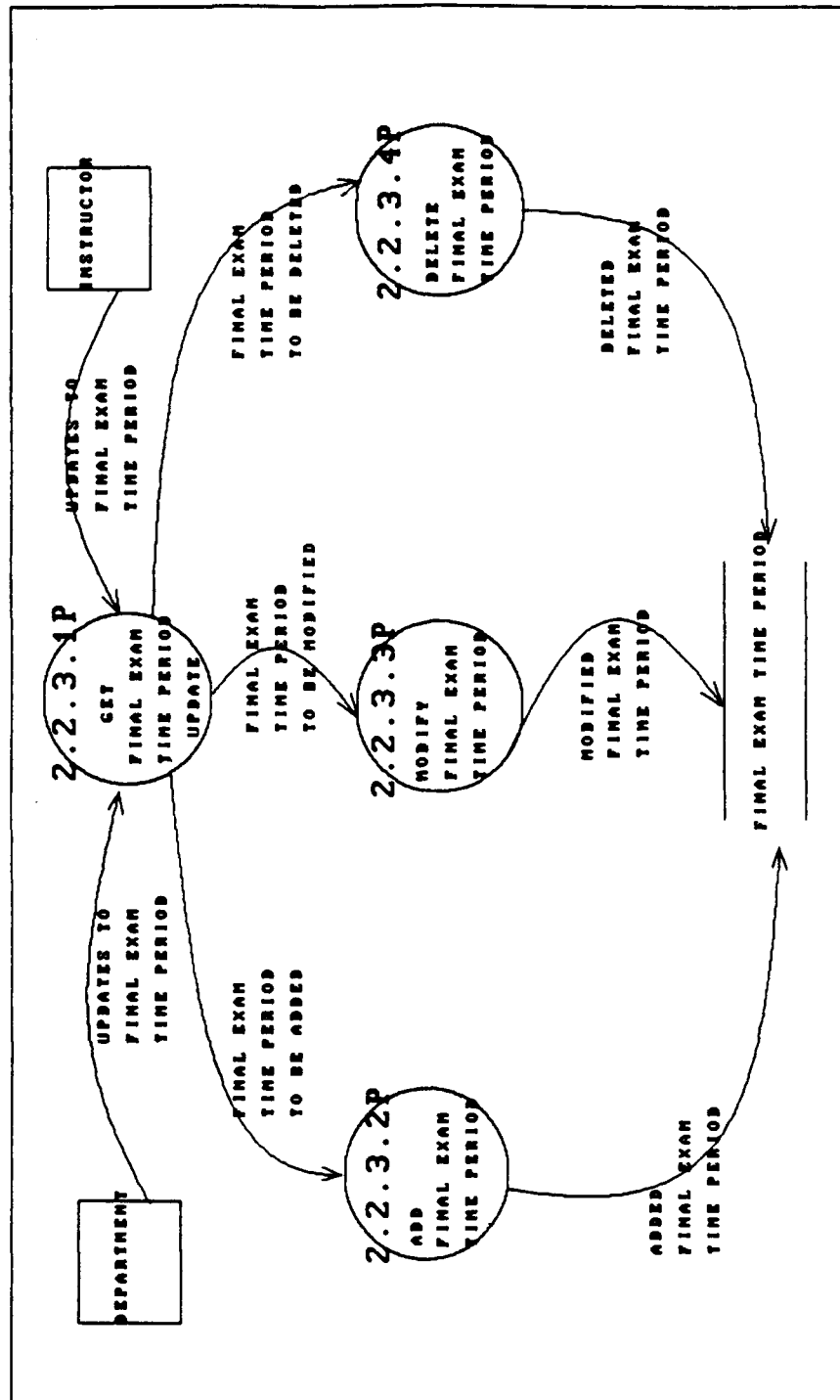


FIG. C-21, Logical Dataflow Diagram for  
FINAL EXAM TIME PERIOD Data Store  
Maintenance.

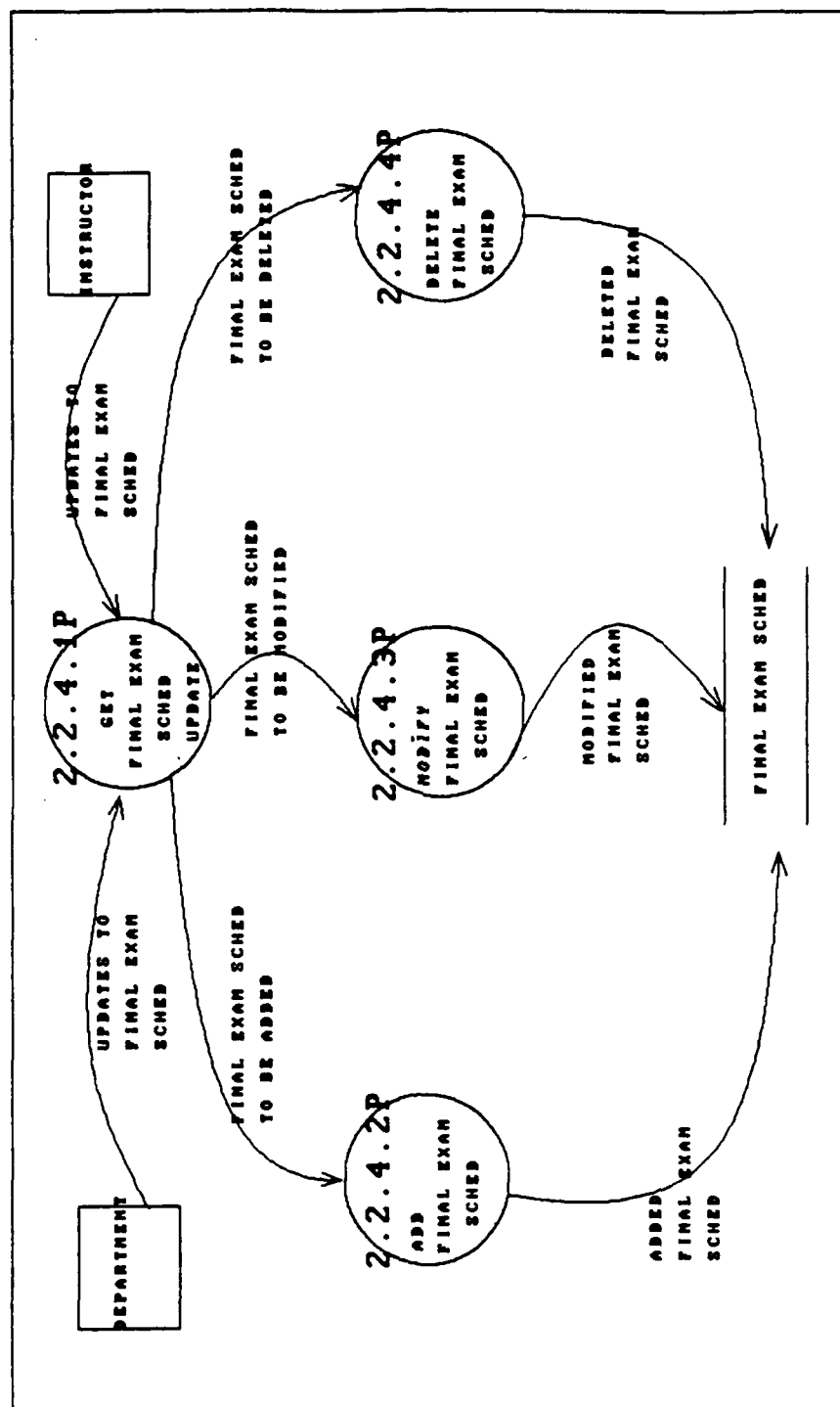


FIG. C-22, Logical Dataflow Diagram for FINAL EXAM SCHED Data Store Maintenance.

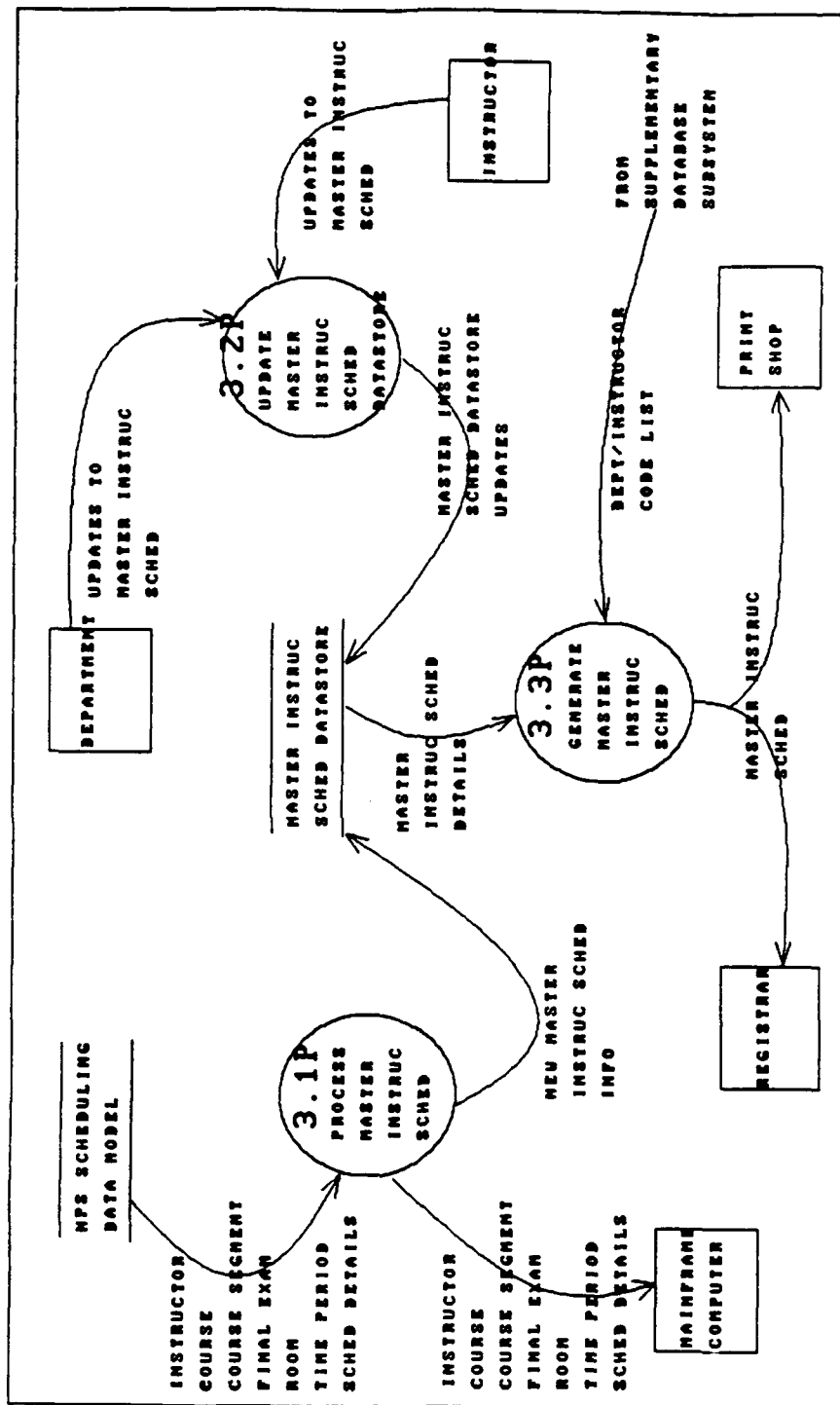


FIG. C-23, Logical Dataflow Diagram for the target Master Instruction Schedule Subsystem.

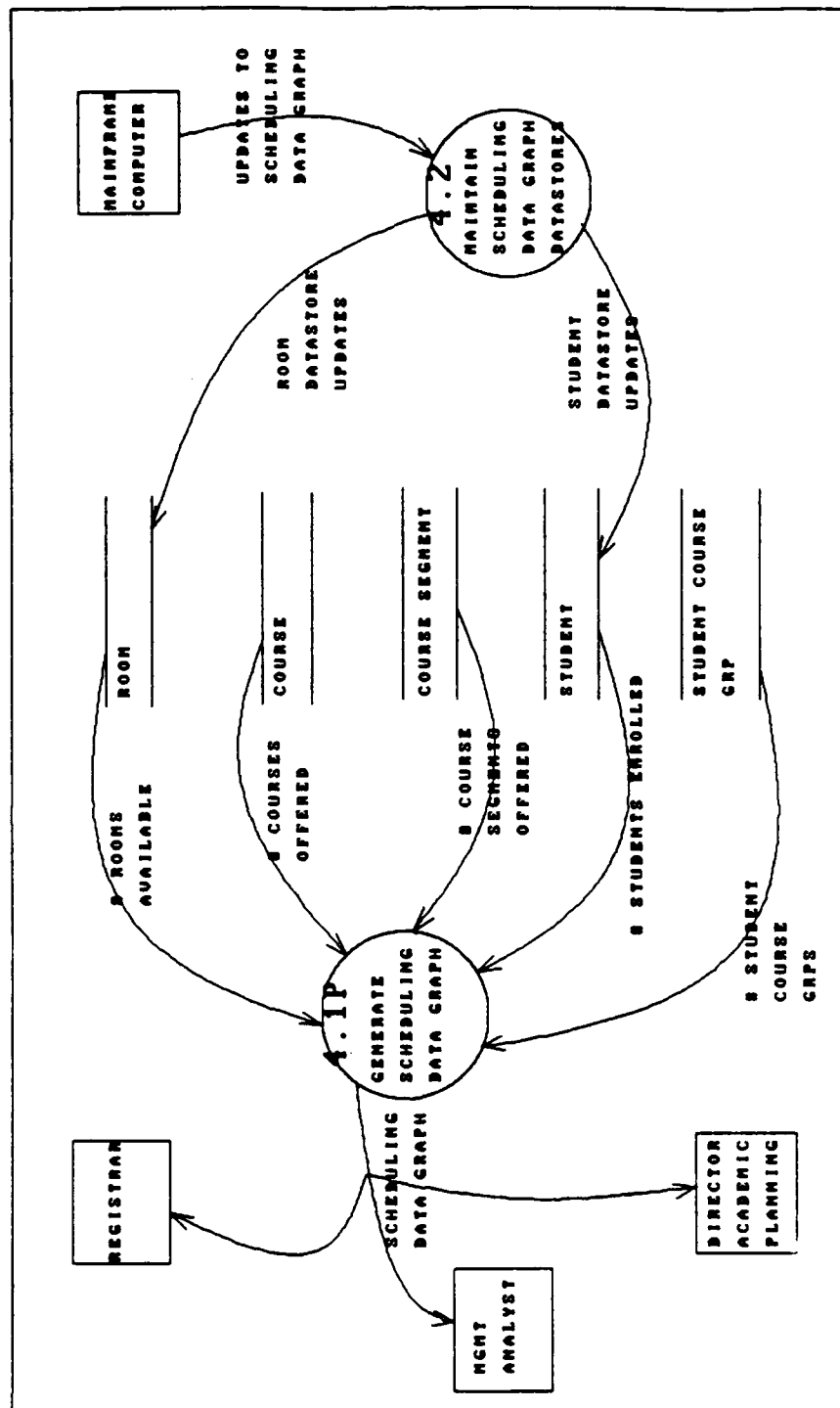


FIG. C-24, Logical Dataflow Diagram for the target Scheduling Data Graph Subsystem.

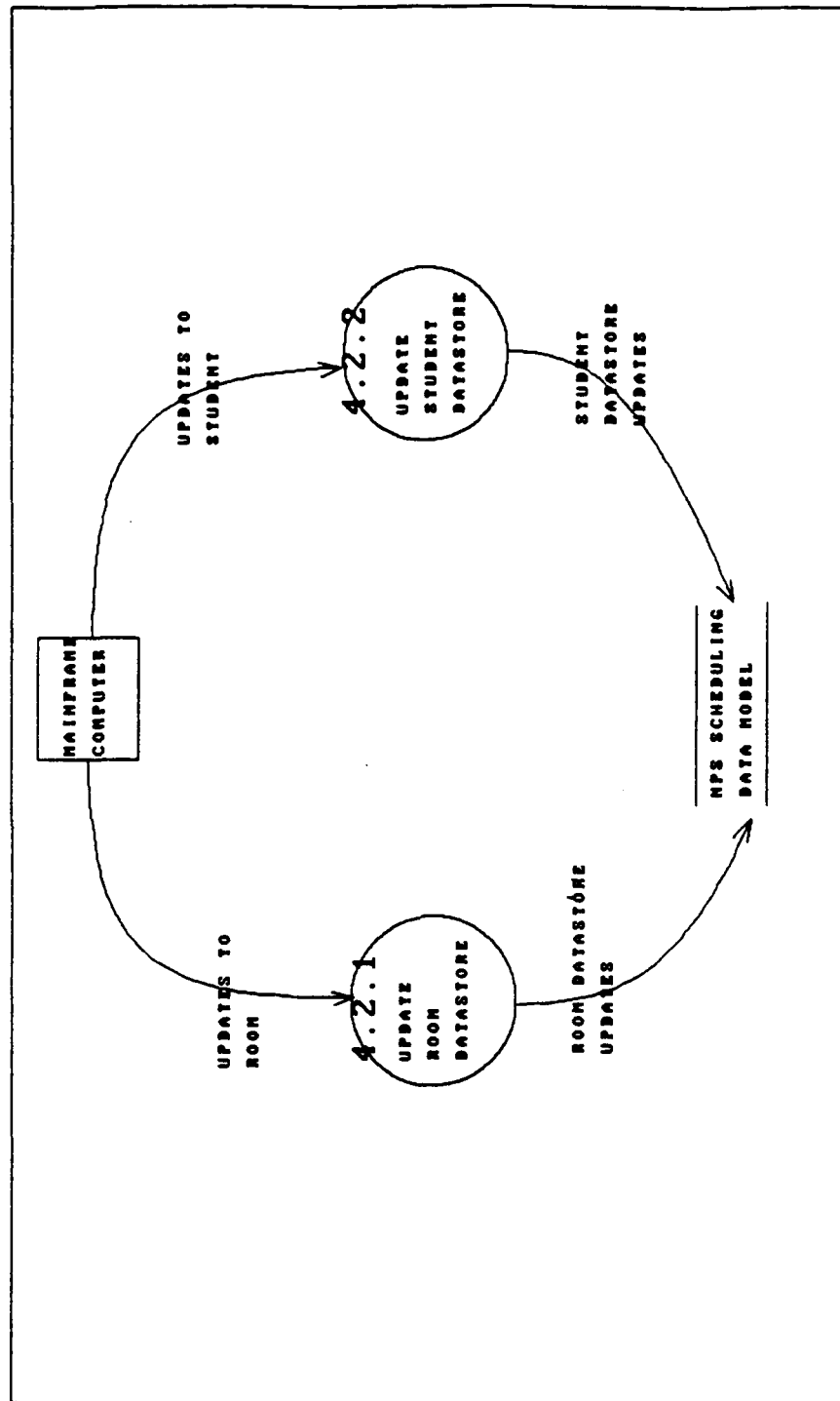


FIG. C-25, Logical Dataflow Diagram for Scheduling Data Graph Data Maintenance.

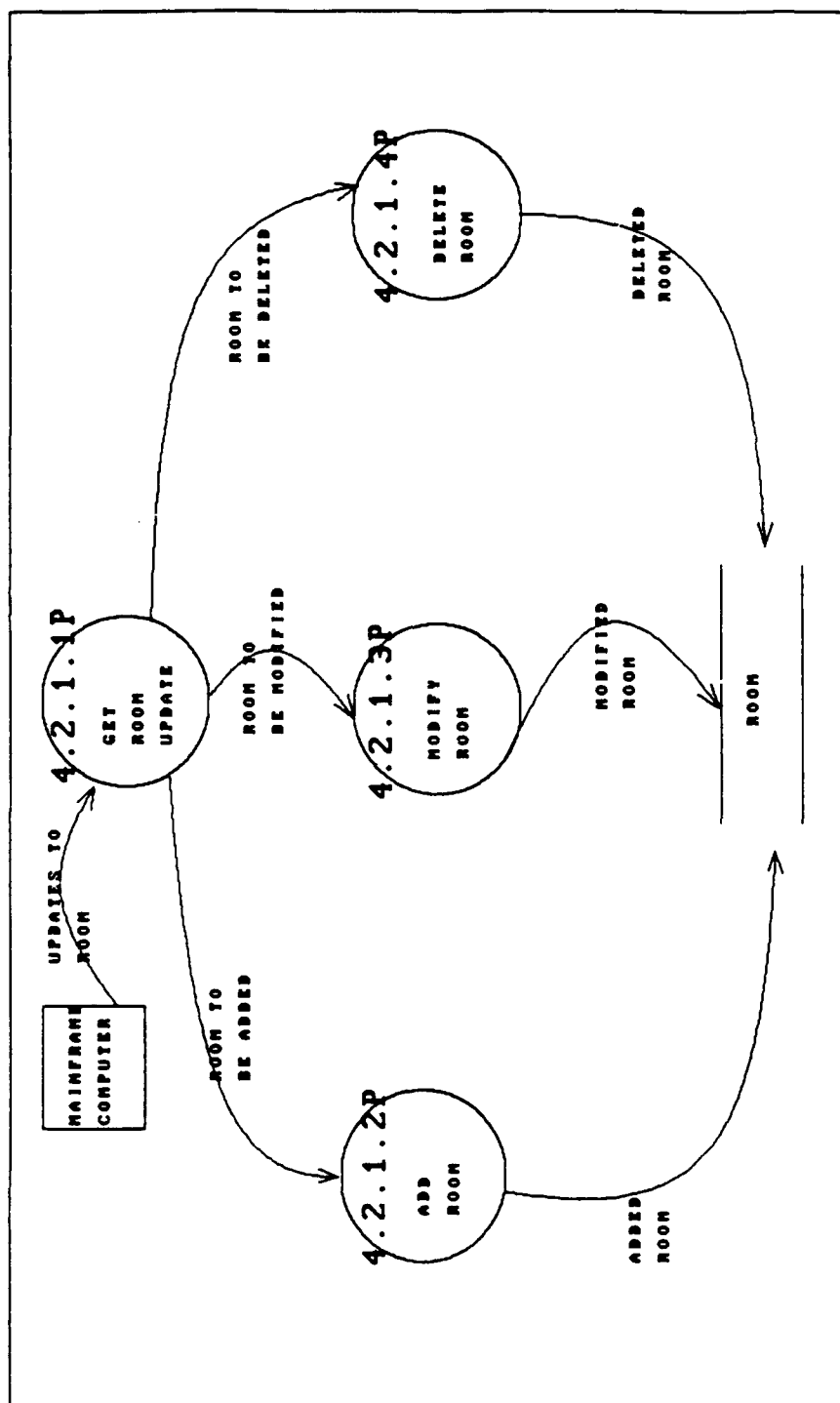


FIG. C-26, Logical Dataflow Diagram for ROOM Data Store Maintenance.

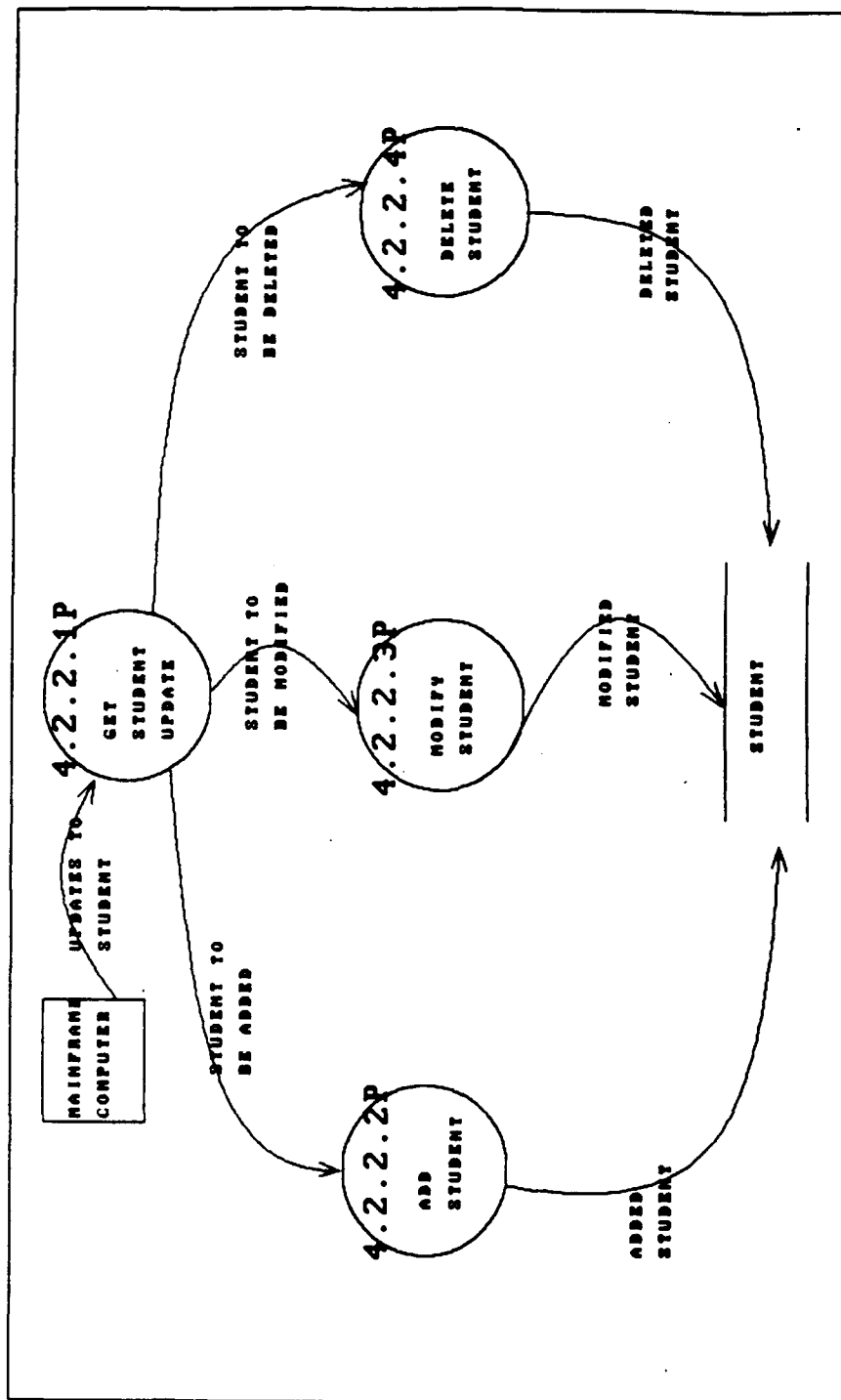


FIG. C-27, Logical Dataflow Diagram for STUDENT Data Store Maintenance.

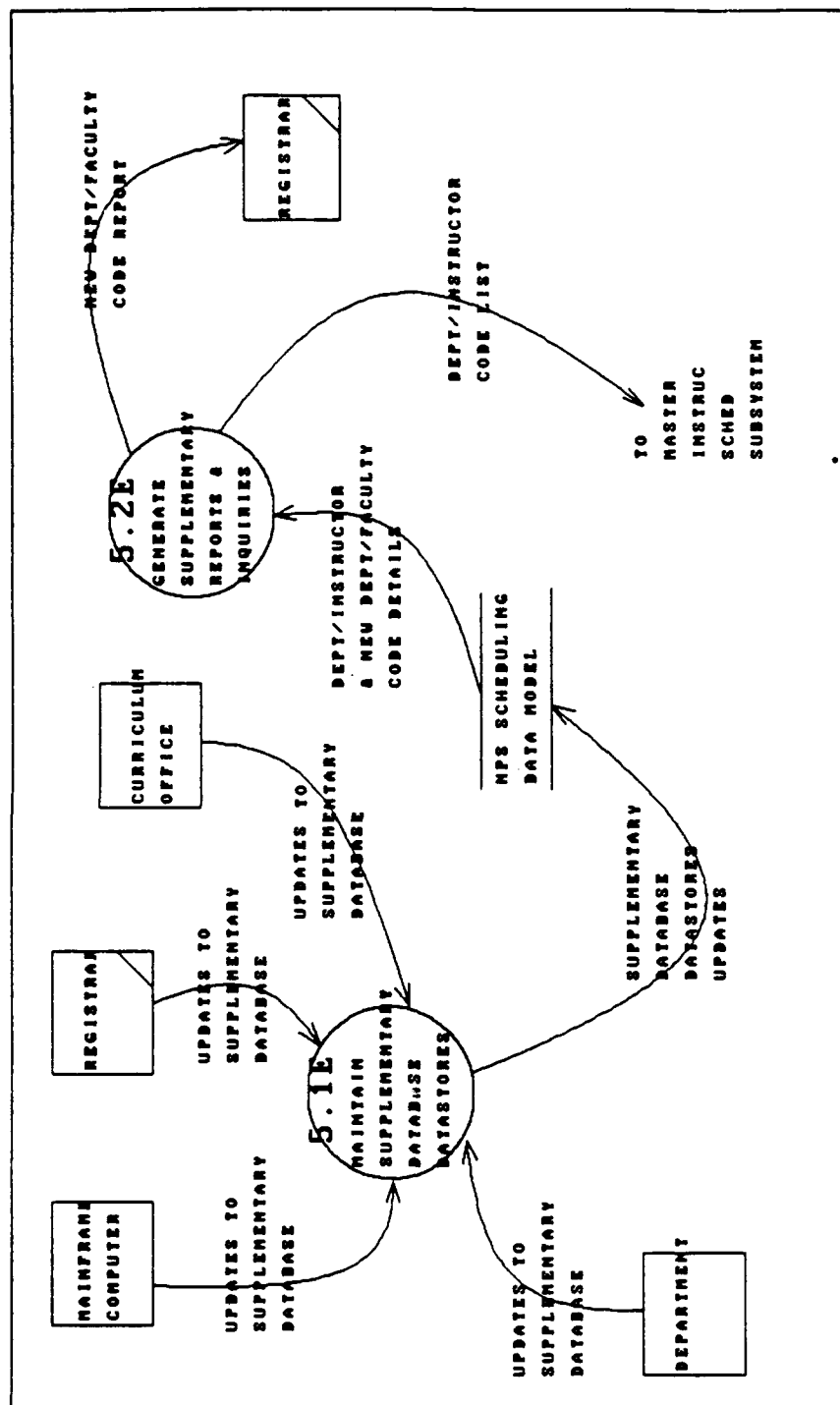


FIG. C-28, Logical Dataflow Diagram for the target Supplementary Database Subsystem.

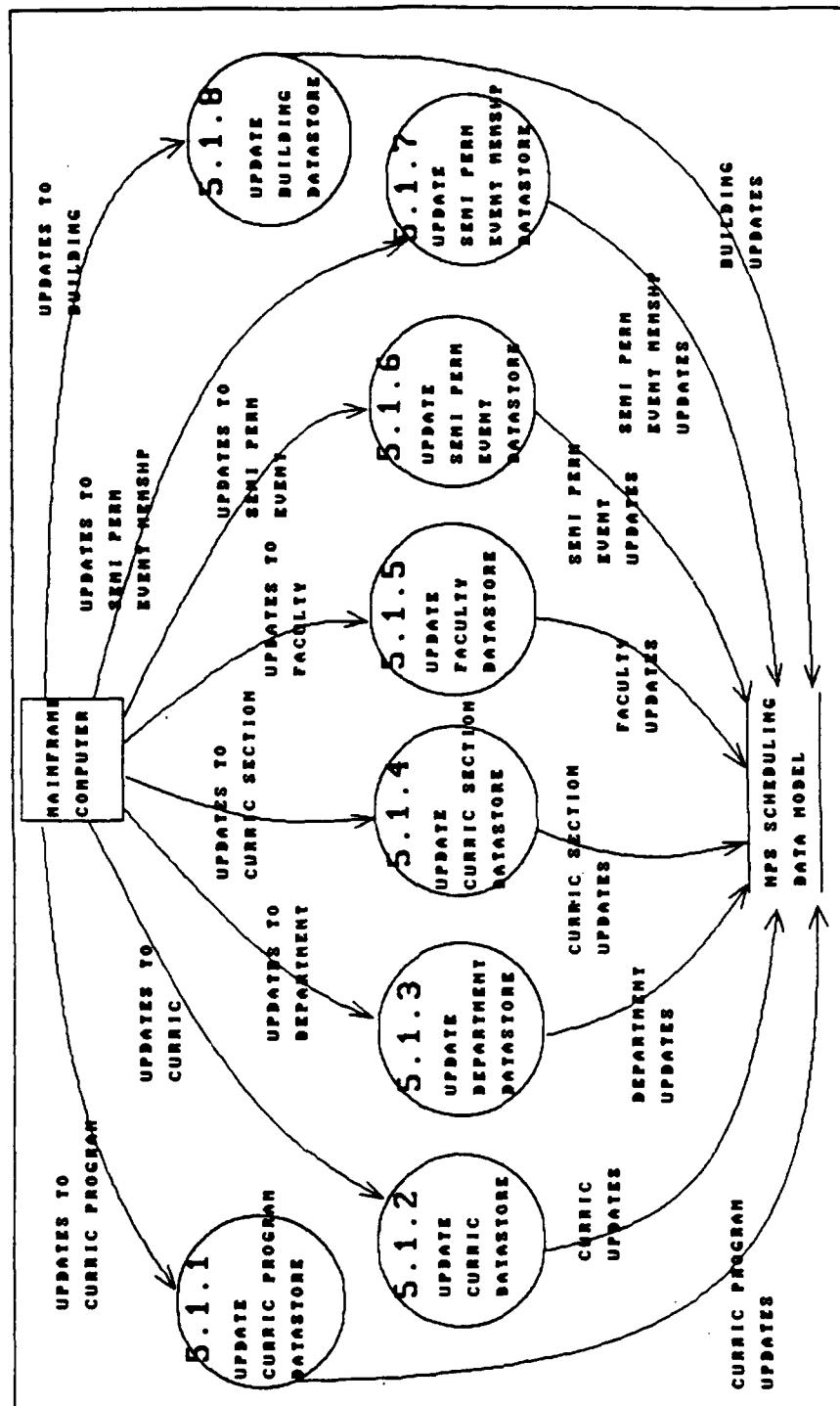


FIG. C-29, Logical Dataflow Diagram for Supplementary Database Data Maintenance.

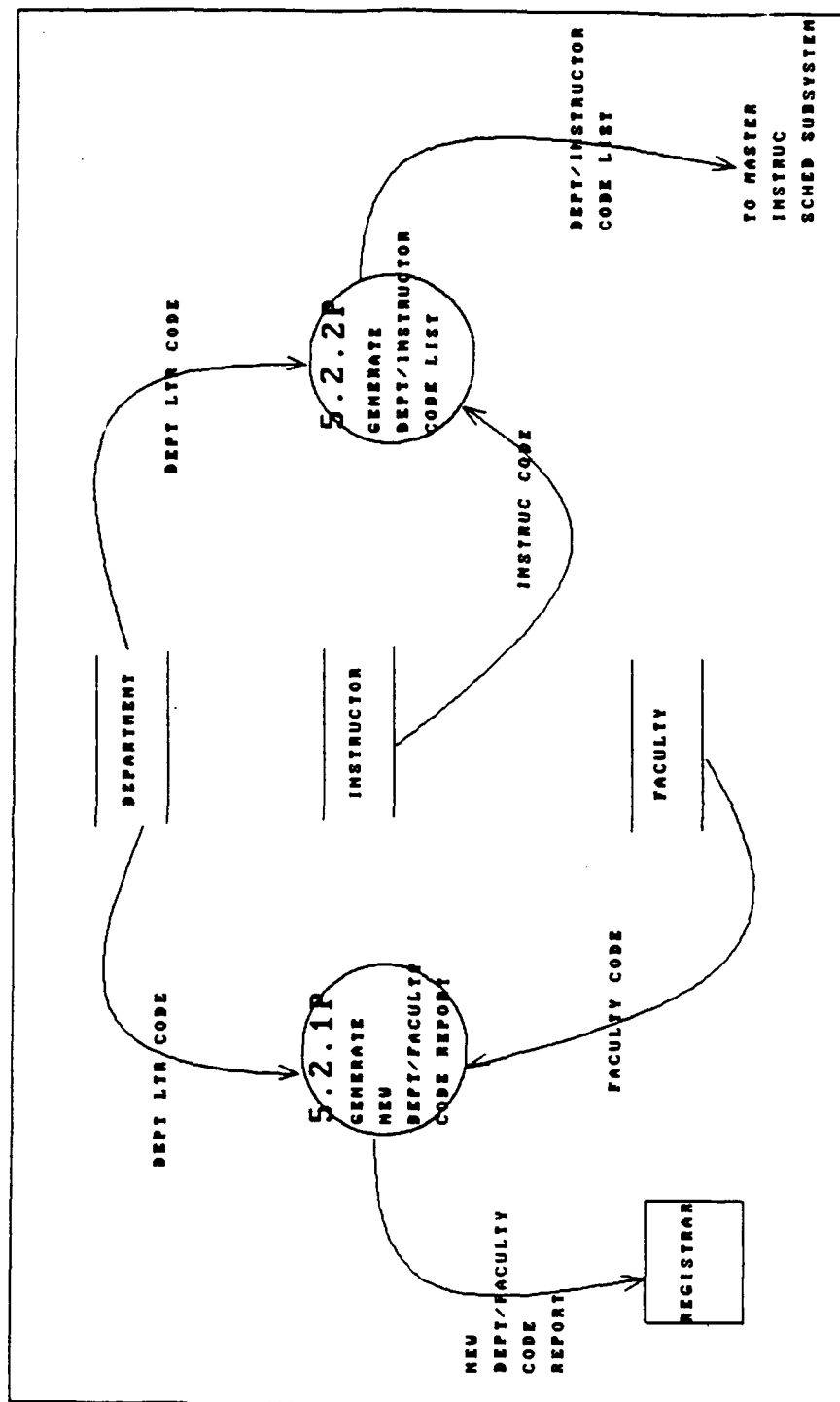


FIG. C-30, Logical Dataflow Diagram for the target Supplementary Database Reports and Lists support.

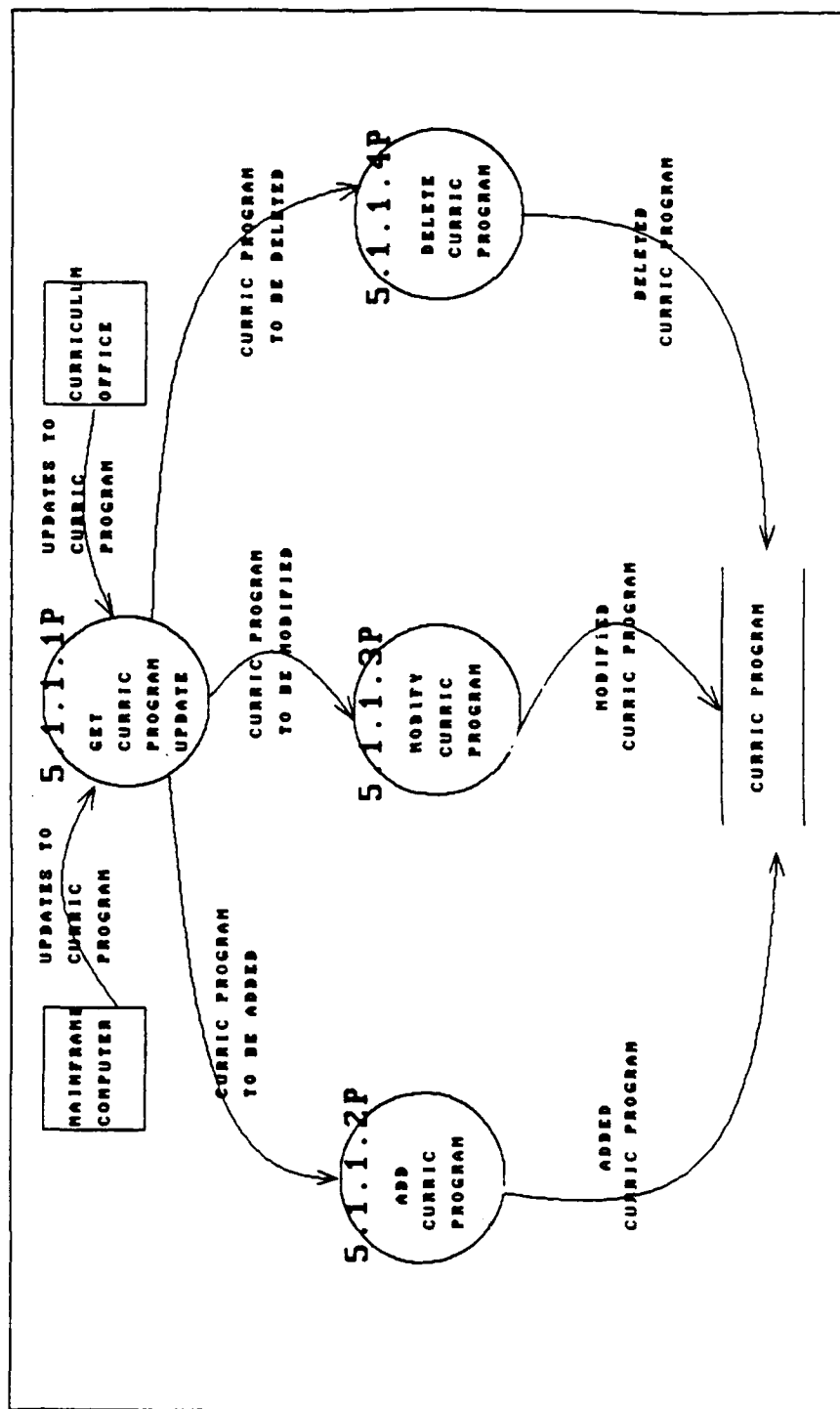


FIG. C-31, Logical Dataflow Diagram for CURRIC PROGRAM Data Store Maintenance.

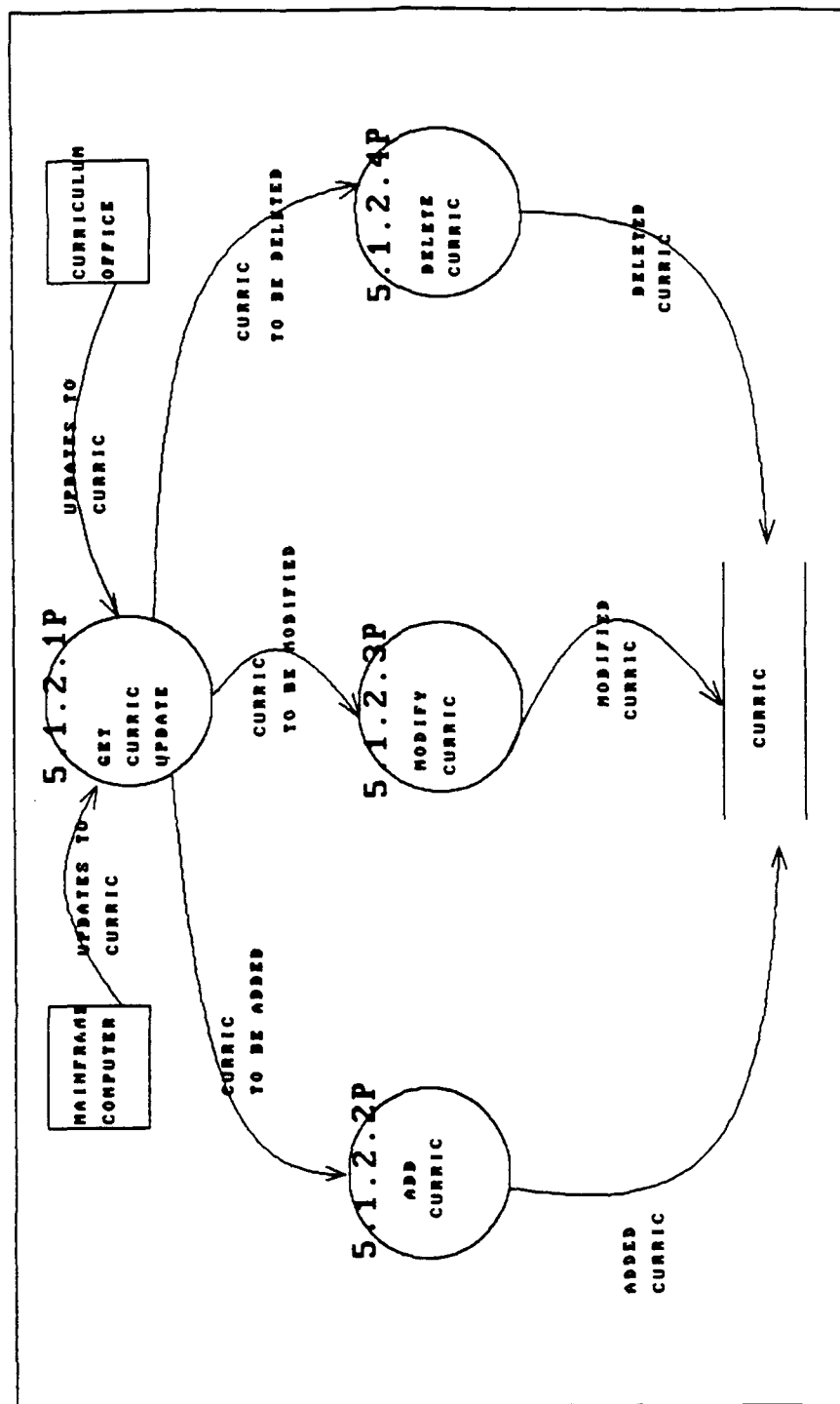


FIG. C-32, Logical Dataflow Diagram for CURRIC Data Store Maintenance.

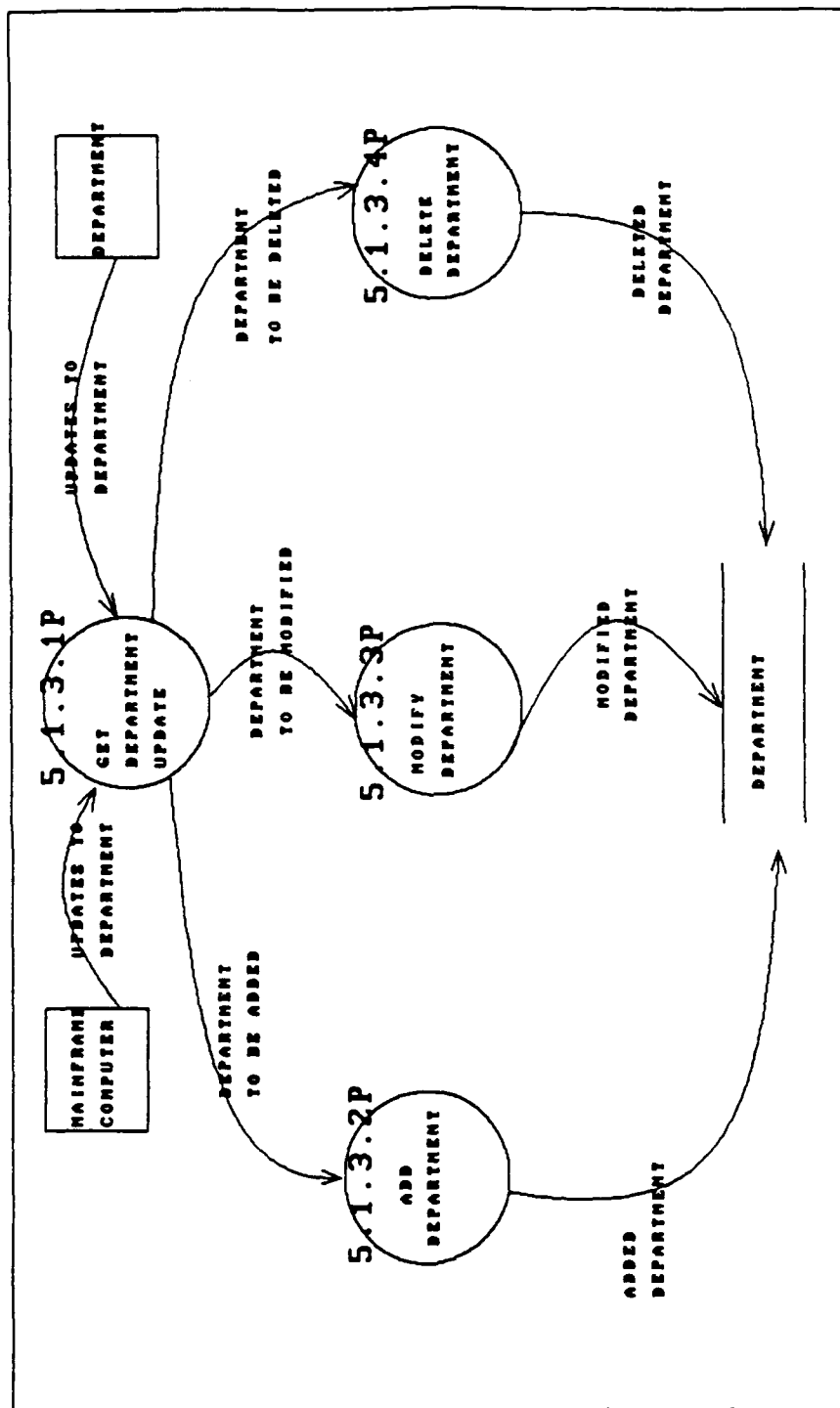


FIG. C-33, Logical Dataflow Diagram for DEPARTMENT Data Store Maintenance.

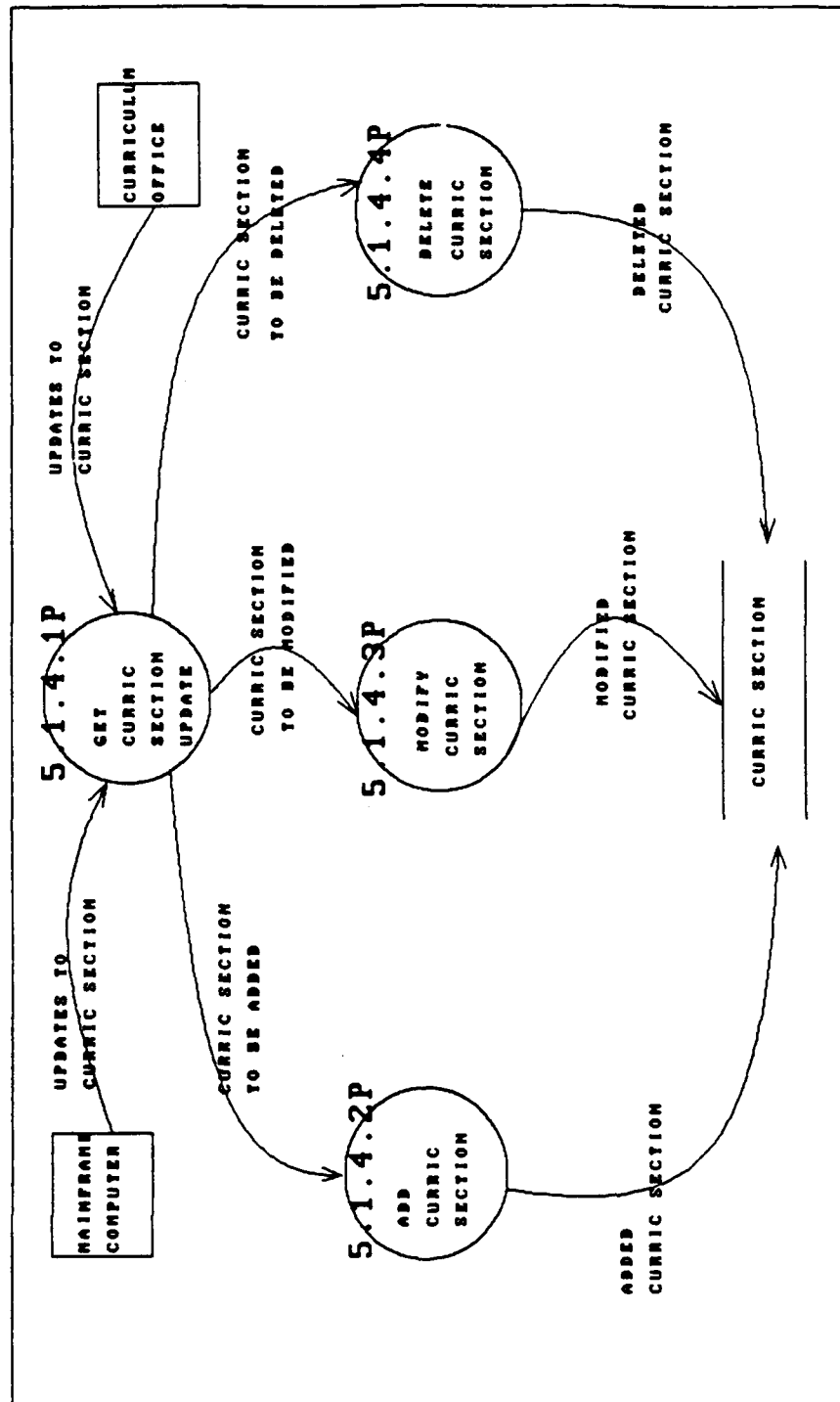


FIG. C-34, Logical Dataflow Diagram for CURRIC SECTION Data Store Maintenance.

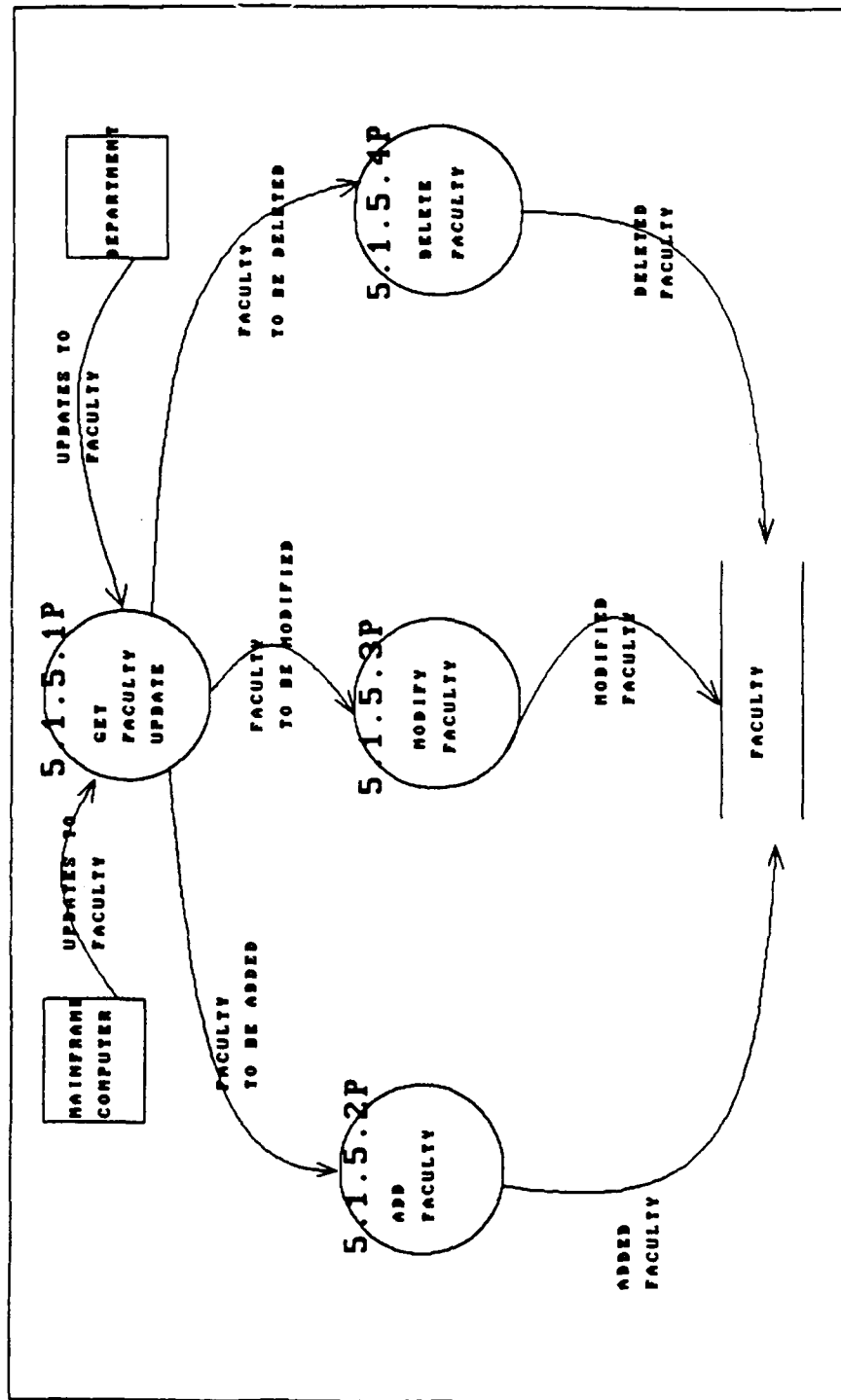


FIG. C-35, Logical Dataflow Diagram for FACULTY Data Store Maintenance.

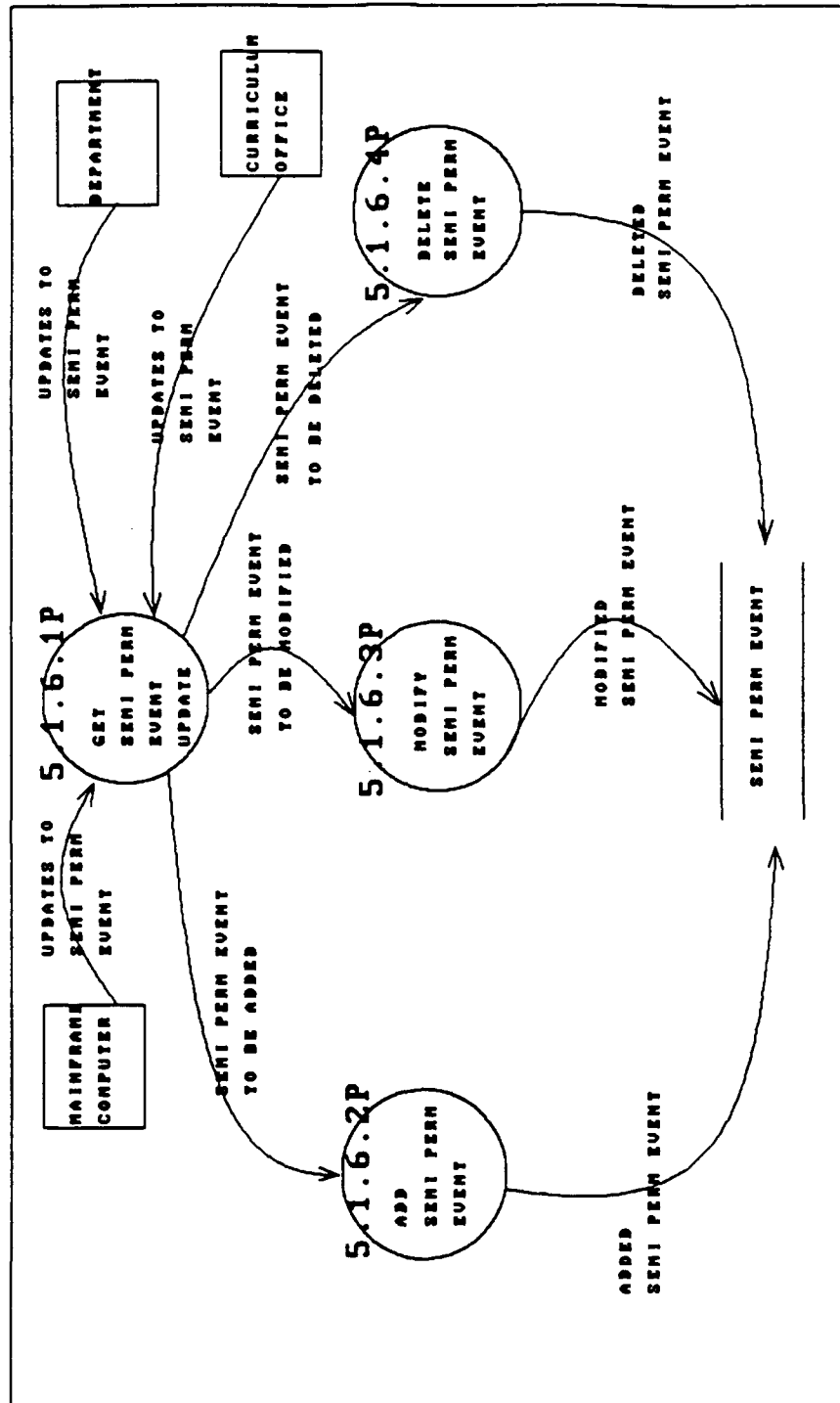


FIG. C-36, Logical Dataflow Diagram for SEMI PERM EVENT Data Store Maintenance.

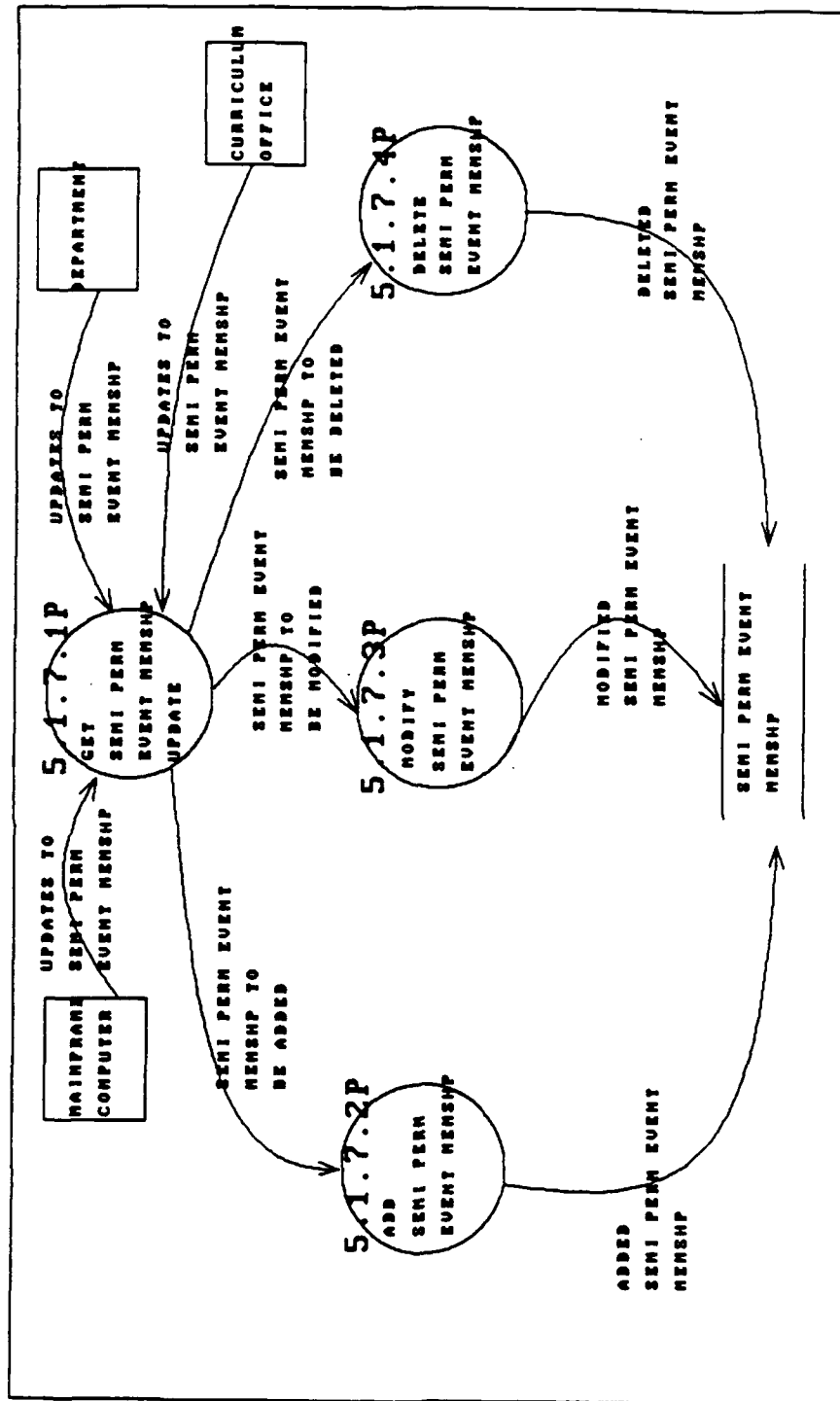


FIG. C-37, Logical Dataflow Diagram for SEMI PERM EVENT MEMSHP Data Store Maintenance.

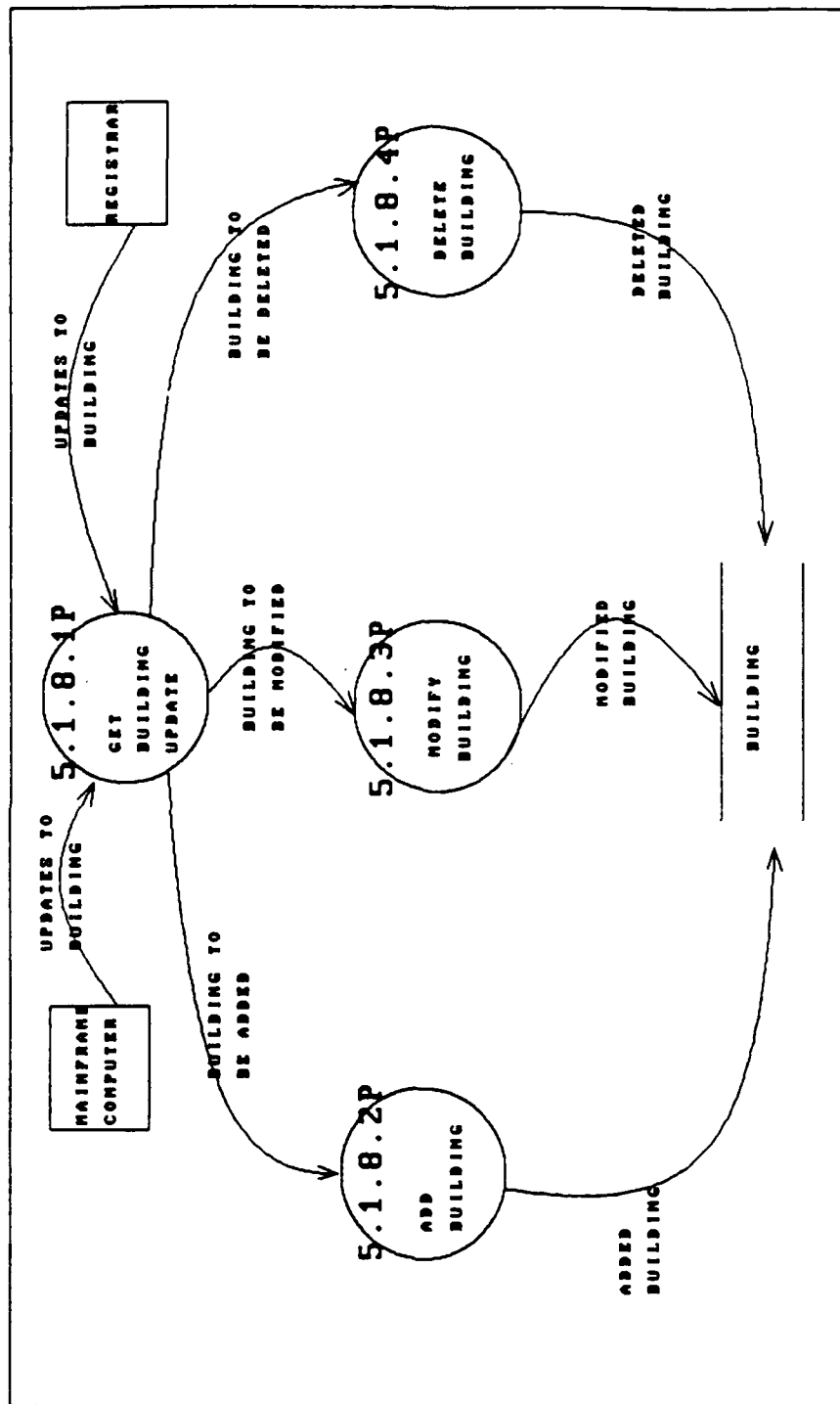


FIG. C-38, Logical Dataflow Diagram for BUILDING Data Store Maintenance.

## **APPENDIX D: NPS<sup>3</sup> STRUCTURE CHARTS**

The following report graphically depicts a computer system structured design, in the form of structure charts, FIG. D-1 thru FIG D-44, for implementing the requirements for the scheduling of courses at the Naval Postgraduate School.

The design of the Final Exam Scheduling, Master Instruction Schedule and Scheduling Data Graph applications are beyond the scope of this thesis and are therefore not addressed, except to show there organization in FIG. D-1 as #'s 5, 6 and 7, respectively. Although not addressed here, the advantages of structured Design allow for these applications to be easily added to NPS<sup>3</sup> in the future.

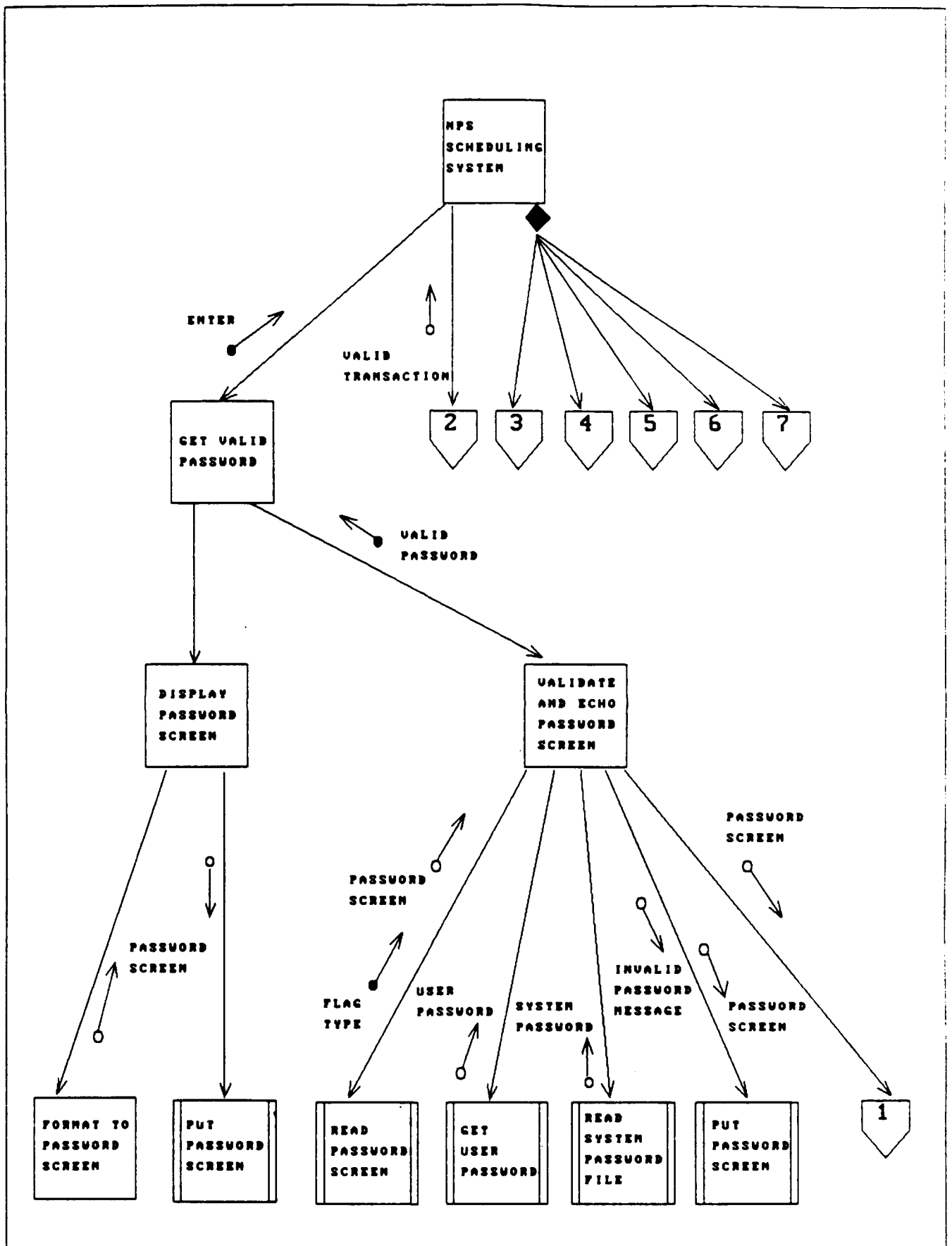


Fig. D-1, NPS SCHEDULING SYSTEM.

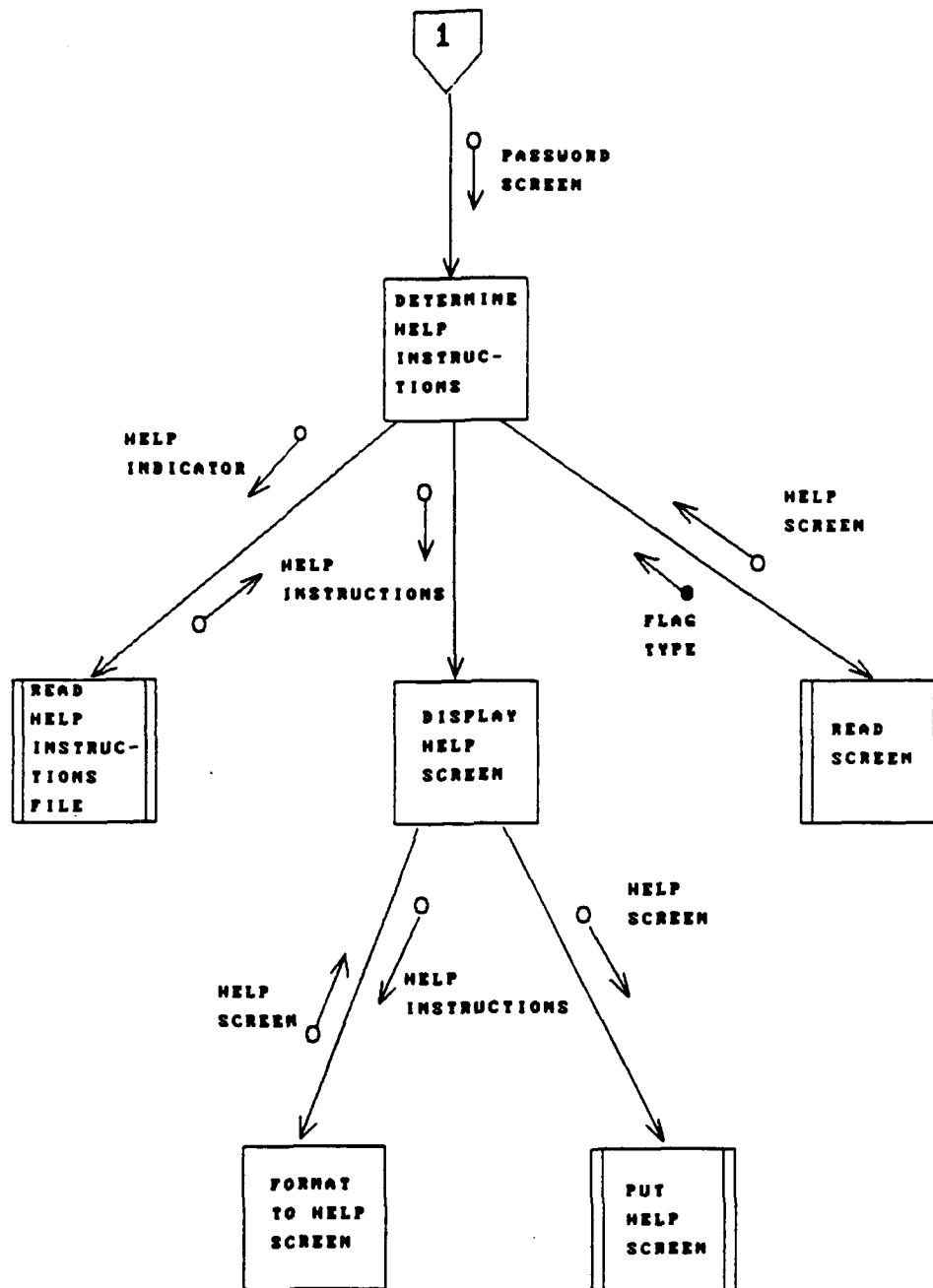


**Fig. D-2, DETERMINE HELP INSTRUCTIONS  
for Password Screen.**

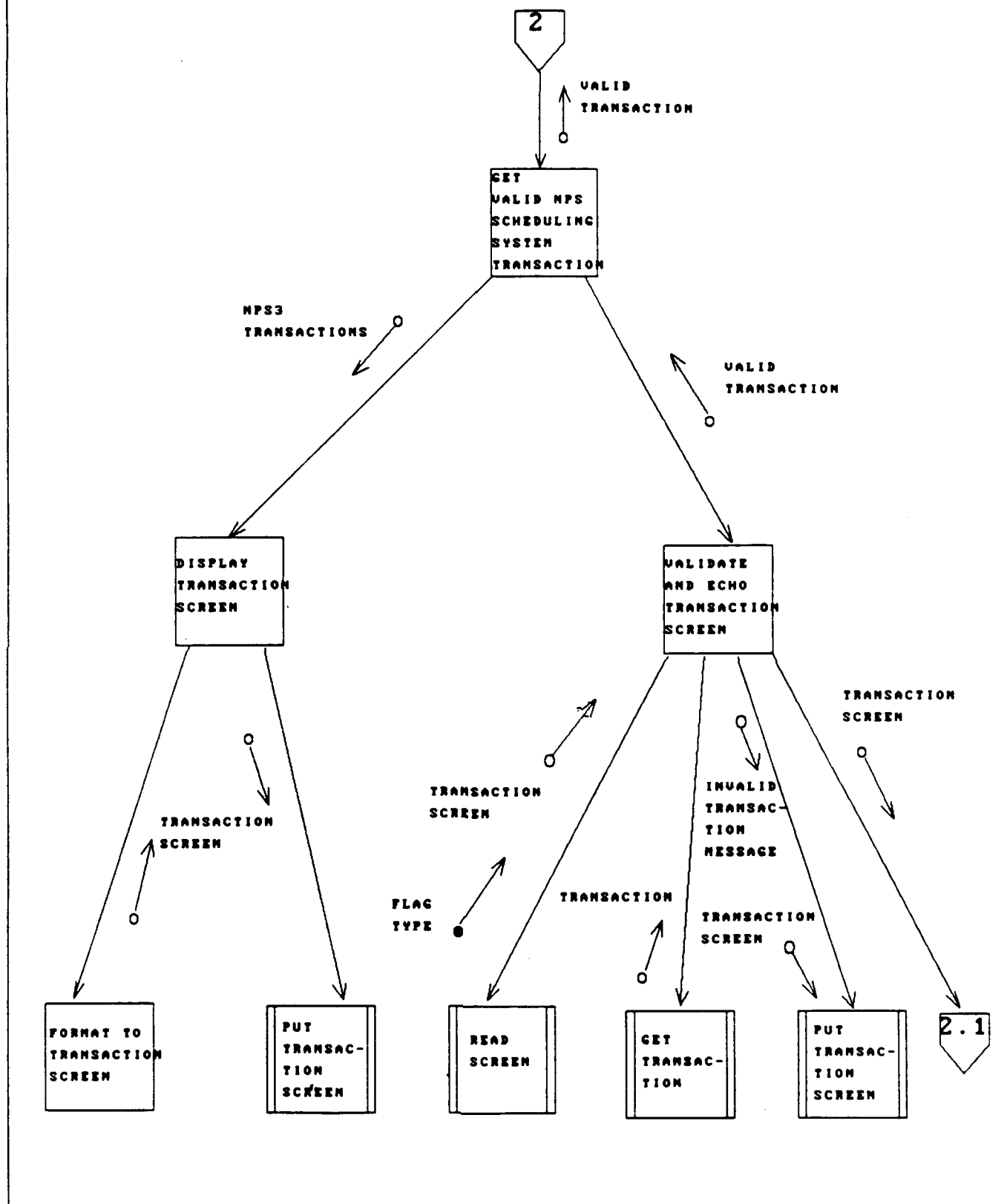


Fig. D-3, GET VALID NPS SCHEDULING SYSTEM TRANSACTION .

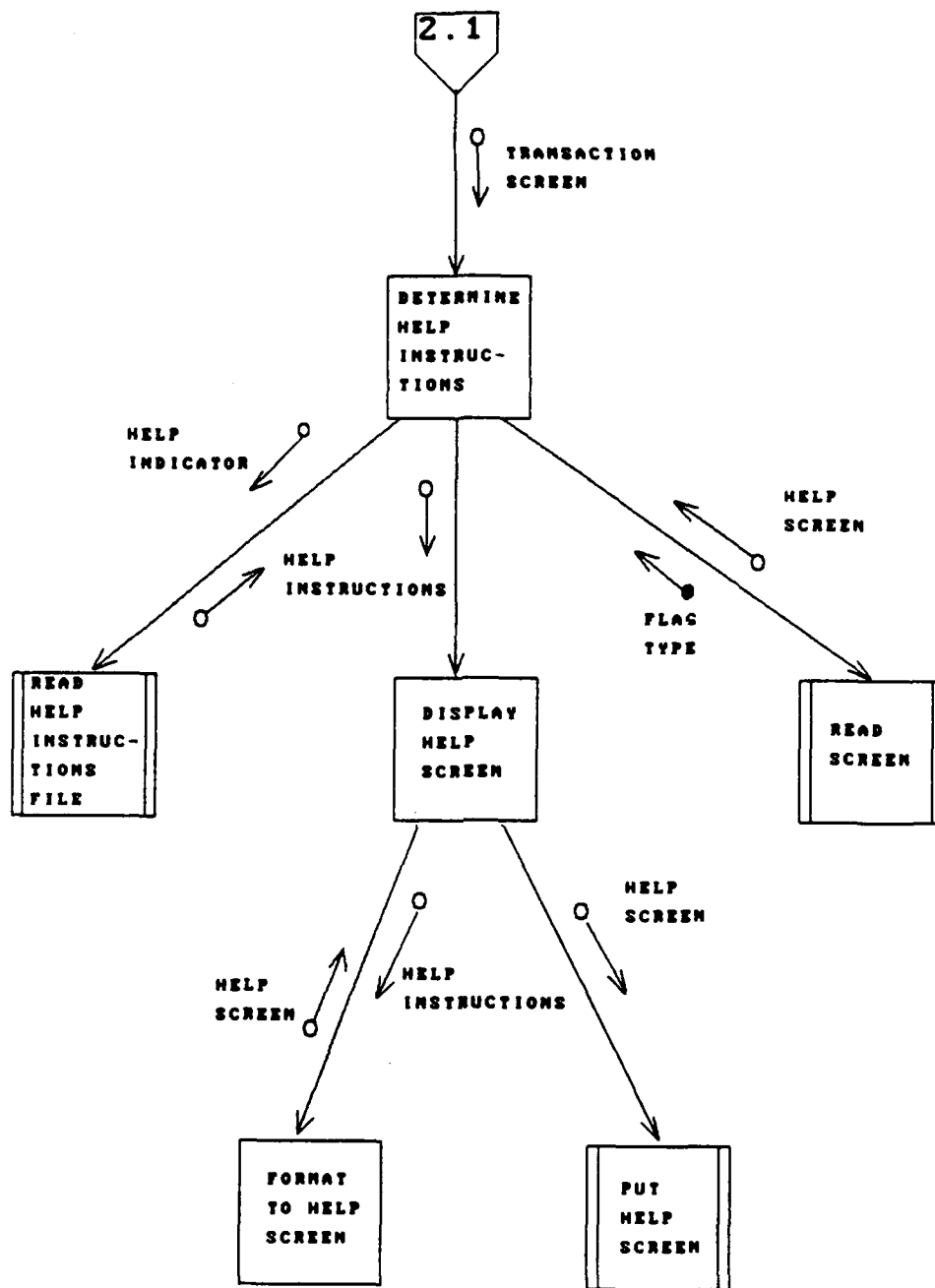


**Fig. D-4, DETERMINE HELP INSTRUCTIONS  
for Transaction Screen.**



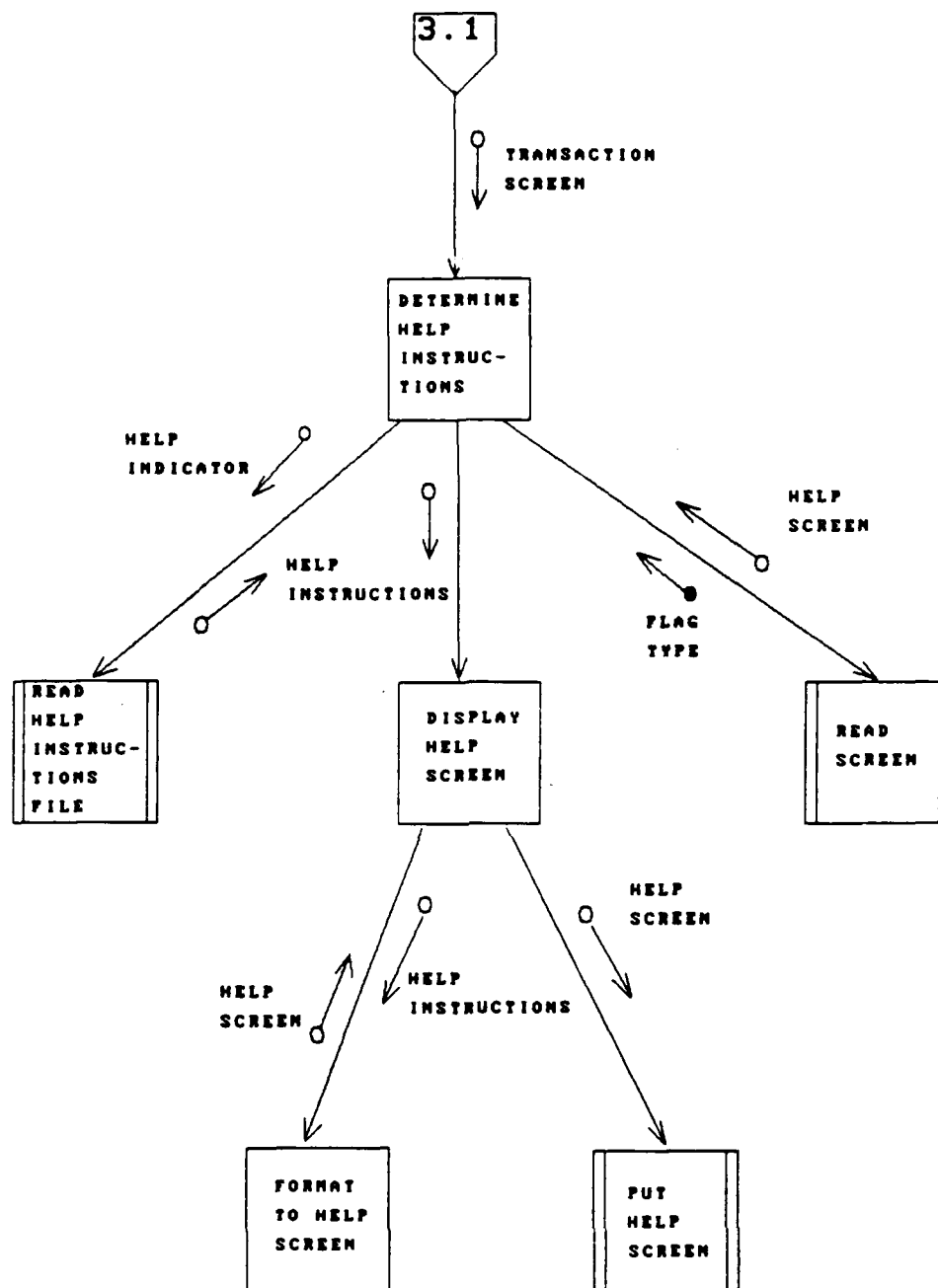


Fig. D-6, DETERMINE HELP INSTRUCTIONS  
for Transaction Screen.

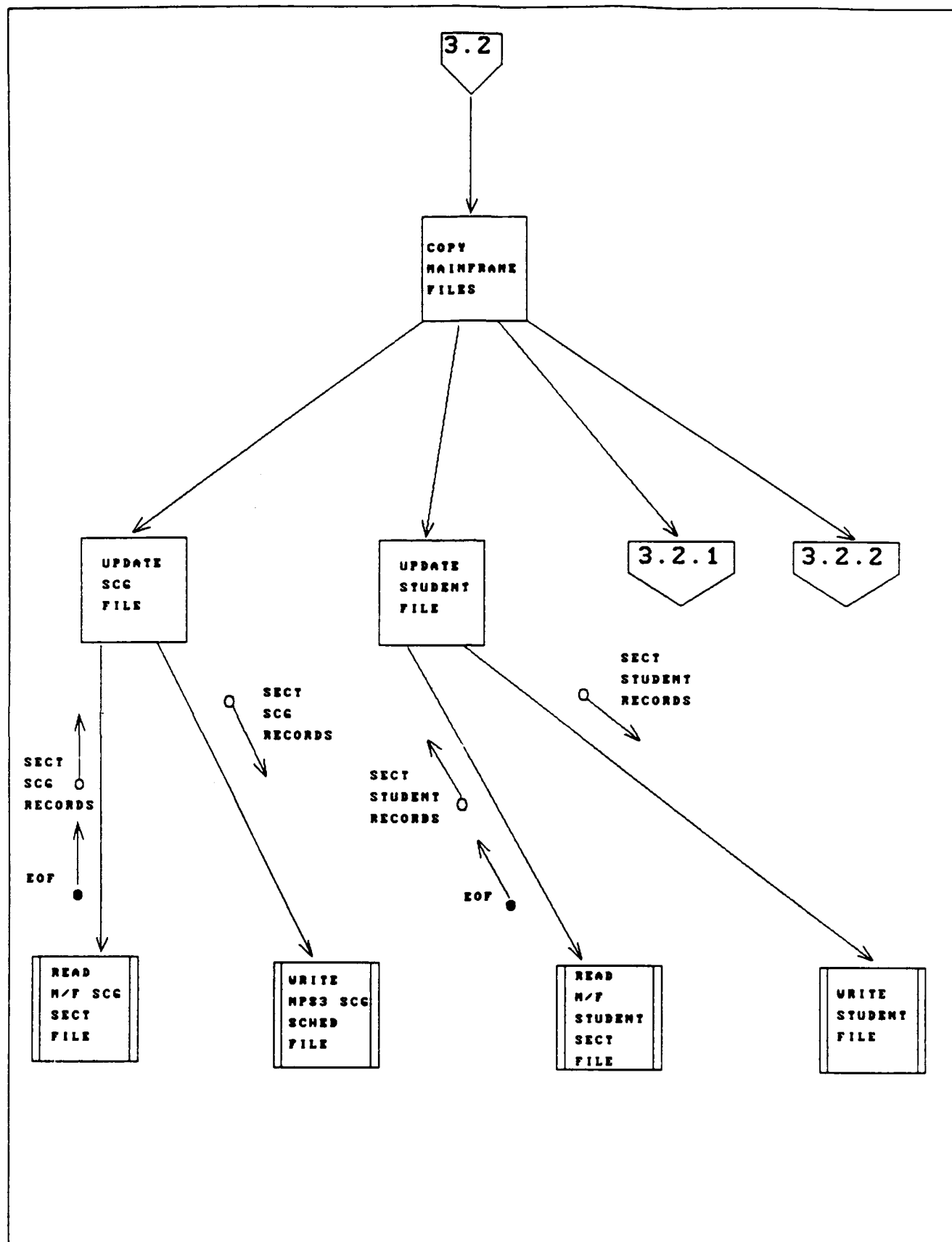


Fig. D-7, COPY MAINFRAME FILES.

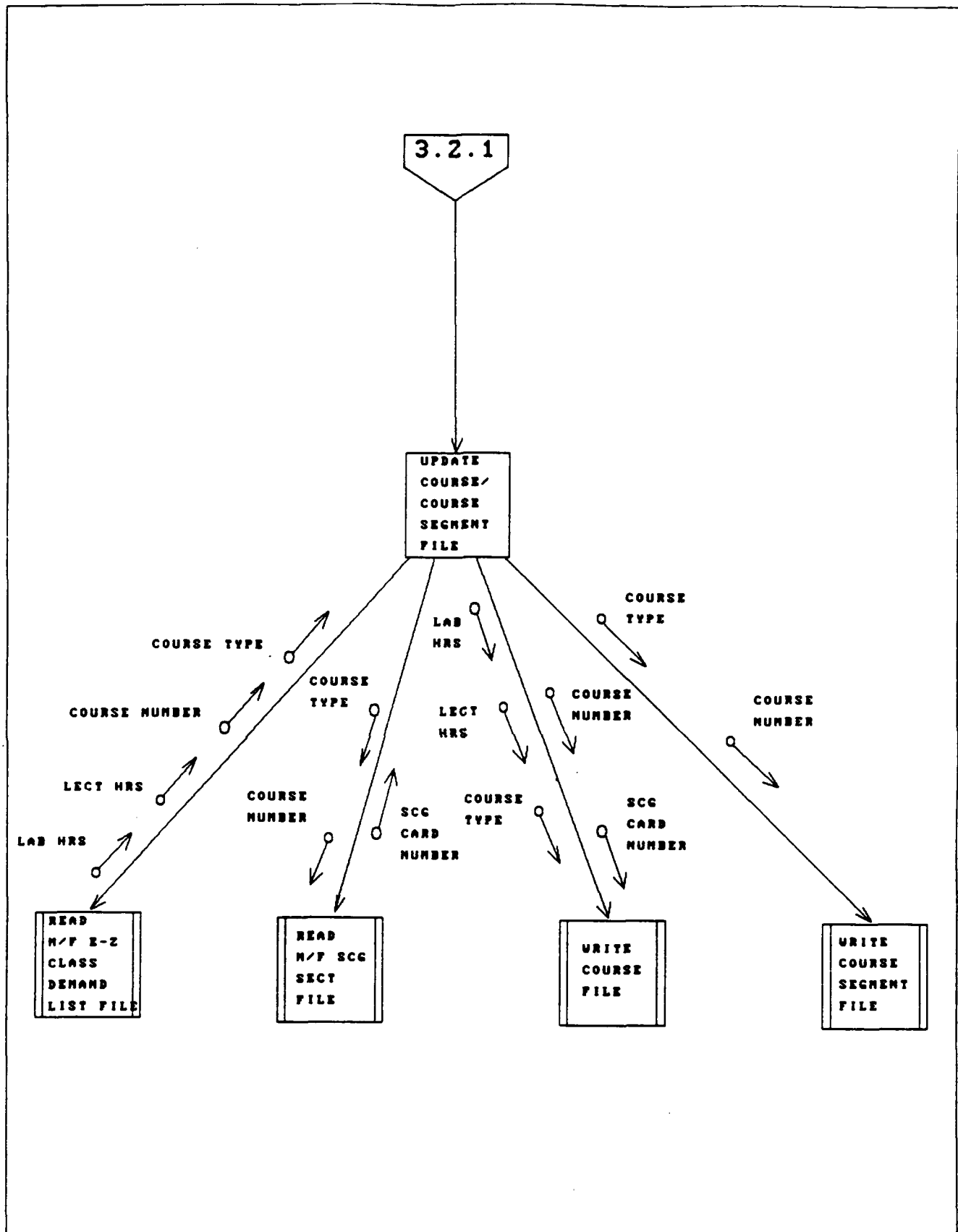


Fig. D-8, UPDATE COURSE/COURSE SEGMENT FILES.

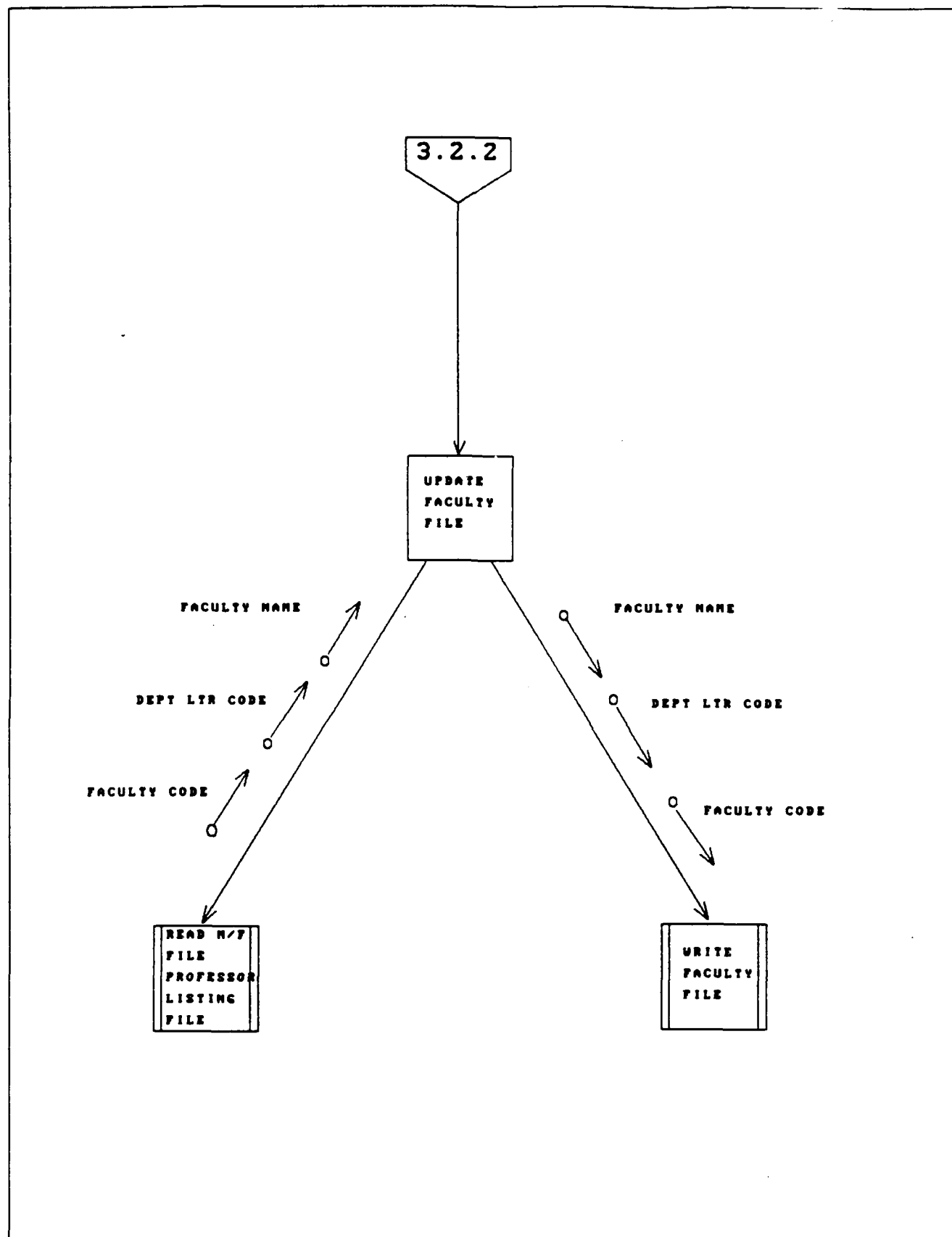


Fig. D-9, UPDATE FACULTY FILE.

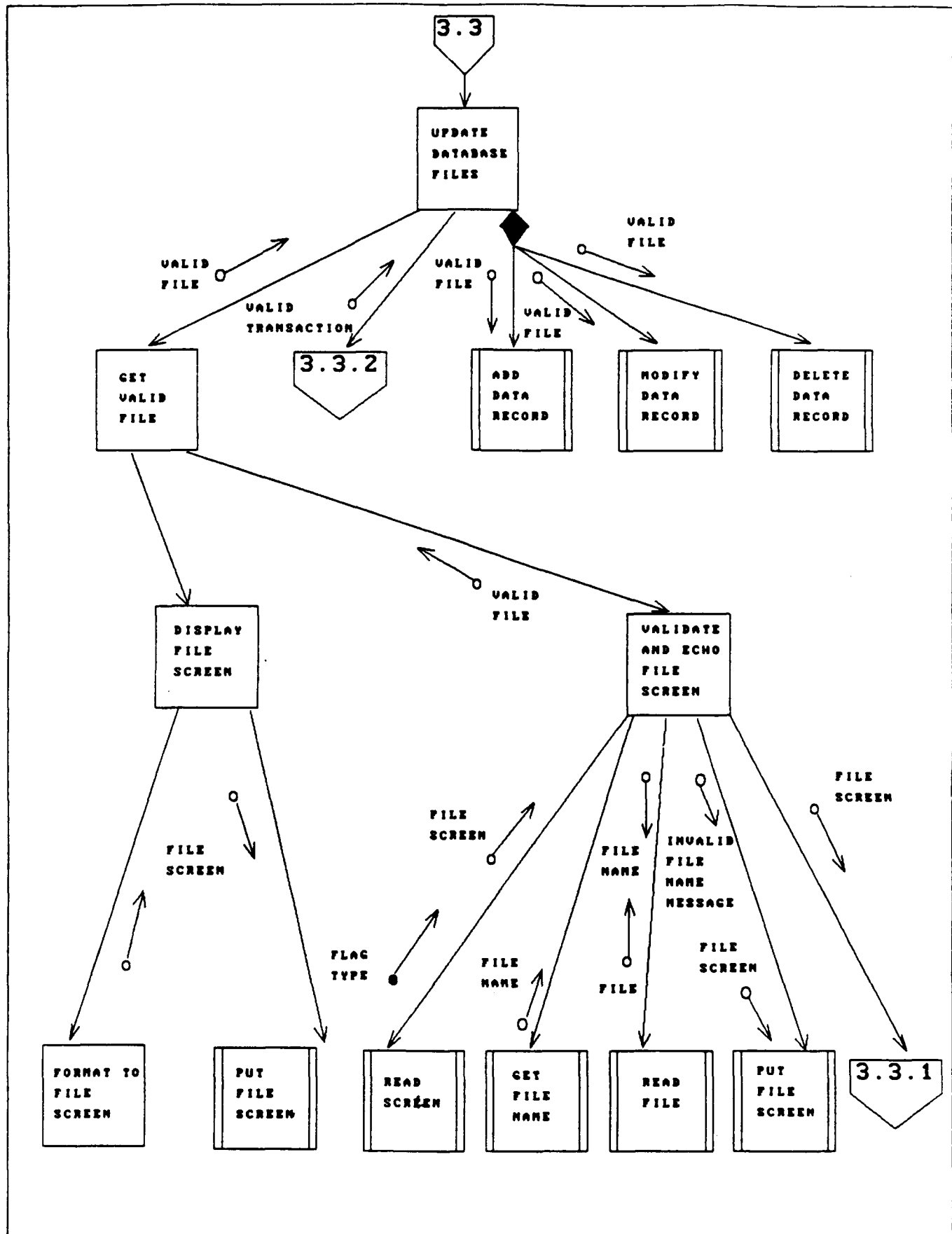


Fig. D-10, UPDATE DATABASE FILES.

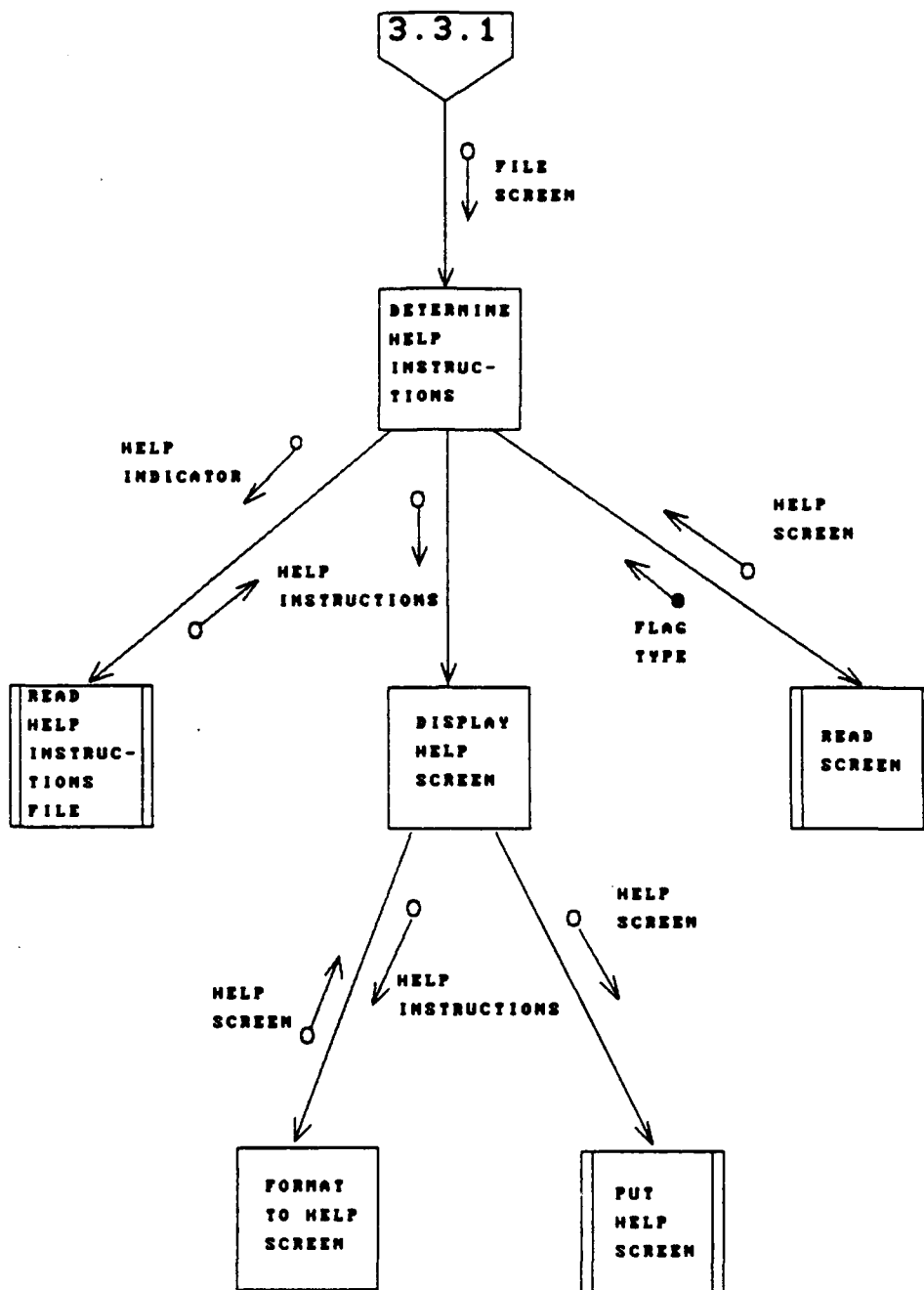


Fig. D-11, DETERMINE HELP INSTRUCTIONS  
for File Screen.

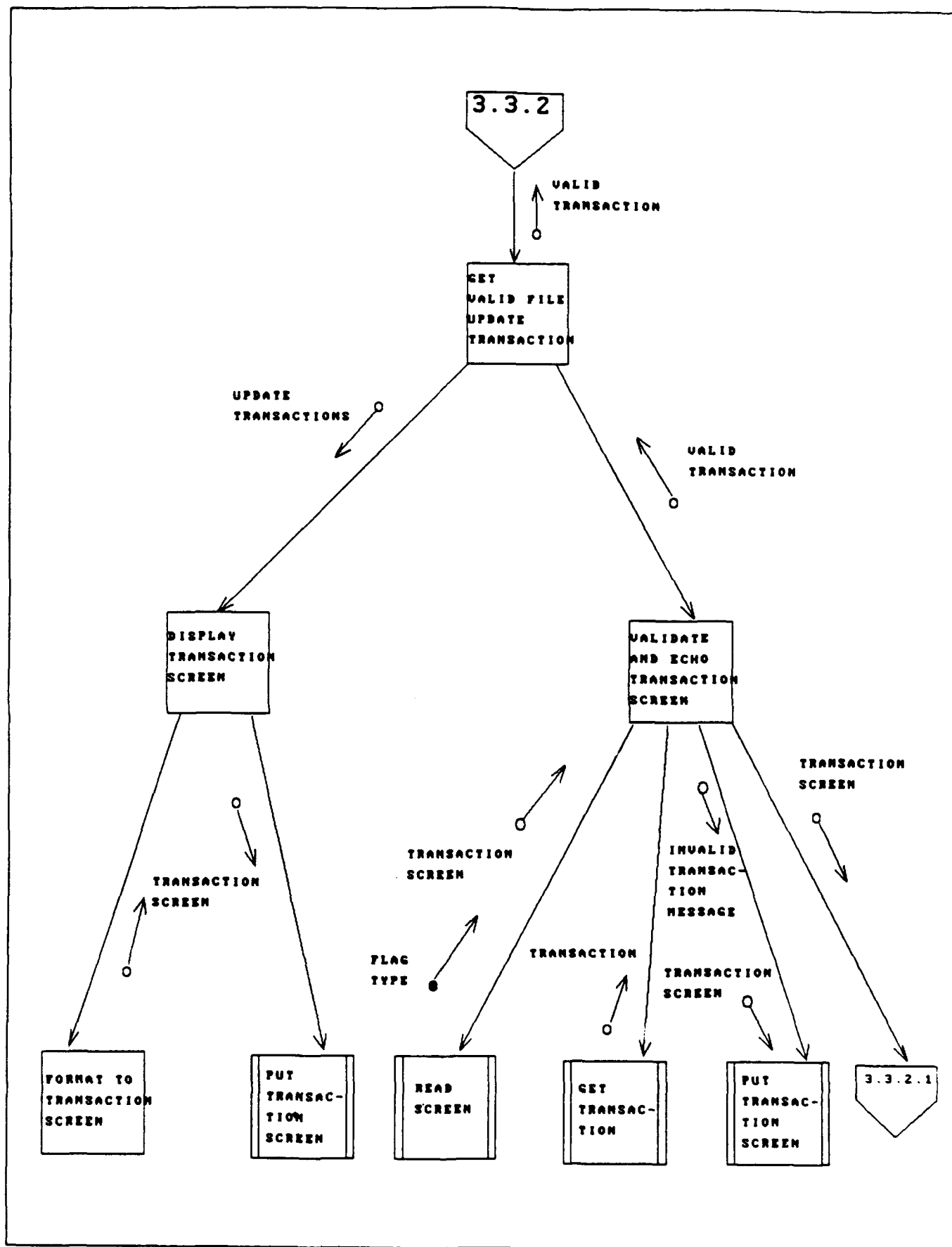


Fig. D-12, GET VALID FILE UPDATE TRANSACTION.

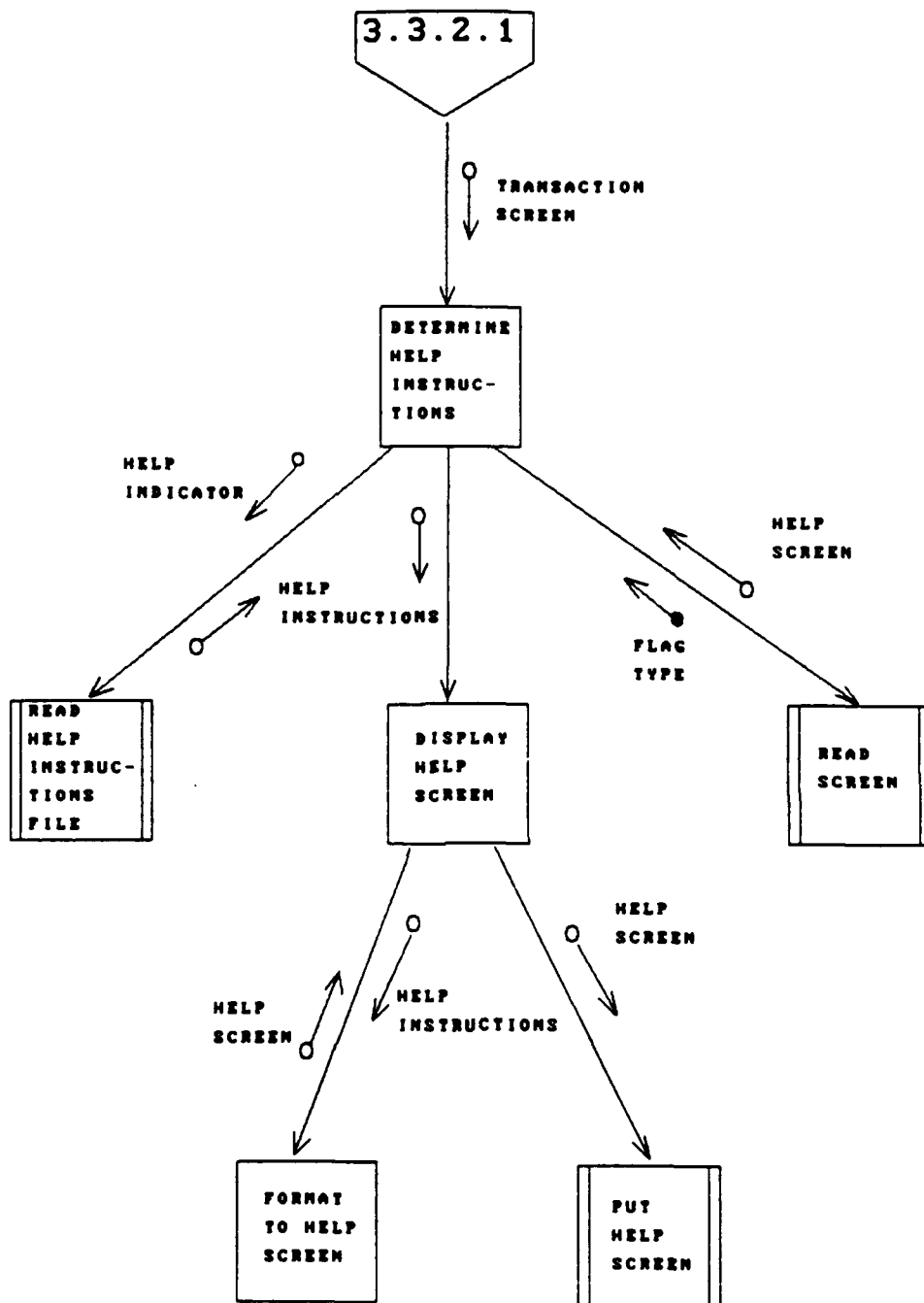


Fig. D-13, DETERMINE HELP INSTRUCTIONS  
for Transaction Screen.

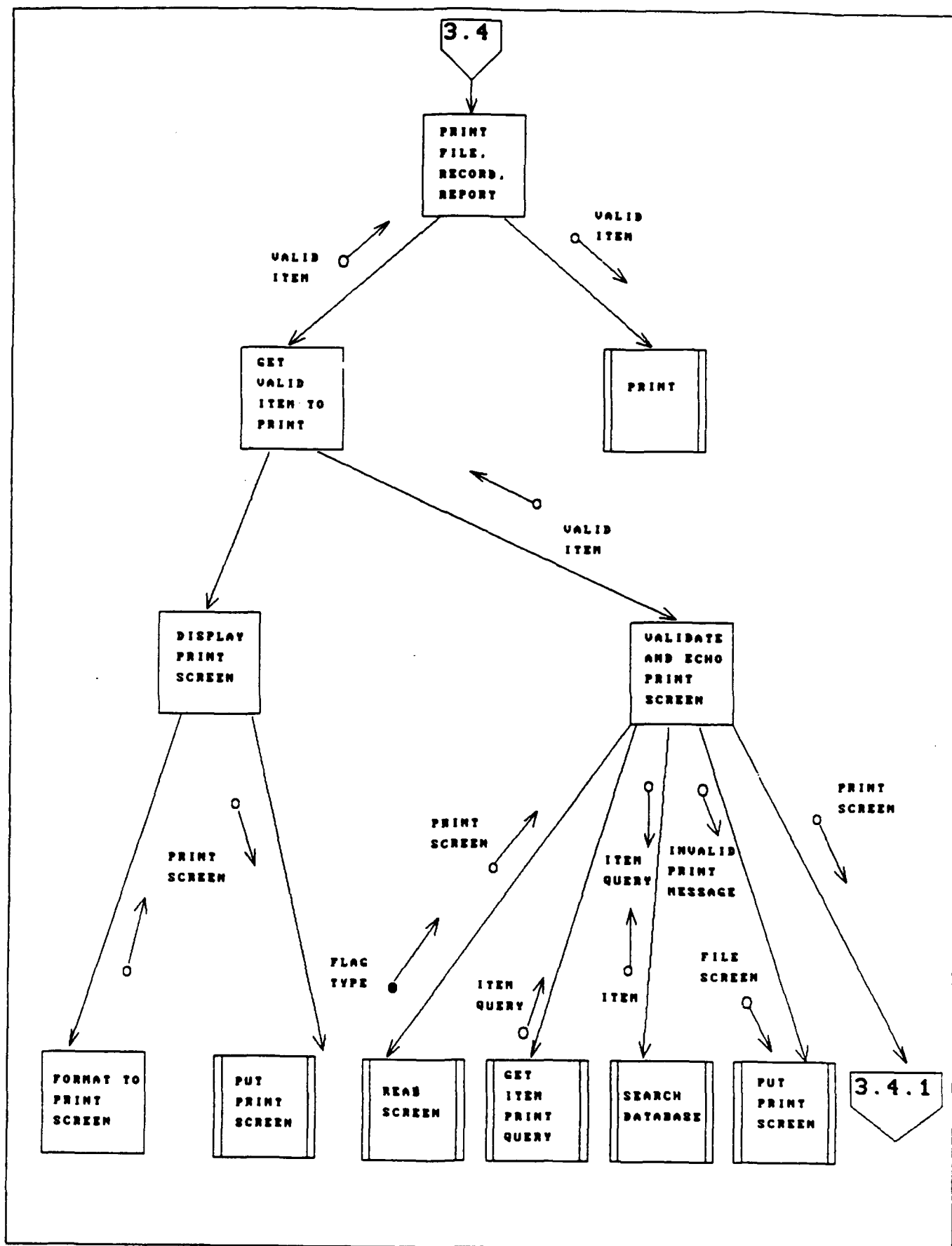


Fig. D-14, PRINT FILE, RECORD, REPORT.

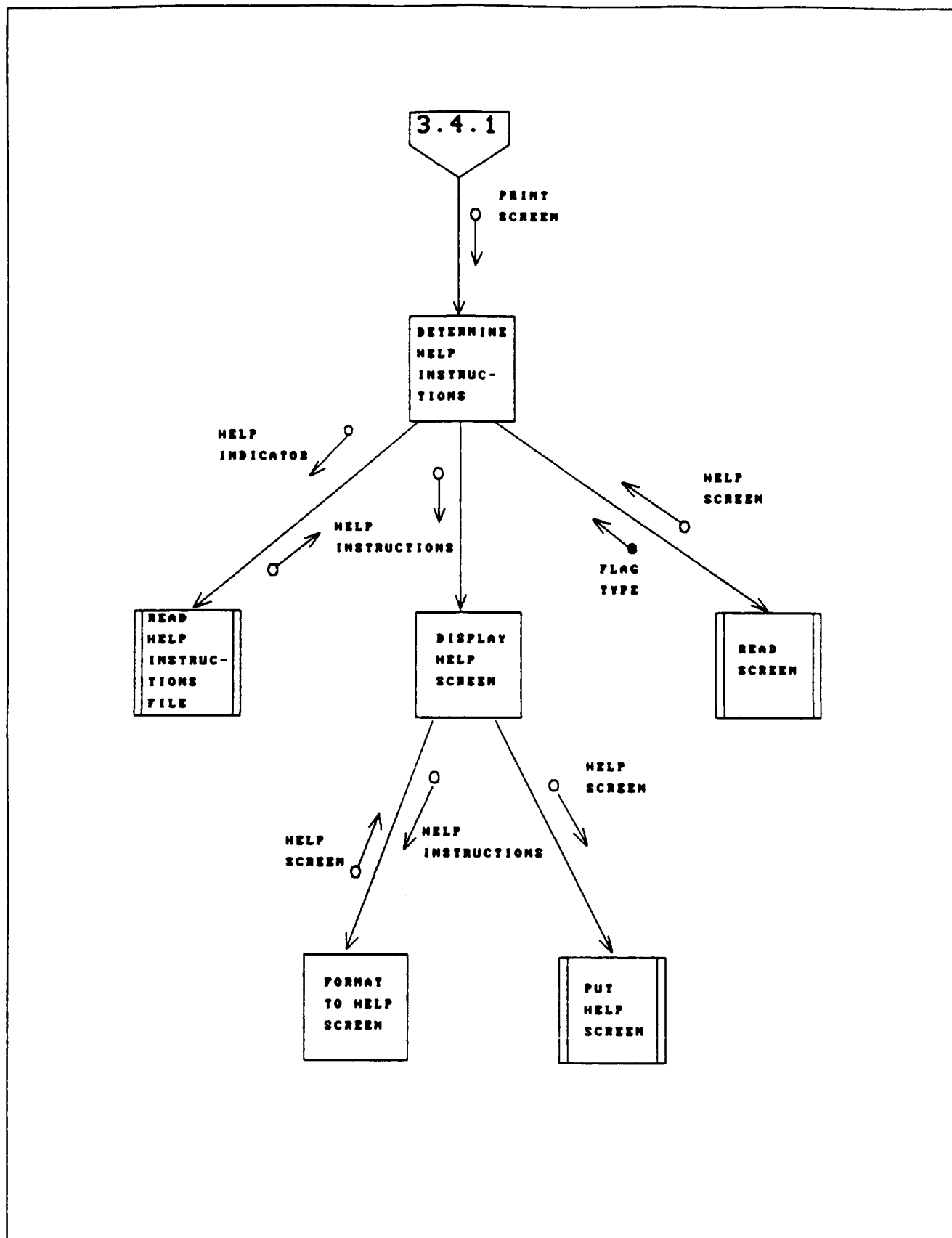


Fig. D-15, DETERMINE HELP INSTRUCTIONS for Print Screen.



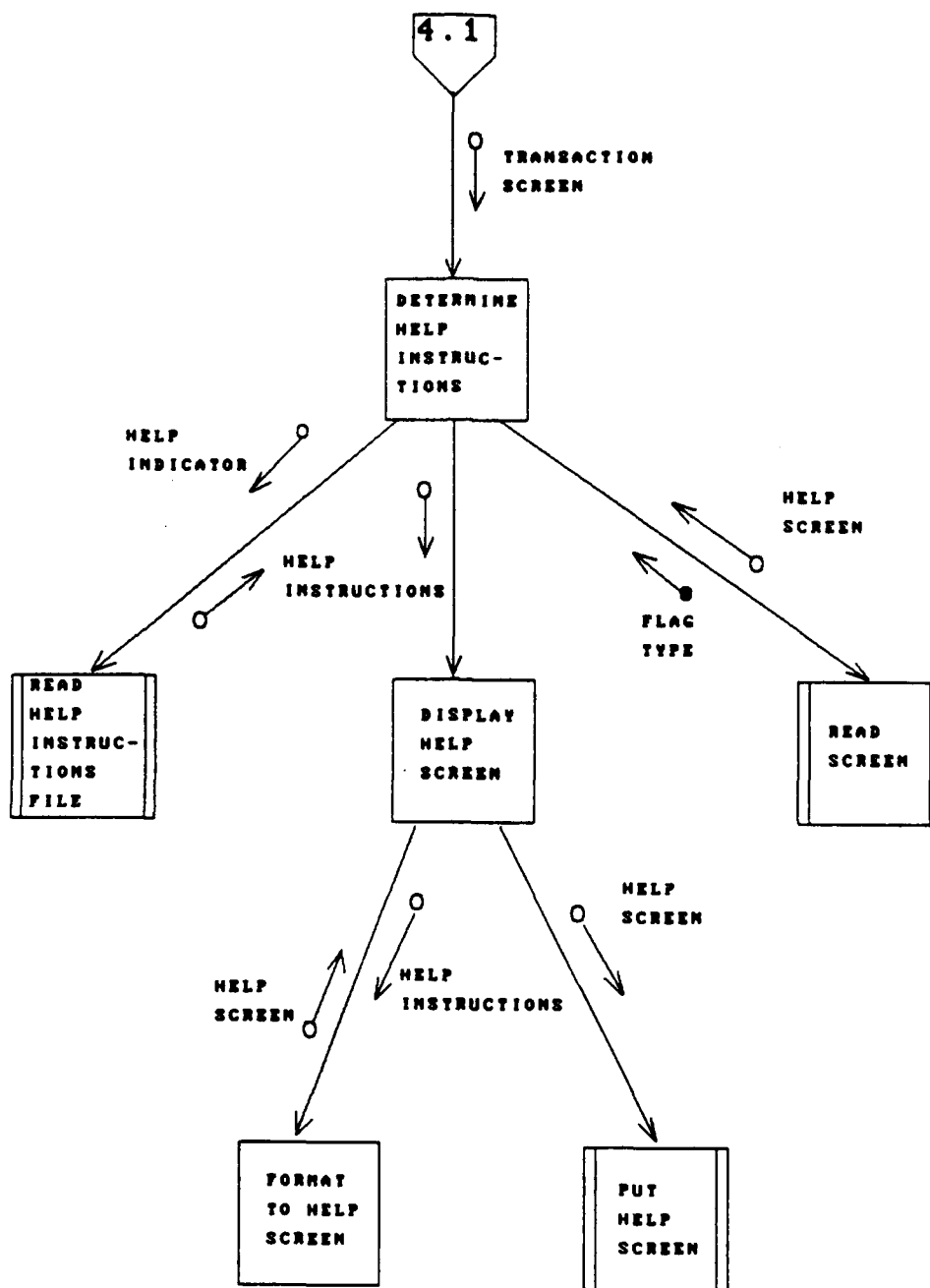


Fig. D-17, DETERMINE HELP INSTRUCTIONS  
for Event/Course Transaction Screen.

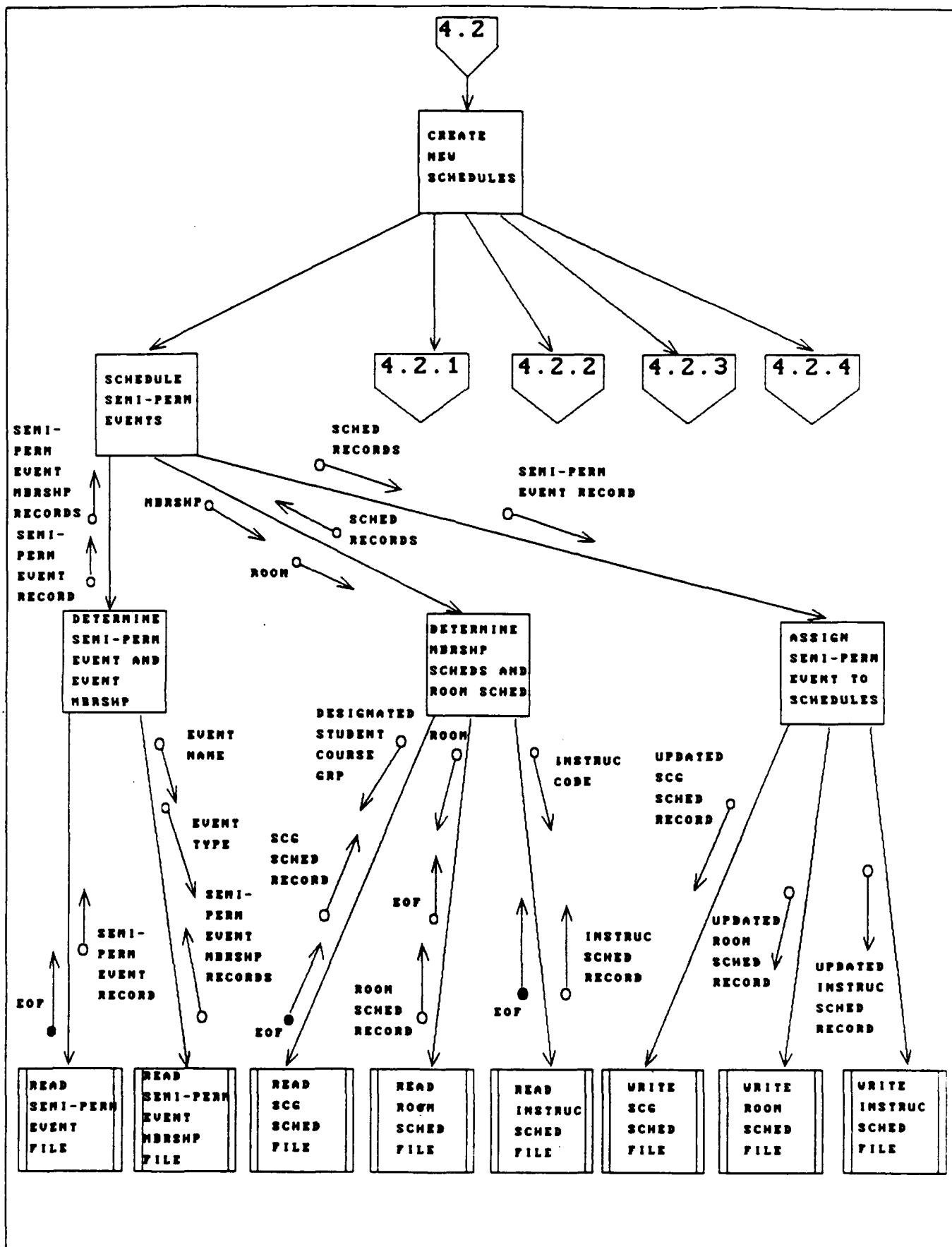


Fig. D-18, CREATE NEW SCHEDULES.

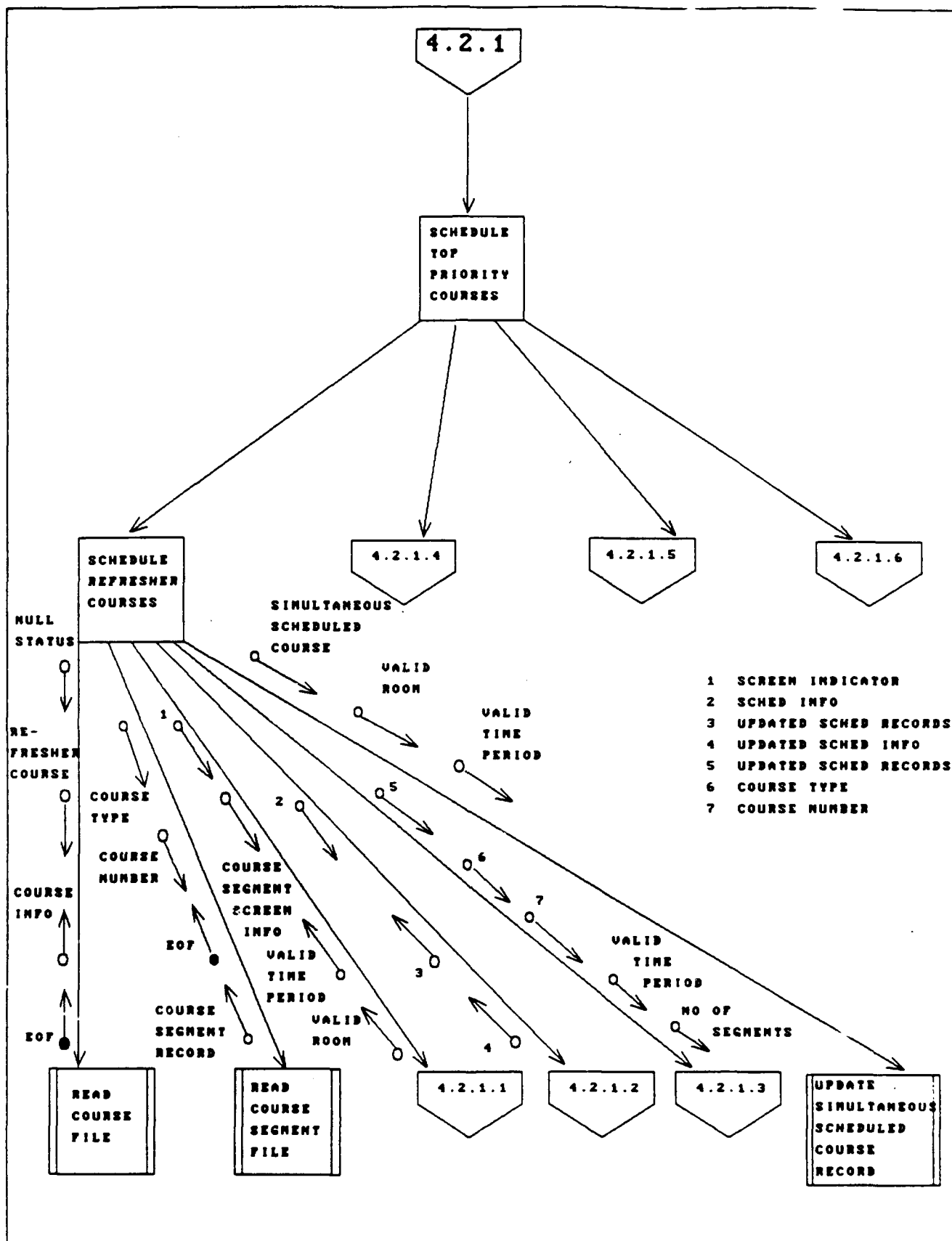


Fig. D-19, SCHEDULE TOP PRIORITY COURSES.

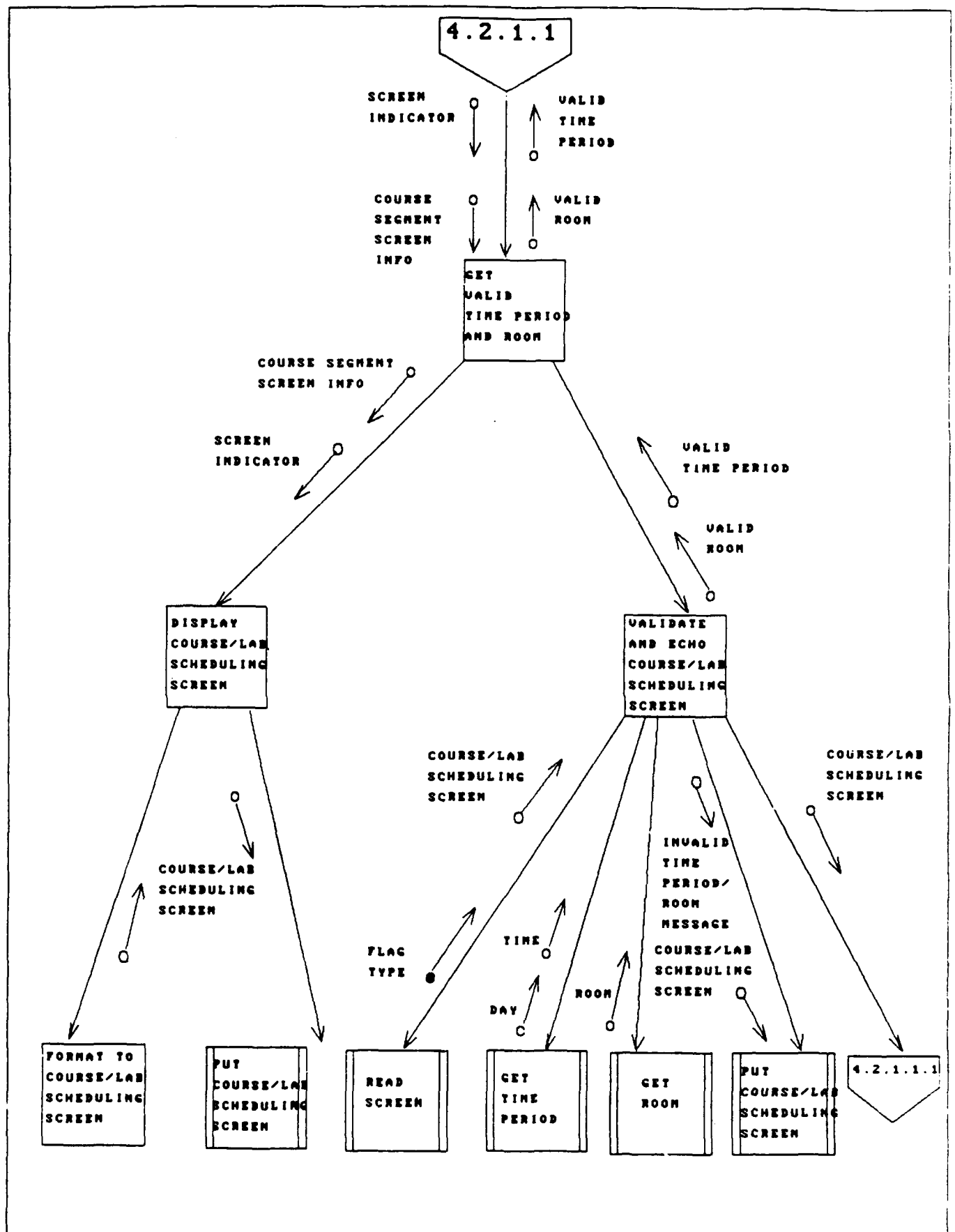


Fig. D-20, GET VALID TIME PERIOD AND ROOM.

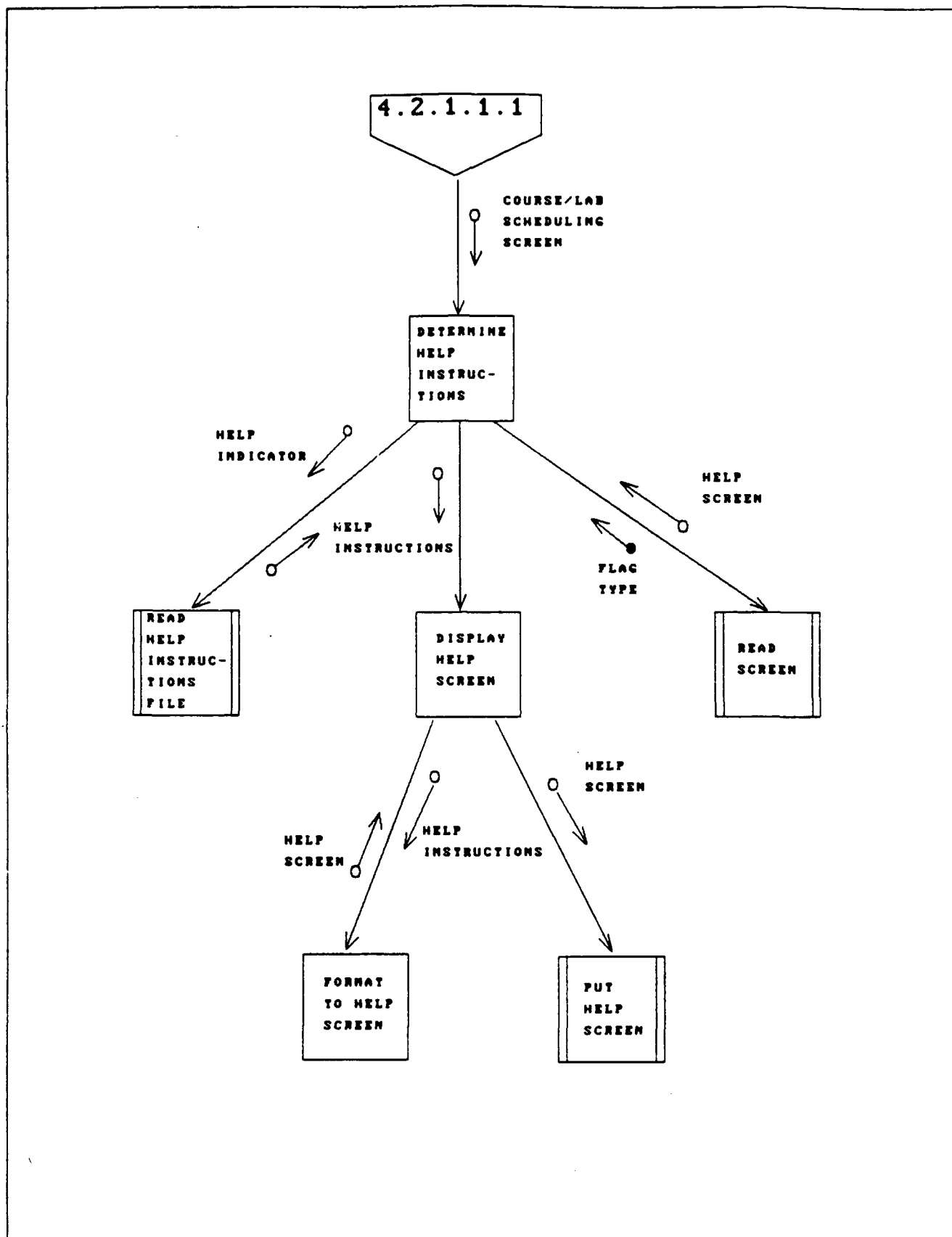
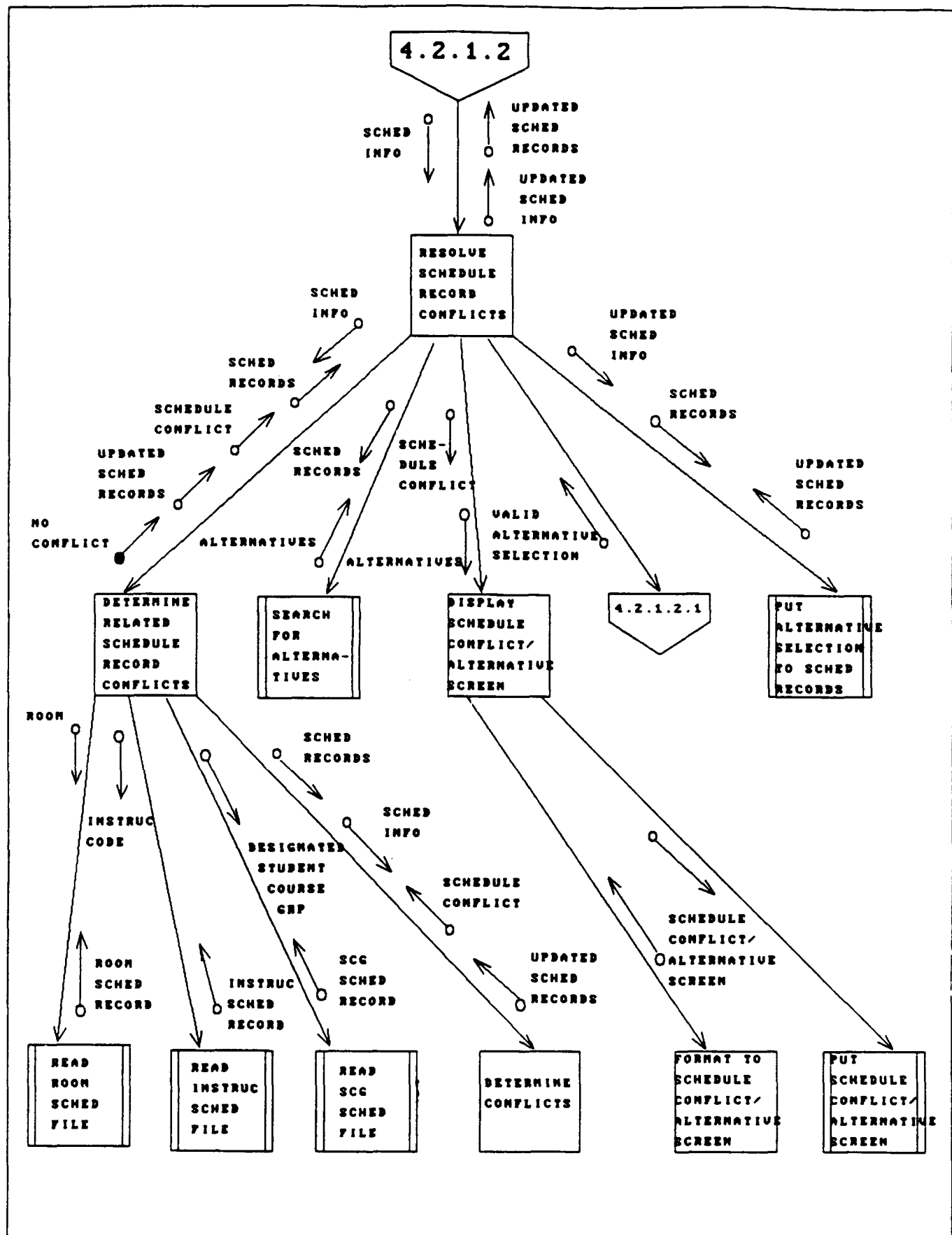


Fig. D-21. DETERMINE HELP INSTRUCTIONS  
for Course/Lab Scheduling Screen.



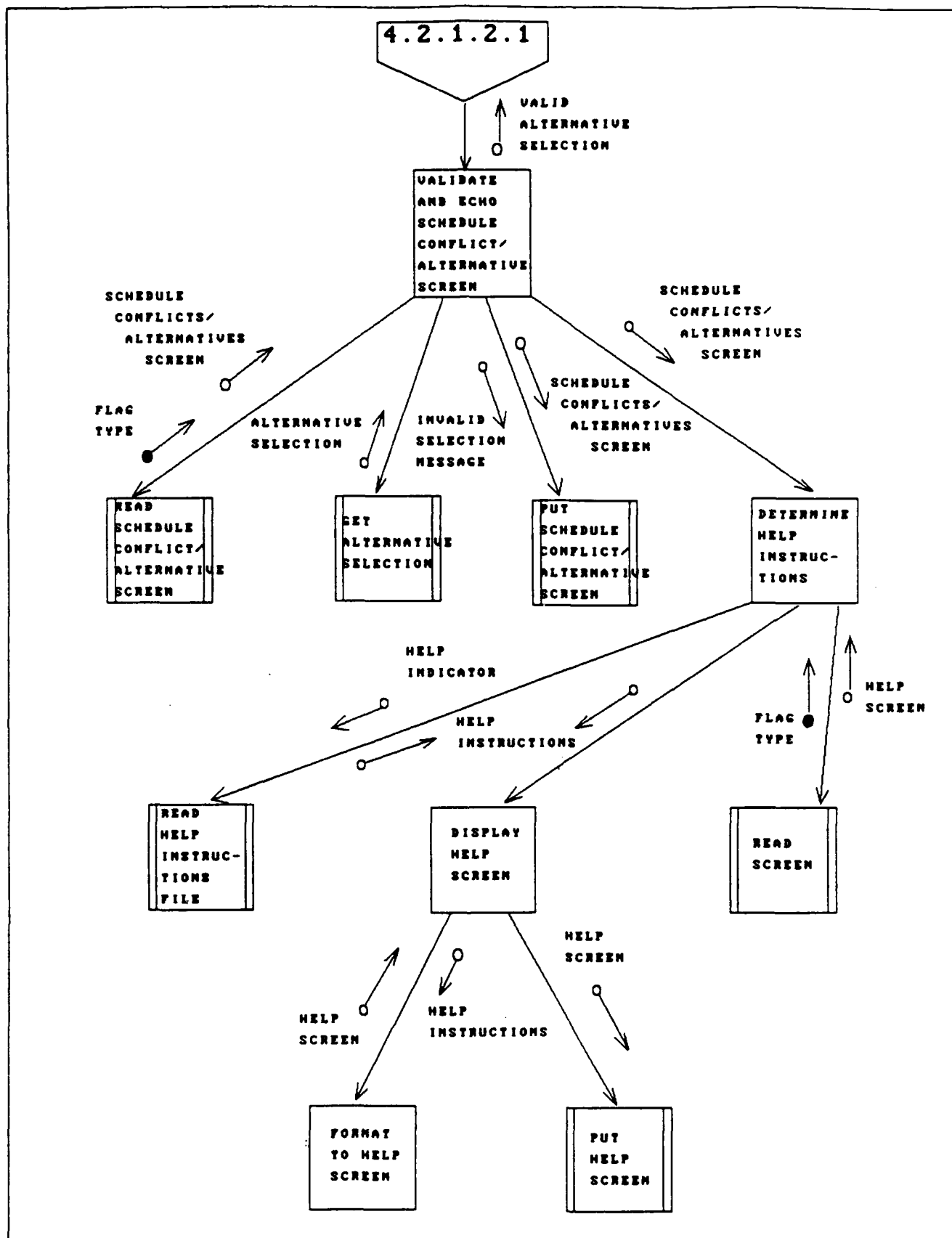


Fig. D-23, VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVE SCREEN.

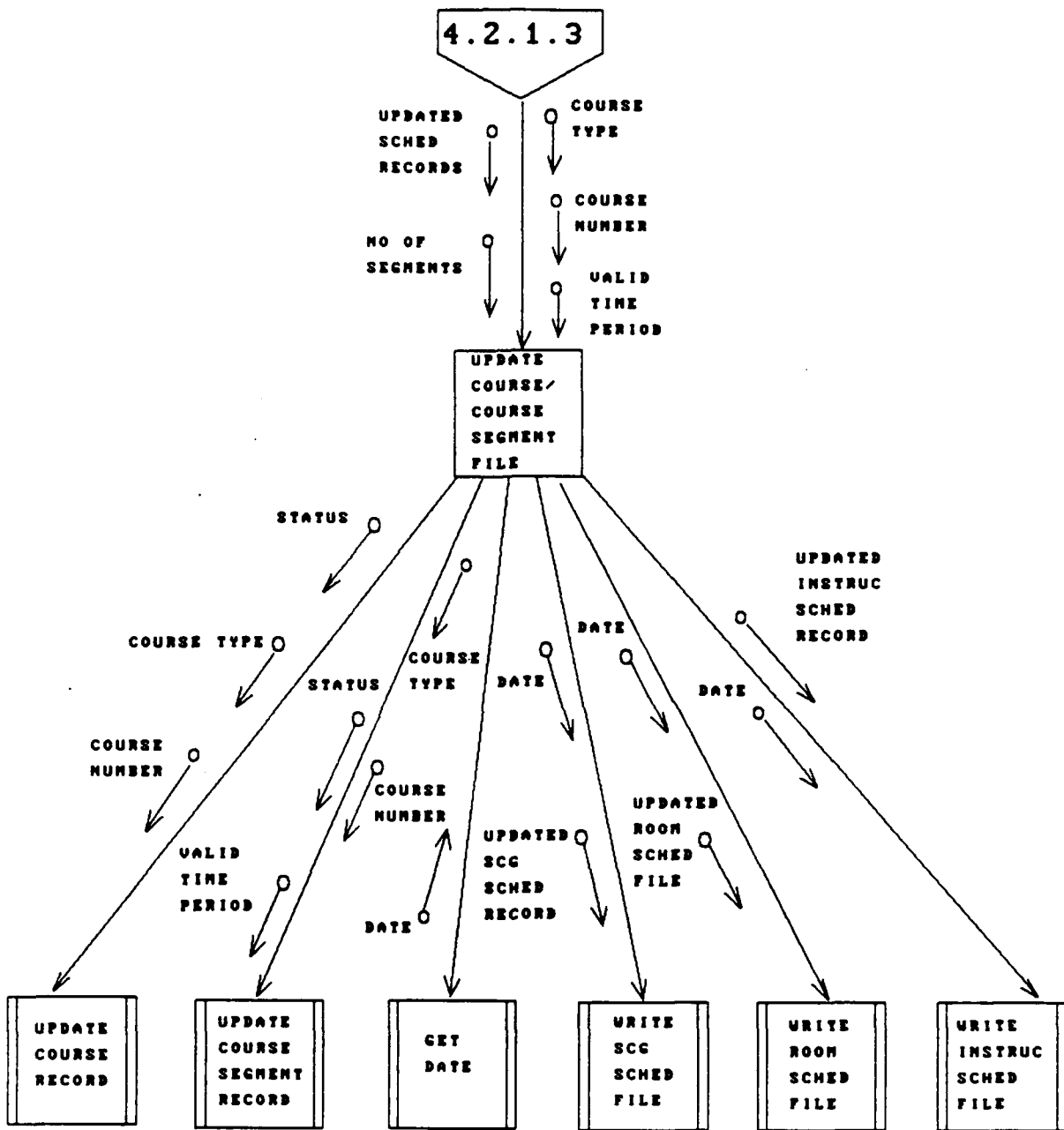


**Fig. D-24, SAVE TO PERTINENT FILE, RECORD.**

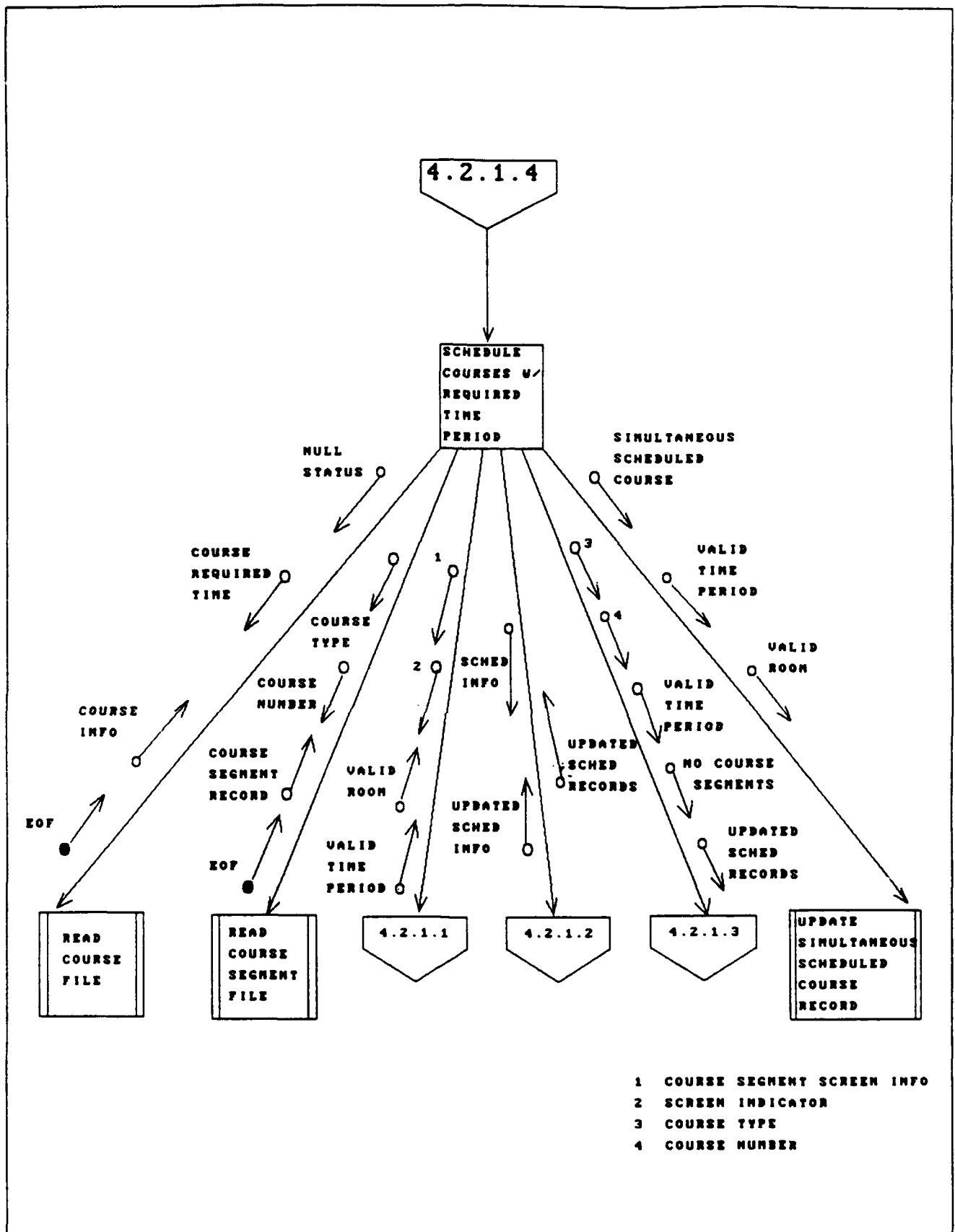


Fig. D-25, SCHEDULE COURSES W/ REQUIRED TIME PERIOD.



**Fig. D-26, SCHEDULE COURSES W/  
REQUIRED TIME PERIOD FOR INSTRU.**



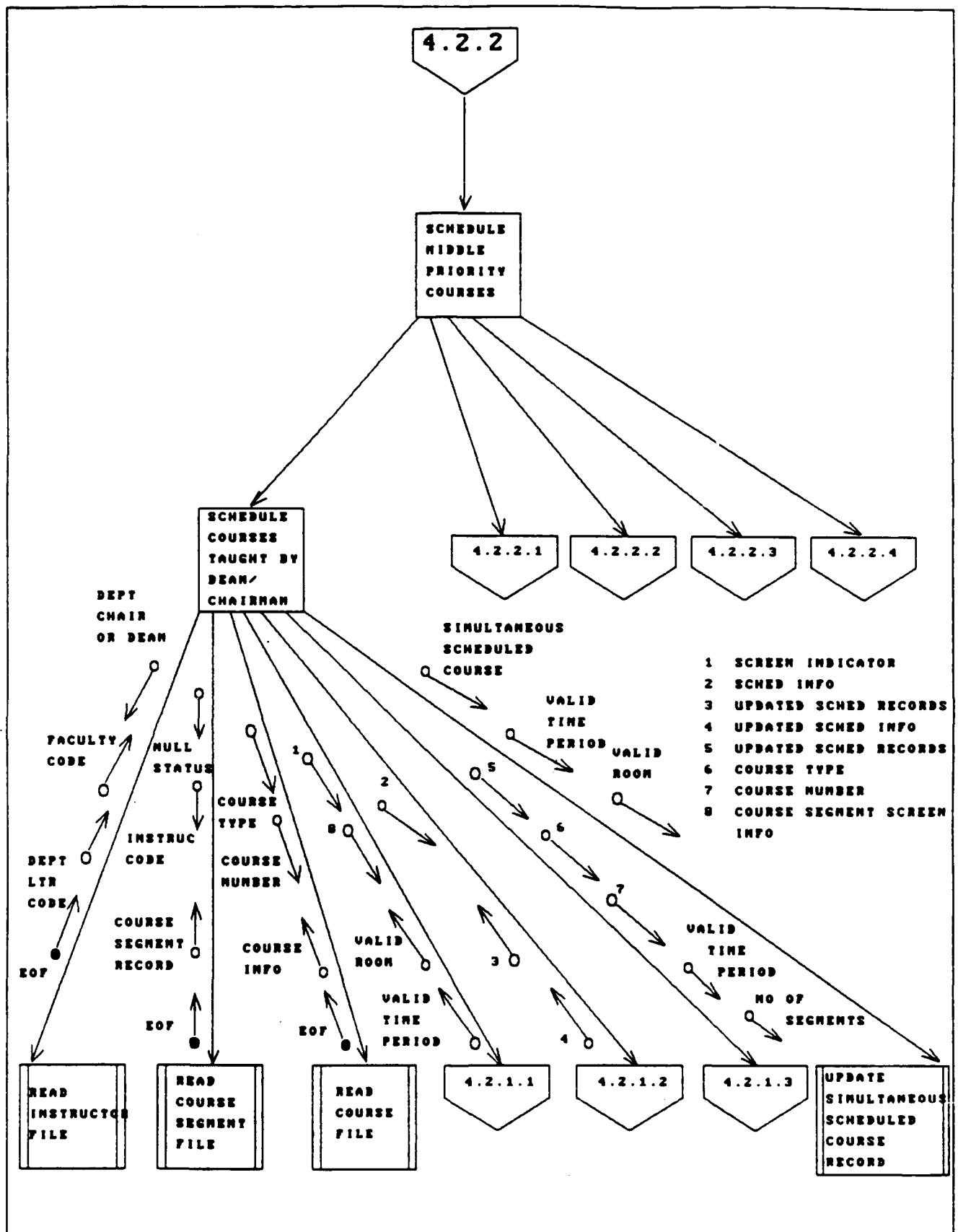


Fig. D-28, SCHEDULE MIDDLE PRIORITY COURSES.



**Fig. D-29, SCHEDULE SIMULTANEOUS SCHEDULED COURSES.**

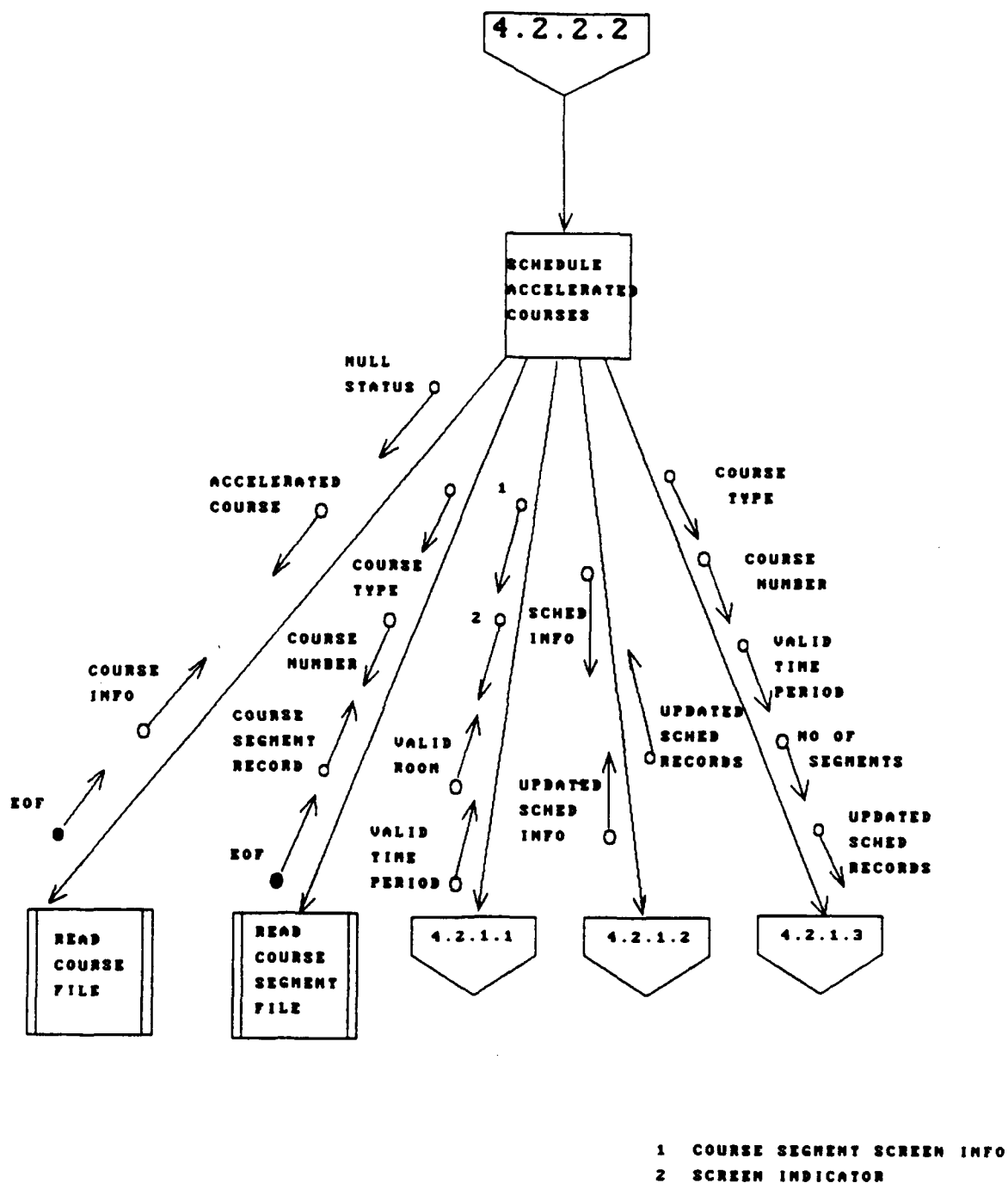


Fig. D-38, SCHEDULE ACCELERATED COURSES.

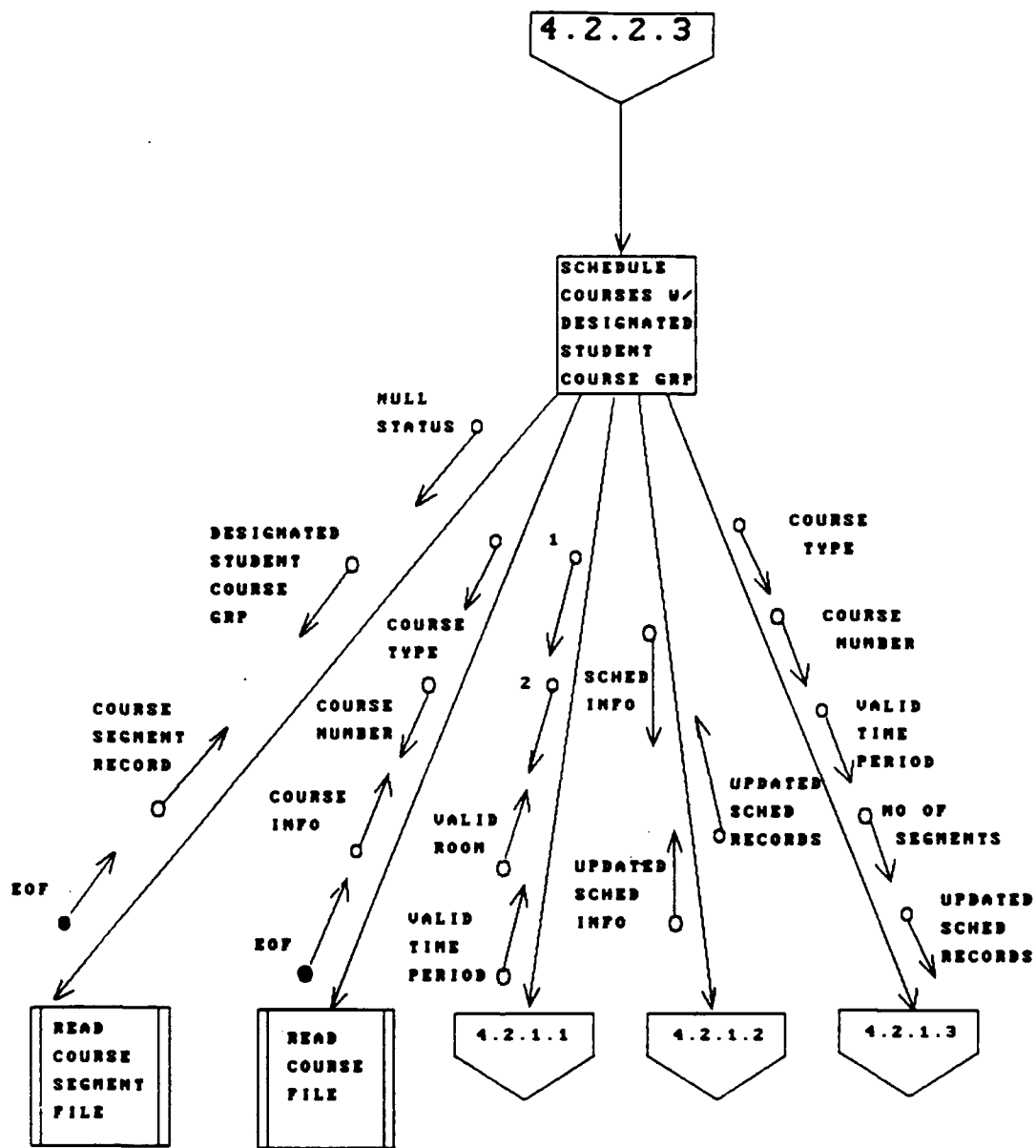


Fig. D-31, SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRP.

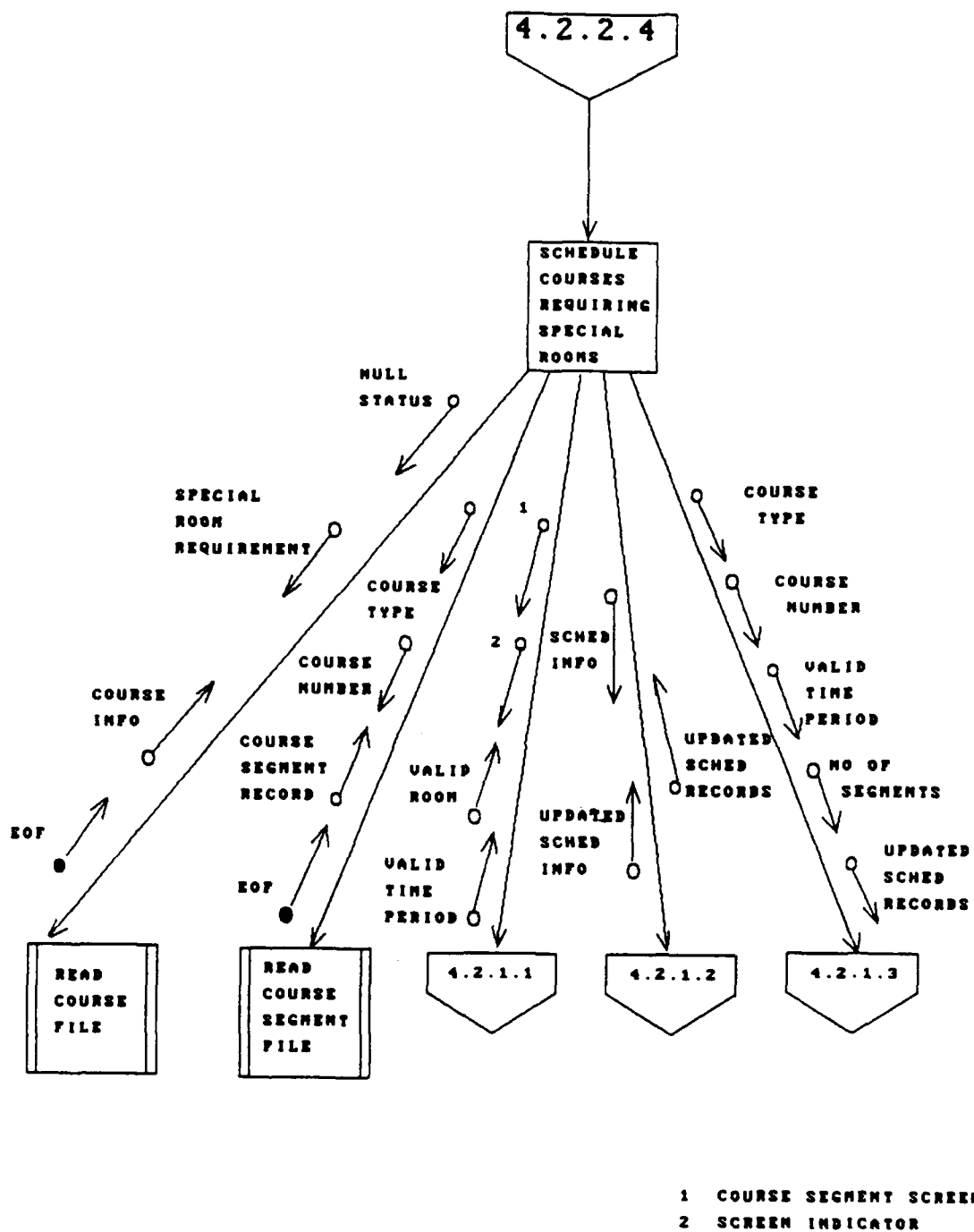
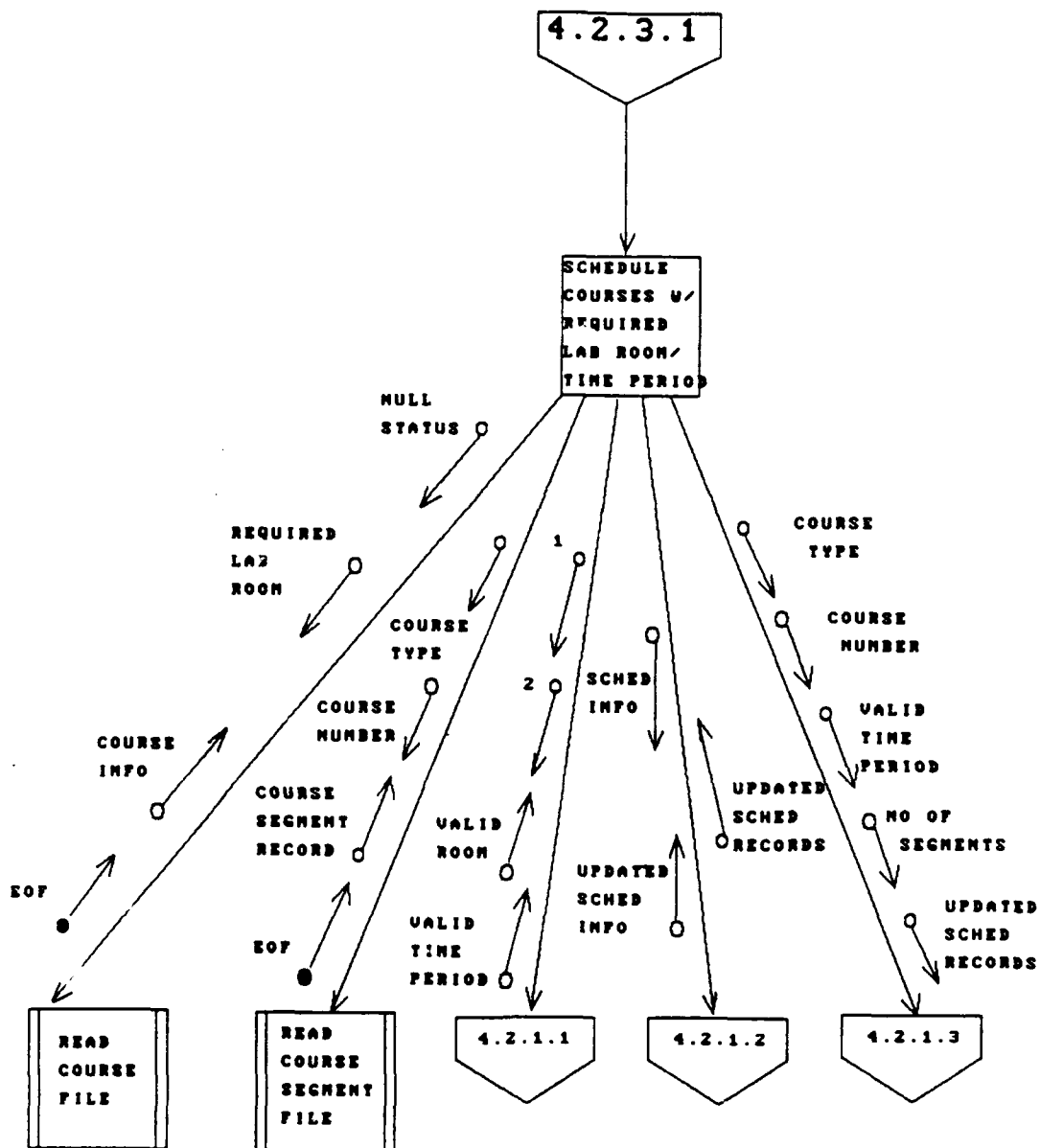


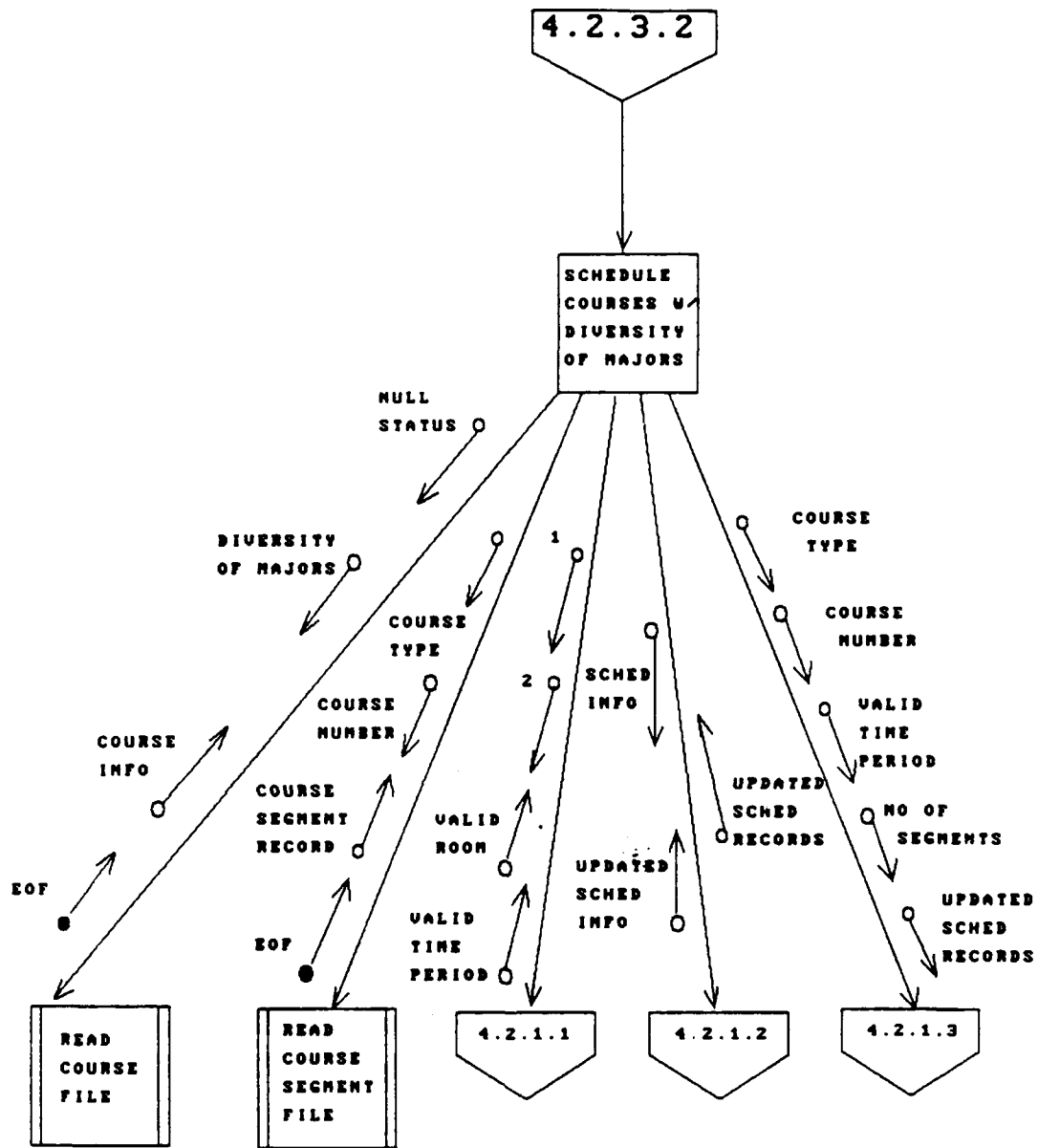
Fig. D-32, SCHEDULE COURSES REQUIRING SPECIAL ROOMS.





- 1 COURSE SEGMENT SCREEN INFO
- 2 SCREEN INDICATOR

Fig. D-34, SCHEDULE COURSES W/ REQUIRED LAB ROOM/ TIME PERIOD.



1 COURSE SEGMENT SCREEN INFO  
2 SCREEN INDICATOR

Fig. D-35, SCHEDULE COURSES W/  
DIVERSITY OF MAJORS.

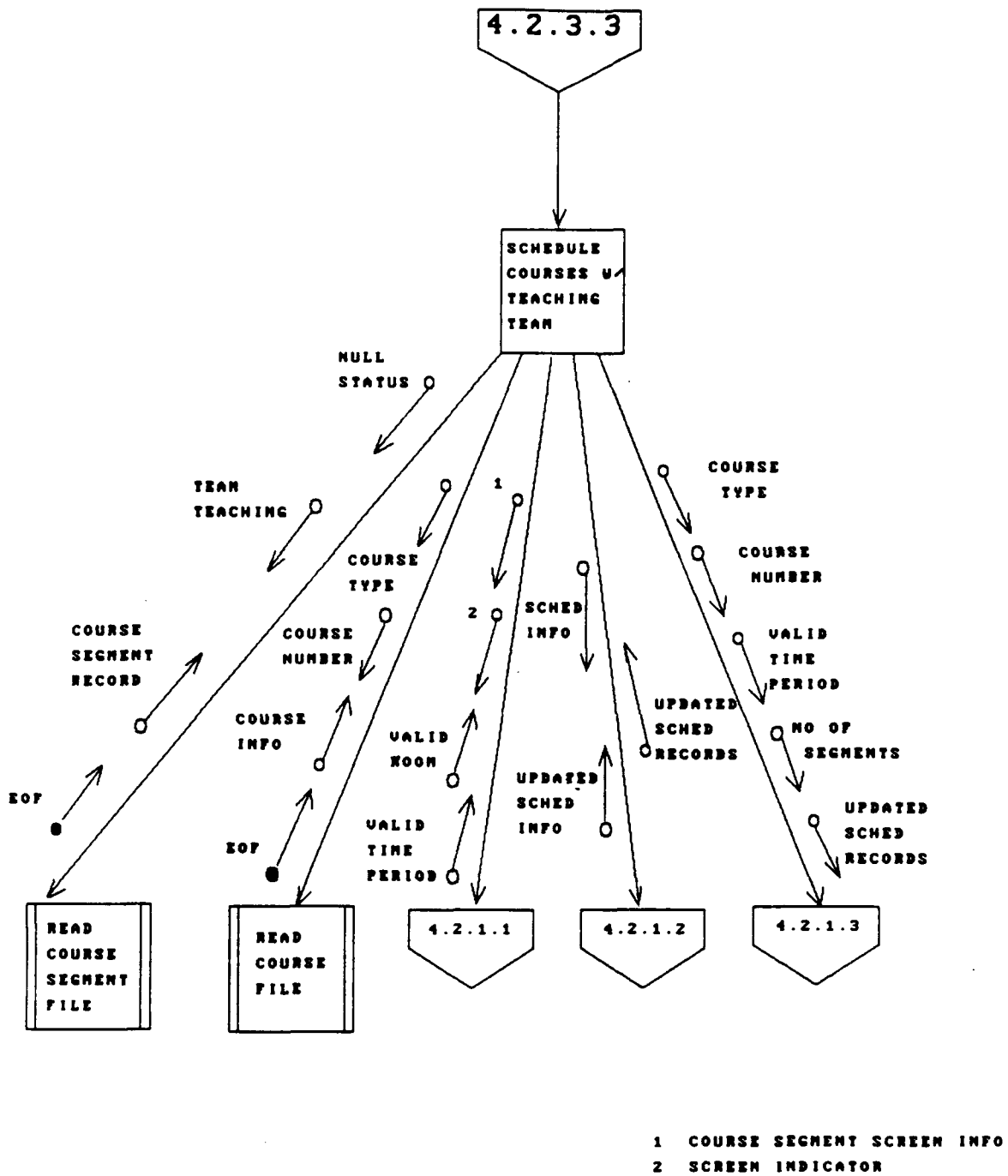


Fig. D-36, SCHEDULE COURSES W/ TEAM TEACHING.



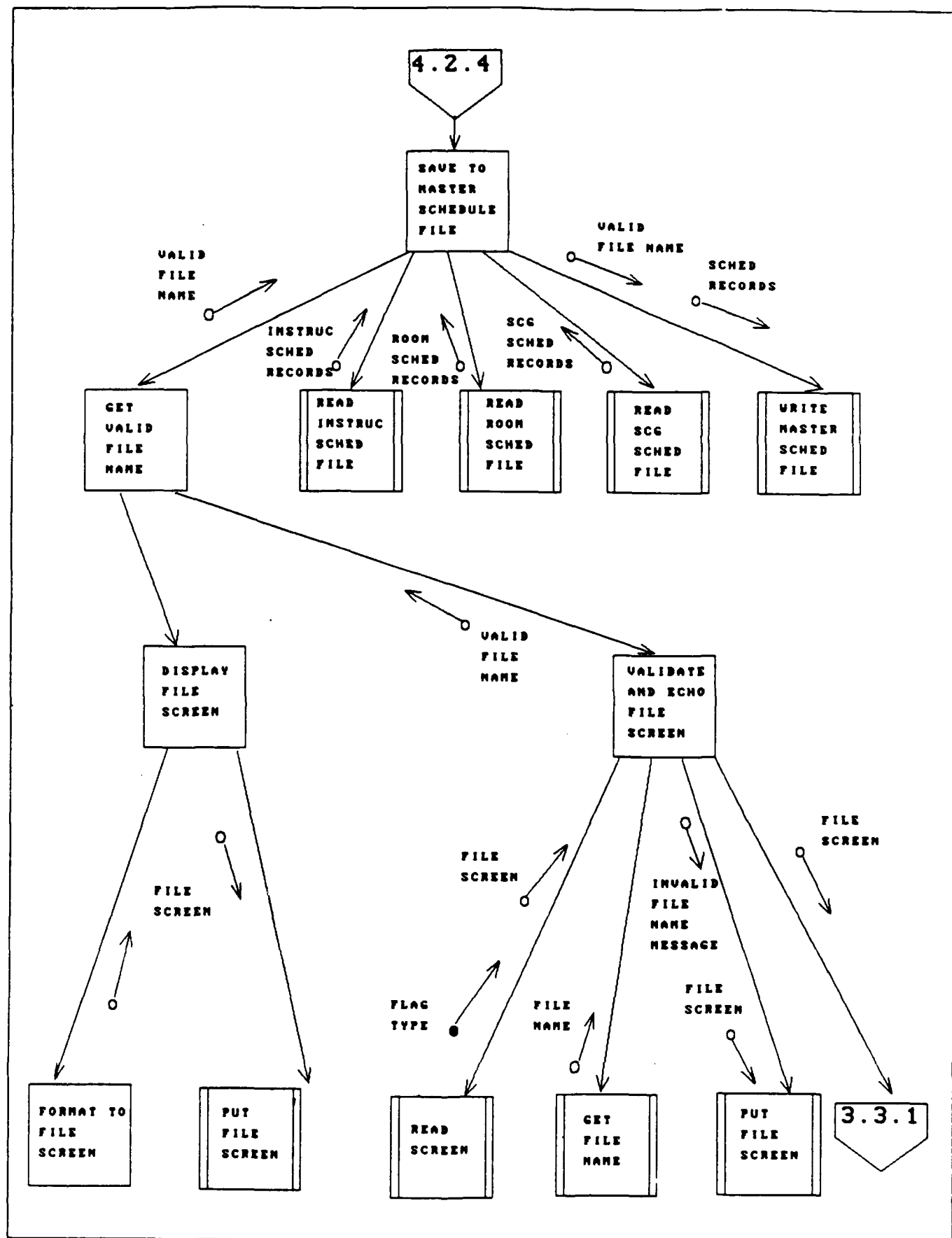


Fig. D-38, SAVE TO MASTER SCHEDULE FILE.

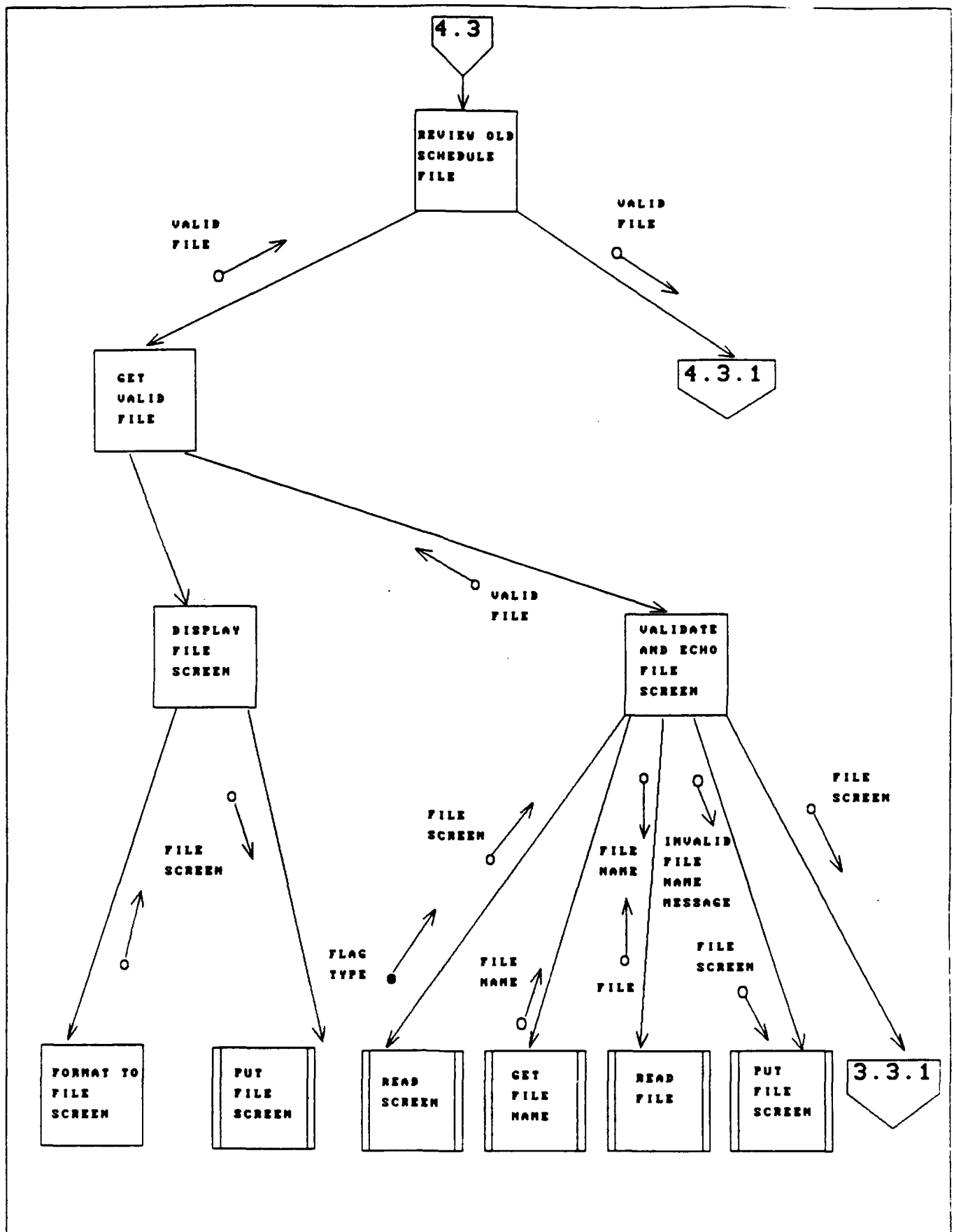


Fig. D-39, REVIEW OLD SCHEDULE FILE.

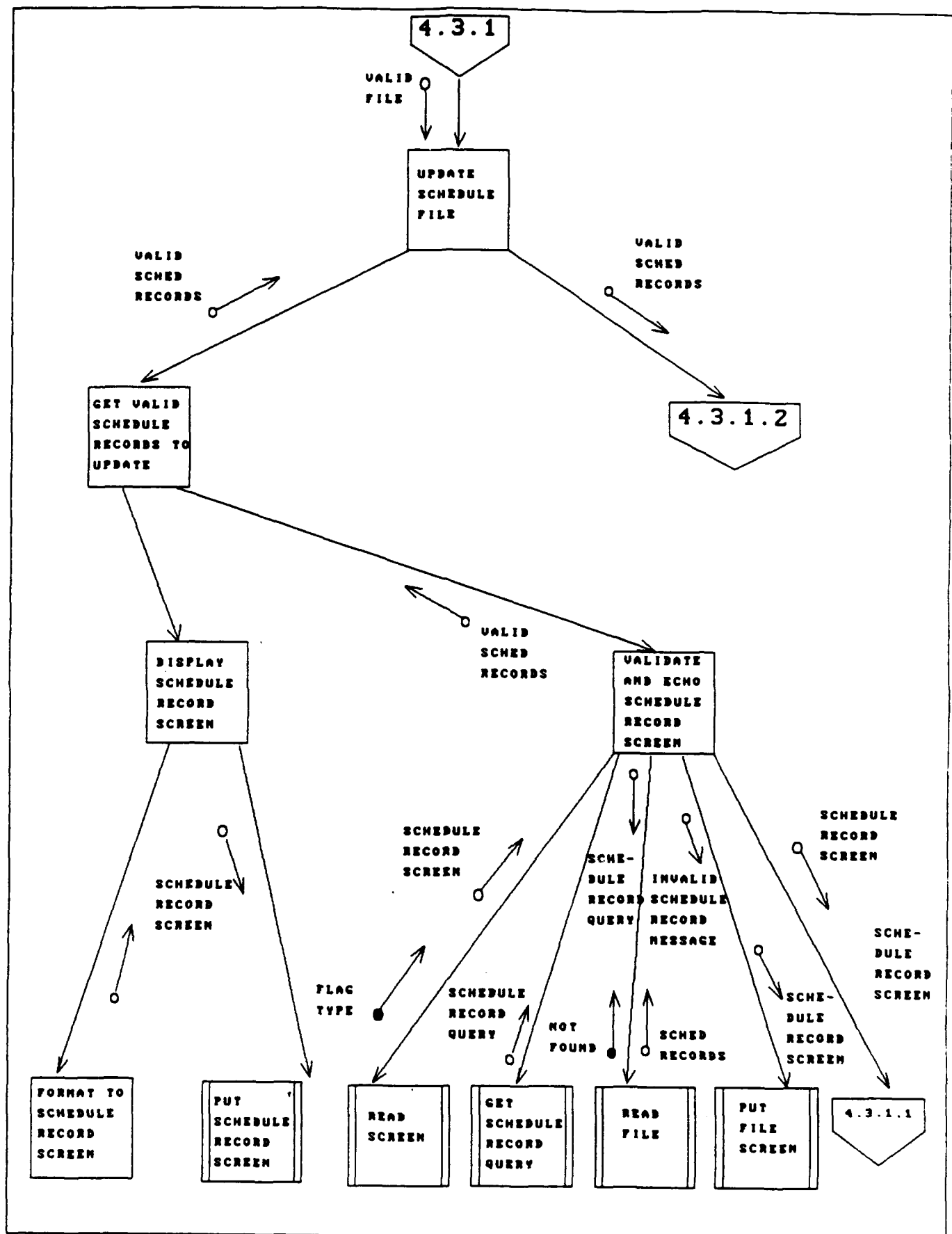


Fig. D-40, UPDATE SCHEDULE FILE.

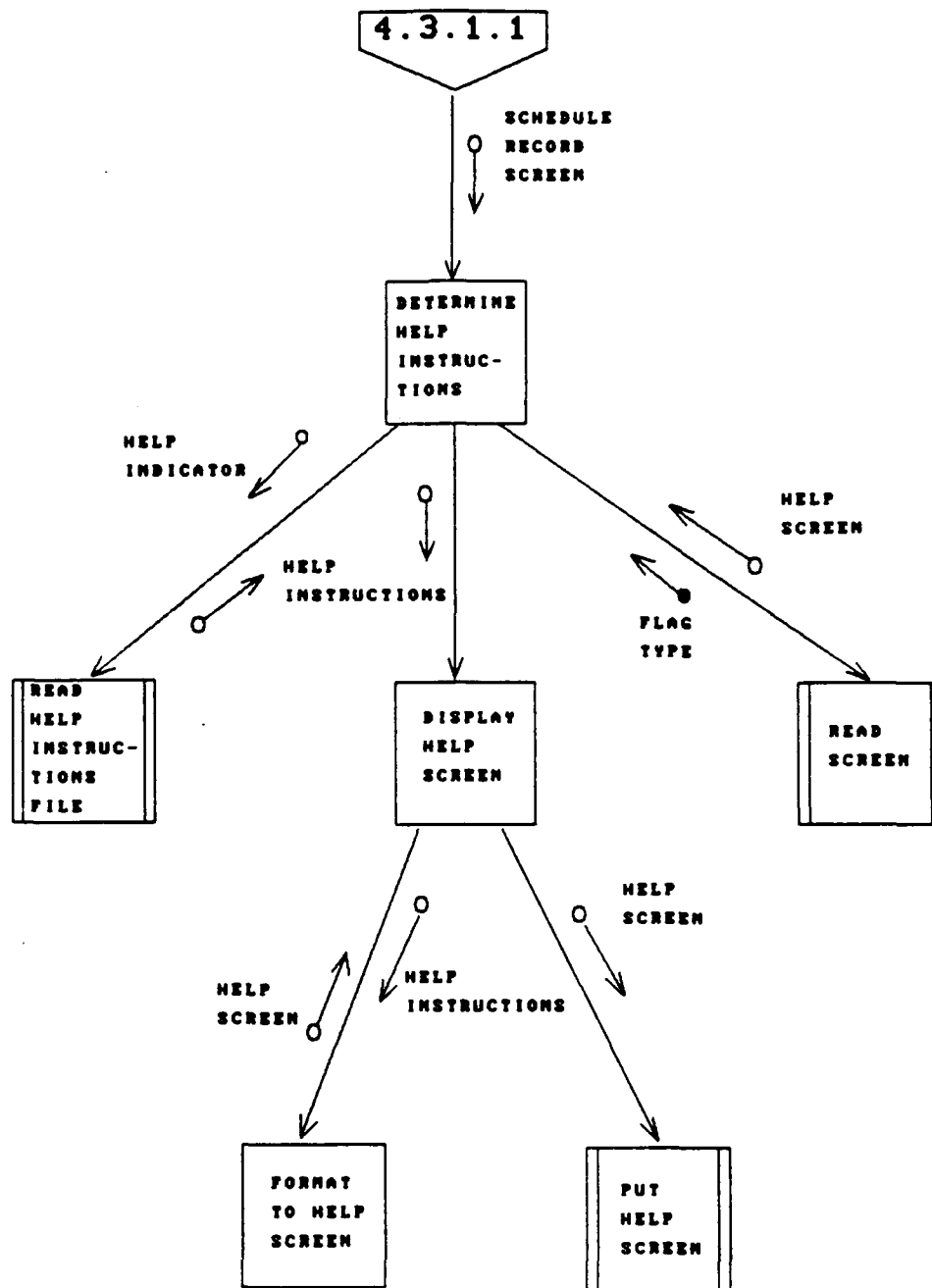


Fig. D-41, DETERMINE HELP INSTRUCTIONS  
for Schedule Record Screen.

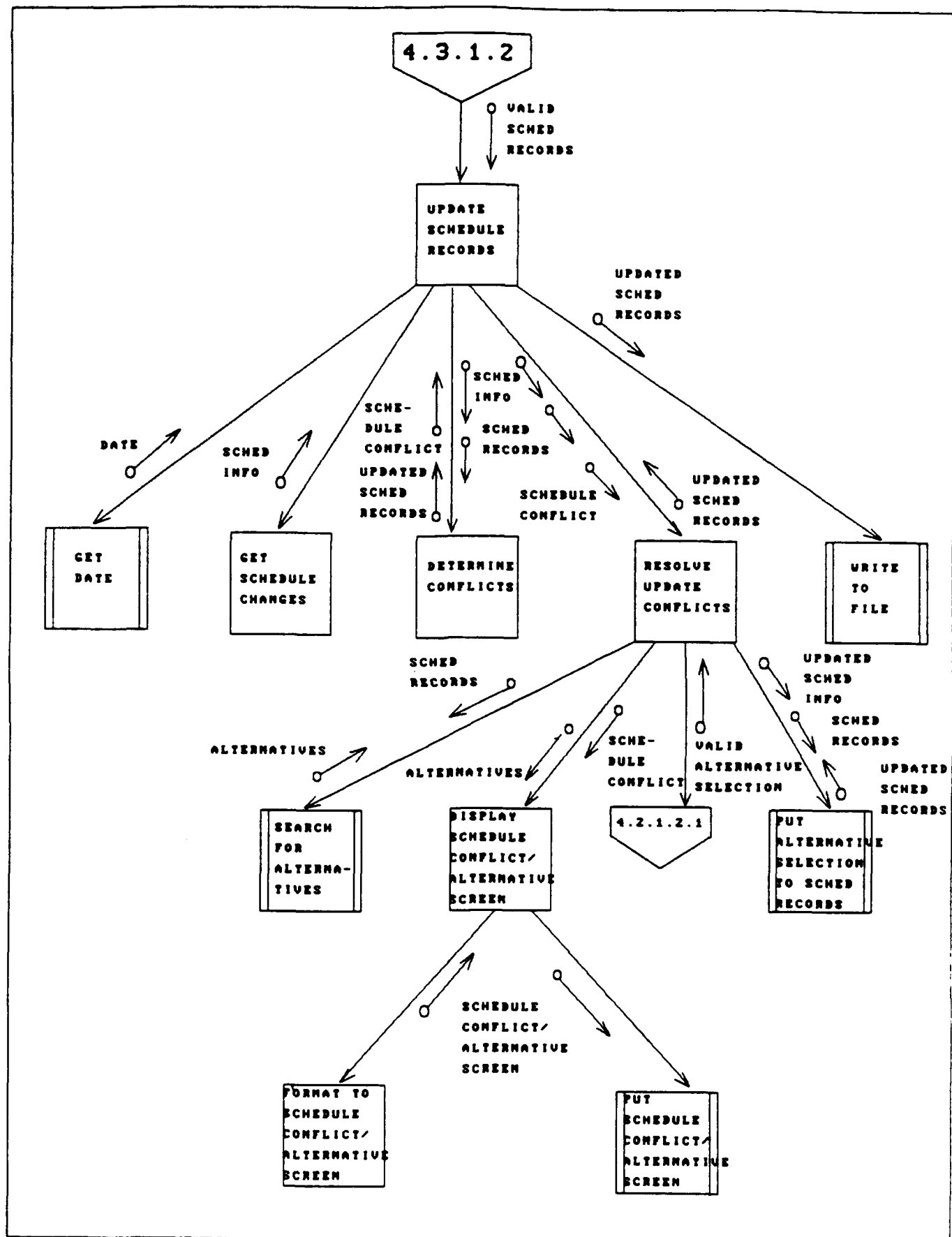


Fig. D-42, UPDATE SCHEDULE RECORDS.

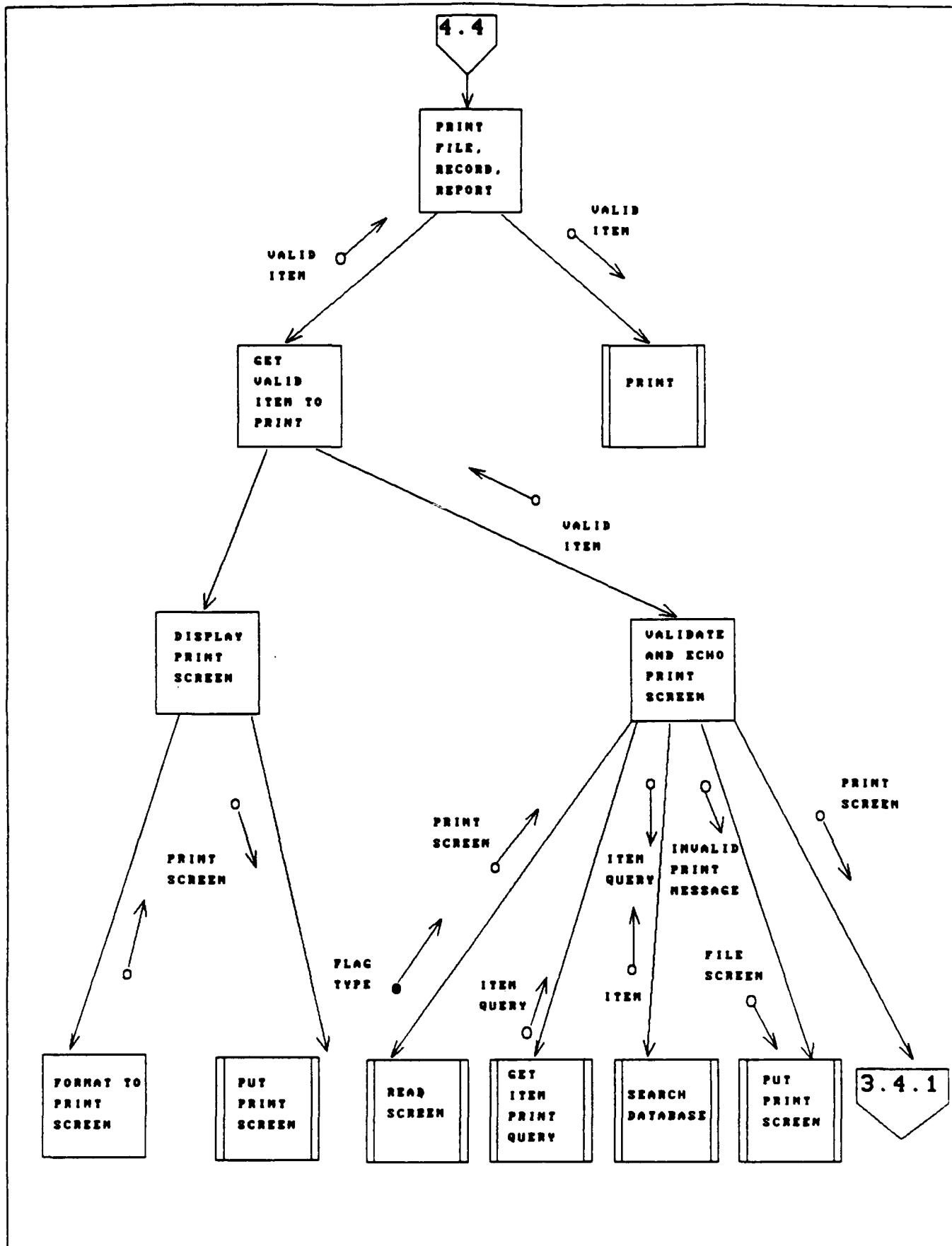


Fig. D-43, PRINT FILE, RECORD, REPORT.

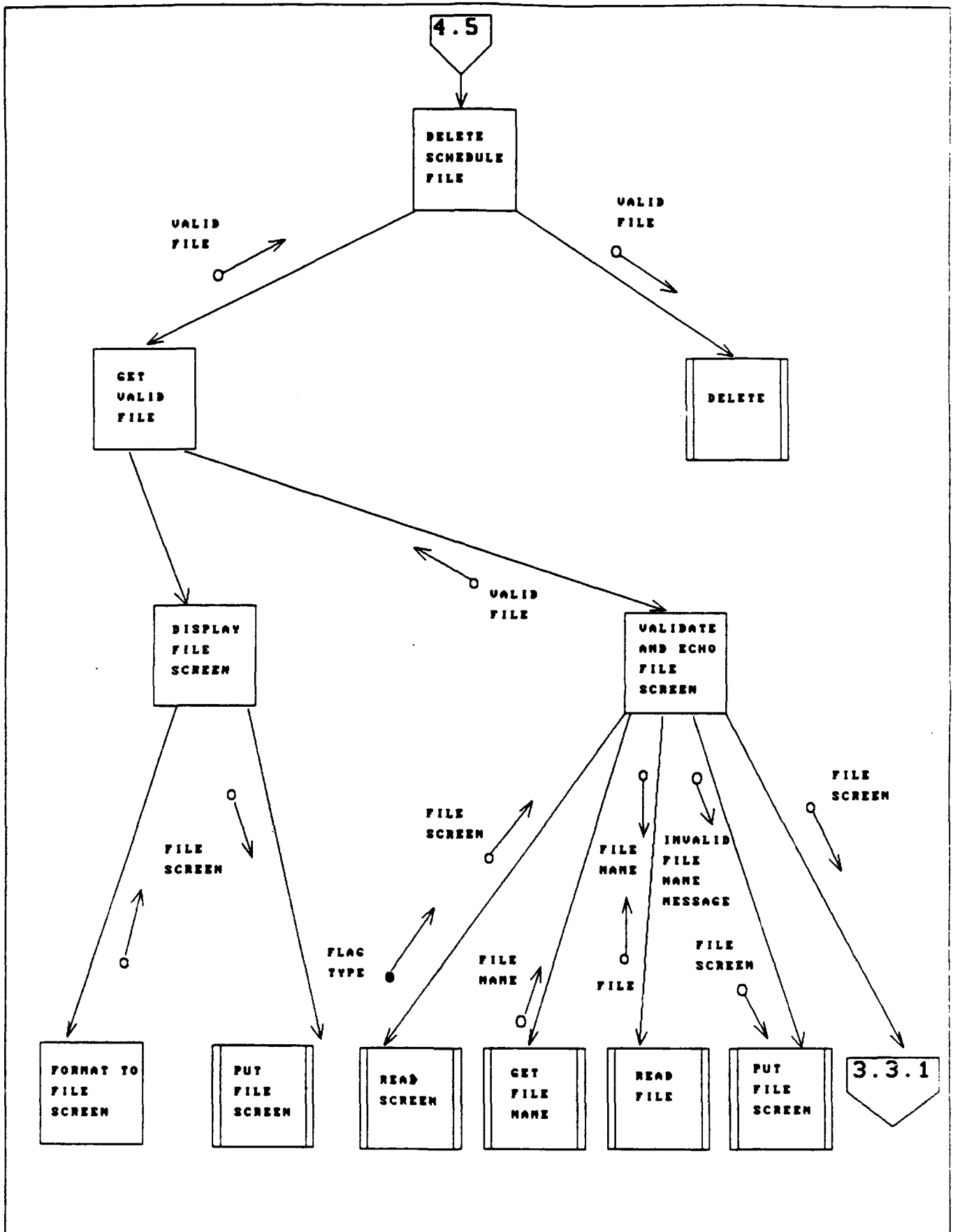


Fig. D-44, DELETE SCHEDULE FILE.

## **APPENDIX E: MODULE SPECIFICATIONS**

The following report details, in alphabetical order, the specifications of each module illustrated in Appendix D.

**MODULE:** ADD DATA RECORD

**PURPOSE:** To add a data record to the given file.

**USES:** VALID FILE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Add a record to the VALID FILE.

**CALLED BY:** UPDATE DATABASE FILES

**MODULE:** ASSIGN SEMI-PERM EVENT TO SCHEDULES

**PURPOSE:** To assign the SEMI-PERM EVENT and its TIME PERIOD  
and ROOM to the related SCHED RECORDS.

**USES:** SCHED RECORDS  
SEMI-PERM EVENT RECORDS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  SCHED RECORDS.TIME PERIOD := SEMI-PERM EVENT
                                RECORD.TIME PERIOD
  PUT SEMI-PERM EVENT RECORD in the SCHED RECORDS.
                                TIME PERIOD slot
  Call WRITE SCG SCHED FILE (UPDATED SCG SCHED
                                RECORD)
  Call WRITE ROOM SCHED FILE (UPDATED ROOM SCHED
                                RECORD)
  Call WRITE INSTRUC SCHED FILE (UPDATED INSTRUC
                                SCHEDRECORD)
End
```

**CALLED BY:** SCHEDULE SEMI-PERM EVENTS

**MODULE:** COPY MAINFRAME FILES

**PURPOSE:** To coordinate copying files downloaded form the NPS  
mainframe computer.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call UPDATE STUDENT COURSE GRP FILE
  Call UPDATE STUDENT FILE
  Call UPDATE COURSE/COURSE SEGMENT FILES
  Call UPDATE FACULTY FILE
End
```

**CALLED BY:** SCHEDULING DATA MAINTENANCE

**MODULE:** CREATE NEW SCHEDULES

**PURPOSE:** To coordinate creation of new event/course  
schedules based on priorities.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call SCHEDULE SEMI-PERM EVENTS
  Call SCHEDULE TOP PRIORITY COURSES
  Call SCHEDULE MIDDLE PRIORITY COURSES
  Call SCHEDULE LOWER PRIORITY COURSES
  Call SAVE TO MASTER SCHEDULE FILE
End
```

**CALLED BY:** MANAGE EVENT/COURSE SCHEDULING

**MODULE:** DELETE

**PURPOSE:** To delete a given schedule file.

**USES:** VALID FILE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Delete the VALID FILE.

**CALLED BY:** DELETE SCHEDULE FILE

**MODULE:** DELETE DATA RECORD

**PURPOSE:** To delete a data record in the given file.

**USES:** VALID FILE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Delete a record in the VALID FILE.

**CALLED BY:** UPDATE DATABASE FILES

**MODULE:** DELETE SCHEDULE FILE

**PURPOSE:** To coordinate deletion of a schedule file.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call GET VALID FILE
  Call DELETE (VALID FILE)
End
```

**CALLED BY:** MANAGE EVENT/COURSE SCHEDULING

**MODULE:** DETERMINE CONFLICTS

**PURPOSE:** To put the schedule information to the related  
SCHEDULE RECORDS.

**USES:** SCHED RECORDS  
SCHED INFO

**RETURNS:** UPDATED SCHED RECORDS  
SCHEDULE CONFLICT

**FUNCTIONAL DETAILS:**

```
Begin
  If INSTRUC SCHED RECORD.TIME PERIOD AND ROOM
    SCHED.TIME PERIOD AND STUDENT COURSE
      GRP.TIME PERIOD = null
    For INSTRUC SCHED RECORD
      Put (COURSE TYPE, COURSE NUMBER, SEGMENT
        NUMBER, SEGMENT STUDENTS, VALID ROOM)
        in TIME PERIOD slot
    For ROOM SCHED RECORD
      Put (COURSE TYPE, COURSE NUMBER, SEGMENT
        NUMBER, SEGMENT STUDENTS, INSTRUC CODE)
        in TIME PERIOD slot
    For STUDENT COURSE GRP RECORD
      Put (COURSE TYPE, COURSE NUMBER, SEGMENT
        NUMBER VALID ROOM, INSTRUC CODE)
        in TIME PERIOD slot
    Return (UPDATED SCHED RECORDS)
  Else Return (SCHED CONFLICT)
End if
End
```

**CALLED BY:** DETERMINE RELATED SCHEDULE RECORD CONFLICTS  
UPDATE SCHEDULE RECORDS

**MODULE:** DETERMINE HELP INSTRUCTIONS

**PURPOSE:** To determine the help instructions needed for a given screen.

**USES:** PASSWORD SCREEN  
TRANSACTION SCREEN  
FILE SCREEN  
PRINT SCREEN  
COURSE/LAB SCHEDULING SCREEN  
SCHEDULE CONFLICT/ALTERNATIVES SCREEN  
SCHEDULE RECORD SCREEN

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```

Begin
  Case Screen
    When Screen = COURSE/LAB SCHEDULING SCREEN
      Call READ HELP INSTRUCTIONS FILE (COURSE/LAB
                                         HELP SCREEN INDICATOR)
    When Screen = SCHEDULE CONFLICT/ALTERNATIVES
      SCREEN
      Call READ HELP INSTRUCTIONS FILE
        (CONFLICT/ALTERNATIVESHELP
         SCREEN INDICATOR)
    When Screen = PASSWORD SCREEN
      Call READ HELP INSTRUCTIONS FILE (PASSWORD
                                         HELP SCREEN INDICATOR)
    When Screen = TRANSACTION SCREEN
      Call READ HELP INSTRUCTIONS FILE (TRANSACTION
                                         HELP SCREEN INDICATOR)
    When Screen = FILE SCREEN
      Call READ HELP INSTRUCTIONS FILE (FILE HELP
                                         SCREEN INDICATOR)
    When Screen = PRINT SCREEN
      Call READ HELP INSTRUCTIONS FILE (PRINT HELP
                                         SCREEN INDICATOR)
    When Screen = SCHEDULE RECORD SCREEN
      Call READ HELP INSTRUCTIONS FILE (SCHEDULE
                                         RECORD HELP SCREEN INDICATOR)
  Endcase
  Call DISPLAY HELP SCREEN (HELP INSTRUCTONS)
  Call READ SCREEN
  If FLAG TYPE = RETURN
    Go back to where called
  Elseif FLAG TYPE = QUIT
    Exit system
  Endif
End

```

**CALLED BY:** VALIDATE AND ECHO PASSWORD SCREEN  
VALIDATE AND ECHO TRANSACTION SCREEN  
VALIDATE AND ECHO FILE SCREEN  
VALIDATE AND ECHO PRINT SCREEN  
VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN  
VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN  
VALIDATE AND ECHO SCHEDULE RECORD SCREEN

**MODULE:** DETERMINE MBRSHP SCHEDS AND ROOM SCHED

**PURPOSE:** To determine the membership and room schedule records for a given semi-permanent event.

**USES:** MBRSHP  
ROOM

**RETURNS:** SCHED RECORDS

**FUNCTIONAL DETAILS:**

```
Begin
  Call READ SCG SCHED FILE (DESIGNATED STUDENT
                           COURSE GRP) until EOF
  Call READ ROOM SCHED FILE (ROOM) until EOF
  Call READ INSTRUC SCHED FILE (INSTRUC CODE) until
                                   EOF

  Return all related SCHED RECORDS
End
```

**CALLED BY:** SCHEDULE SEMI-PERM EVENTS

**MODULE:** DETERMINE RELATED SCHEDULE RECORD CONFLICTS

**PURPOSE:** To determine the SCHEDULE CONFLICTS that exist  
between the related SCHEDULE RECORDS.

**USES:** COURSE SEGMENT SCHED INFO

**RETURNS:** NO CONFLICT (flag)  
UPDATED SCHED RECORDS  
SCHEDULE CONFLICT

**FUNCTIONAL DETAILS:**

```
Begin
  Call READ ROOM SCHED FILE (ROOM)
  Call READ INSTRUC SCHED FILE (INSTRUC CODE)
  Call READ SCG SCHED FILE (DESIGNATED STUDENT
                           COURSE GRP'S)
  Call DETERMINE CONFLICTS (SCHED RECORDS, SCHED
                           INFO)
  If SCHEDULE CONFLICT exists
    Return (SCHED RECORDS, SCHEDULE CONFLICTS)
  Else
    Return (NO CONFLICT, UPDATED SCHED RECORDS)
  End if
End
```

**CALLED BY:** RESOLVE SCHEDULE RECORD CONFLICTS

**MODULE:** DETERMINE SEMI-PERM EVENT AND EVENT MBRSHP

**PURPOSE:** To determine a semi-permanent event and the membership of that event.

**USES:** N/A

**RETURNS:** MBRSHP  
SEMI-PERM EVENT RECORD

**FUNCTIONAL DETAILS:**

```
Begin
  Call READ SEMI-PERM EVENT FILE
  If EOF go back to CREATE NEW SCHEDULE FILE
  Else CALL READ SEMI-PERM EVENT MBRSHP FILE (EVENT
                                           TYPE, EVENT NAME)
  End if
  Return (MBRSHP, SEMI-PERM EVENT RECORD)
End
```

**CALLED BY:** SCHEDULE SEMI-PERM EVENTS

**MODULE:** DISPLAY COURSE/LAB SCHEDULING SCREEN

**PURPOSE:** To display a CRT screen for TIME PERIOD and ROOM entry.

**USES:** COURSE SEGMENT SCREEN INFO  
SCREEN INDICATOR

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO COURSE/LAB SCHEDULING SCREEN
  Put COURSE SEGMENT SCREEN INFO and SCREEN
    INDICATOR to COURSE/LAB SCHEDULING SCREEN
  Call PUT COURSE/LAB SCHEDULING SCREEN
End
```

**CALLED BY:** GET VALID TIME PERIOD AND ROOM

**MODULE:**        DISPLAY FILE SCREEN

**PURPOSE:**     To display a CRT screen for filename entry.

**USES:**        N/A

**RETURNS:**     N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO FILE SCREEN
  Call PUT FILE SCREEN (FILE SCREEN)
End
```

**CALLED BY:**    GET VALID FILE  
                 GET VALID FILE NAME

**MODULE:** DISPLAY HELP SCREEN

**PURPOSE:** To display CRT screen of HELP INSTRUCTIONS.

**USES:** HELP INSTRUCTIONS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT HELP SCREEN (HELP INSTRUCTIONS)
  Call PUT HELP SCREEN (HELP SCREEN)
End
```

**CALLED BY:** DETERMINE HELP INSTRUCTIONS

**MODULE:** DISPLAY PASSWORD SCREEN

**PURPOSE:** To display a CRT screen for password entry.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO PASSWORD SCREEN
  Call PUT PASSWORD SCREEN (PASSWORD SCREEN)
End
```

**CALLED BY:** GET VALID PASSWORD

**MODULE:** DISPLAY PRINT SCREEN

**PURPOSE:** To display a CRT screen for selecting an item to print.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO PRINT SCREEN
  Call PUT PRINT SCREEN (PRINT SCREEN)
End
```

**CALLED BY:** GET VALID ITEM TO PRINT

**MODULE:** DISPLAY SCHEDULE CONFLICT/ALTERNATIVES SCREEN

**PURPOSE:** To display a CRT screen for selection of an alternative TIME PERIOD.

**USES:** ALTERNATIVES  
SCHEDULE CONFLICT

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO SCHEDULE CONFLICT/ALTERNATIVES
                                     SCREEN
  Put ALTERNATIVES and SCHEDULE COMFLICT to
                                     SCHEDULE CONFLICT/ALTERNATIVES SCREEN
  Call PUT SCHEDULE CONFLICT/ALTERNATIVES SCREEN
End
```

**CALLED BY:** RESOLVE SCHEDULE RECORD CONFLICT  
RESOLVE UPDATE CONFLICTS

**MODULE:** DISPLAY SCHEDULE RECORD SCREEN

**PURPOSE:** To display a CRT screen for input by the system user of schedule of schedule records to get to update.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call FORMAT TO SCHEDULE RRECORD SCREEN
  Call PUT SCHEDULE RECORD SCREEN
End
```

**CALLED BY:** GET VALID SCHEDULE RECORDS TO UPDATE

**MODULE:** DISPLAY TRANSACTION SCREEN

**PURPOSE:** To display a CRT screen for TRANSACTION entry.

**USES:** NPS<sup>3</sup> TRANSACTIONS  
DATA MAINTENANCE TRANSACTIONS  
UPDATE TRANSACTIONS  
EVENT/COURSE TRANSACTIONS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

Begin  
    Call FORMAT TO TRANSACTION SCREEN  
    Call PUT TRANSACTION SCREEN (TRANSACTION SCREEN)  
End

**CALLED BY:** GET VALID NPS SCHEDULING SYSTEM TRANSACTION  
GET VALID DATA MAINTENANCE TRANSACTION  
GET VALID EVENT/COURSE SCHEDULING TRANSACTION  
GET VALID FILE UPDATE TRANSACTION

**MODULE:** FORMAT TO COURSE/LAB SCHEDULING SCREEN

**PURPOSE:** To format the screen for TIME PERIOD and ROOM entry.

**USES:** N/A

**RETURNS:** COURSE/LAB SCHEDULING SCREEN

**FUNCTIONAL DETAILS:**

1. Format screen for COURSE/LAB TIME PERIOD and ROOM entry.

**CALLED BY:** DISPLAY COURSE/LAB SCHEDULING SCREEN

**MODULE:**       FORMAT TO FILE SCREEN

**PURPOSE:**     To format the CRT screen for filename entry.

**USES:**        N/A

**RETURNS:**     FILE SCREEN

**FUNCTIONAL DETAILS:**

1.   Format screen with filename entry data and prompt.

**CALLED BY:**   DISPLAY FILE SCREEN

**MODULE:**       FORMAT TO HELP SCREEN

**PURPOSE:**     To format the CRT screen for help instructions.

**USES:**        HELP INSTRUCTIONS

**RETURNS:**     HELP SCREEN

**FUNCTIONAL DETAILS:**

1.   Format screen with given HELP INSTRUCTIONS.

**CALLED BY:**   DISPLAY HELP SCREEN

**MODULE:**       FORMAT TO PASSWORD SCREEN

**PURPOSE:**     To format the CRT screen for password entry.

**USES:**        N/A

**RETURNS:**     PASSWORD SCREEN

**FUNCTIONAL DETAILS:**

1. Format screen with password entry data and prompt.

**CALLED BY:**    DISPLAY PASSWORD SCREEN

**MODULE:**       FORMAT TO PRINT SCREEN

**PURPOSE:**     To format the CRT screen for print item query.

**USES:**        N/A

**RETURNS:**     PRINT SCREEN

**FUNCTIONAL DETAILS:**

1. Format screen with item query data and prompt.

**CALLED BY:**   DISPLAY PRINT SCREEN

**MODULE:** FORMAT TO SCHEDULE CONFLICT/ALTERNATIVE SCREEN

**PURPOSE:** To format the screen for ALTERNATIVE SELECTION.

**USES:** N/A

**RETURNS:** SCHEDULE CONFLICT/ALTERNATIVES SCREEN

**FUNCTIONAL DETAILS:**

1. Format screen for selection of displayed alternative TIME PERIODs.

**CALLED BY:** DISPLAY SCHEDULE CONFLICT/ALTERNATIVES SCREEN

**MODULE:** FORMAT TO SCHEDULE RECORD SCREEN

**PURPOSE:** To format the CRT screen for schedule record queries by system user.

**USES:** N/A

**RETURNS:** SCHEDULE RECORD SCREEN

**FUNCTIONAL DETAILS:**

1. Format screen with schedule record query dqtg and prompt.

**CALLED BY:** DISPLAY SCHEDULE RECORD SCREEN

**MODULE:**       FORMAT TO TRANSACTION SCREEN

**PURPOSE:**     To format the CRT screen for TRANSACTION entry.

**USES:**        N/A

**RETURNS:**     TRANSACTION SCREEN

**FUNCTIONAL DETAILS:**

1.   Format screen with TRANSACTION entry data and prompt.

**CALLED BY:**   DISPLAY TRANSACTION SCREEN

**MODULE:** GET ALTERNATIVE SELECTION

**PURPOSE:** To get an ALTERNATIVE SELECTION, from a list of ALTERNATIVES, entered by the system user.

**USES:** N/A

**RETURNS:** ALTERNATIVE SELECTION

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter ALTERNATIVE SELECTION.

**CALLED BY:** VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN

**MODULE:** GET DATE

**PURPOSE:** To get the current date from the operating system.

**USES:** N/A

**RETURNS:** DATE

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Get current date from operating system.

**CALLED BY:** SAVE TO PERTINENT FILE/RECORD  
UPDATE SCHEDULE RECORDS

**MODULE:** GET FILE NAME

**PURPOSE:** To get a FILENAME from system user.

**USES:** N/A

**RETURNS:** FILENAME

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter FILENAME.

**CALLED BY:** VALIDATE AND ECHO FILE SCREEN

**MODULE:** GET ITEM PRINT QUERY

**PURPOSE:** To get a query on an item to print from the system user.

**USES:** N/A

**RETURNS:** ITEM QUERY

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter ITEM PRINT QUERY.

**CALLED BY:** VALIDATE AND ECHO PRINT SCREEN

**MODULE:** GET ROOM

**PURPOSE:** To get a ROOM, for a given course/lab, entered by the system user.

**USES:** N/A

**RETURNS:** ROOM NUMBER  
BUILDING CODE

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter BUILDING CODE and ROOM NUMBER.

**CALLED BY:** VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN

**MODULE:** GET SCHEDULE CHANGES

**PURPOSE:** To get the schedule information changes for updating schedule records.

**USES:** N/A

**RETURNS:** SCHED INFO

**FUNCTIONAL DETAILS:**

1. Get the schedule information changes for a particular course and its related SCHED RECORDS.
2. Return the schedule info.

**CALLED BY:** UPDATE SCHEDULE RECORDS

**MODULE:** GET SCHEDULE RECORD QUERY

**PURPOSE:** To get a SCHEDULE RECORD QUERY from the system user.

**USES:** N/A

**RETURNS:** SCHEDULE RECORD QUERY

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter SCHEDULE RECORD QUERY

**CALLED BY:** VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN

**MODULE:** GET TIME PERIOD

**PURPOSE:** To get a TIME PERIOD, for a given course/lab,  
entered by the system user.

**USES:** N/A

**RETURNS:** DAY  
TIME

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter DAY(s) and TIME(s).

**CALLED BY:** VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN

**MODULE:** GET TRANSACCTION

**PURPOSE:** To get TRANSACTION from system user.

**USES:** N/A

**RETURNS:** TRANSACTION

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter TRANSACTION.

**CALLED BY:** VALIDATE AND ECHO TRANSACTION SCREEN

**MODULE:** GET USER PASSWORD

**PURPOSE:** To get the password from the system user.

**USES:** N/A

**RETURNS:** USER PASSWORD

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Enter USER PASSWORD.

**CALLED BY:** VALIDATE AND ECHO PASSWORD SCREEN

**MODULE:** GET VALID DATA MAINTENANCE TRANSACTION

**PURPOSE:** To get a valid data maintenance transaction.

**USES:** N/A

**RETURNS:** VALID TRANSACTION

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY TRANSACTION SCREEN (DATA MAINTENANCE
                                  TRANSACTIONS)
  Call VALIDATE AND ECHO TRANSACTION SCREEN
  RETURN VALID TRANSACTION
End
```

**CALLED BY:** SCHEDULING DATA MAINTENANCE

**MODULE:** GET VALID EVENT/COURSE SCHEDULING TRANSACTION

**PURPOSE:** To get a valid event/course scheduling transaction.

**USES:** N/A

**RETURNS:** VALID TRANSACTION

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY TRANSACTION SCREEN (EVENT/COURSE
                                  TRANSACTIONS)
  Call VALIDATE AND ECHO TRANSACTION SCREEN
  Return VALID TRANSACTION
End
```

**CALLED BY:** MANAGE EVENT/COURSE SCHEDULING

**MODULE:** GET VALID FILE

**PURPOSE:** To get a valid file to update.

**USES:** N/A

**RETURNS:** VALID FILE

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY FILE SCREEN
  Call VALIDATE AND ECHO FILE SCREEN
  RETURN VALID FILE
End
```

**CALLED BY:** UPDATE DATABASE FILES  
REVIEW OLD SCHEDULE FILE  
DELETE SCHEDULE FILE

**MODULE:** GET VALID FILE NAME

**PURPOSE:** To get a VALID FILE NAME for a newly created file.

**USES:** N/A

**RETURNS:** VALID FILE NAME

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY FILE SCREEN
  Call VALIDATE AND ECHO FILE SCREEN
  Return VALID FILE NAME
End
```

**CALLED BY:** SAVE TO MASTER SCHEDULE FILE

**MODULE:** GET VALID FILE UPDATE TRANSACTION

**PURPOSE:** To get a valid file update transaction.

**USES:** N/A

**RETURNS:** VALID TRANSACTION

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY TRANSACTION SCREEN (UPDATE
                                   TRANSACTIONS)
  Call VALIDATE AND ECHO TRANSACTION SCREEN
  Return VALID TRANSACTION
End
```

**CALLED BY:** UPDATE DATABASE FILE

**MODULE:** GET VALID ITEM TO PRINT

**PURPOSE:** To get a valid file, record or report to print.

**USES:** N/A

**RETURNS:** VALID ITEM

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY PRINT SCREEN
  Call VALIDATE AND ECHO PRINT SCREEN
  Return VALID ITEM
End
```

**CALLED BY:** PRINT FILE, RECORD, REPORT

**MODULE:** GET VALID NPS SCHEDULING SYSTEM TRANSACTION

**PURPOSE:** To get a valid NPS Scheduling System transaction.

**USES:** N/A

**RETURNS:** VALID TRANSACTION

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY TRANSACTION SCREEN (NPS3
                                TRANSACTIONS)
  Call VALIDATE AND ECHO TRANSACTION SCREEN
  Return VALID TRANSACTION
End
```

**CALLED BY:** NPS SCHEDULING SYSTEM

**MODULE:** GET VALID PASSWORD

**PURPOSE:** To get a valid password from the user, in order to allow the user to enter the NPS scheduling system.

**USES:** N/A

**RETURNS:** ENTER

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY PASSWORD SCREEN
  Call VALIDATE AND ECHO PASSWORD SCREEN
  If flag = VALID PASSWORD
    Return ENTER
  End if
End
```

**CALLED BY:** NPS SCHEDULING SYSTEM

**MODULE:** GET VALID SCHEDULE RECORD TO UPDATE

**PURPOSE:** To get the VALID SCHEDULE RECORDS the system user wishes to update.

**USES:** N/A

**RETURNS:** VALID SCHEDULE RECORDS

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY SCHEDULE RECORD SCREEN
  Call VALIDATE AND ECHO SCHEDULE RECORD SCREEN
  Return VALID SCHEDULE RECORDS
End
```

**CALLED BY:** UPDATE SCHEDULE FILE

**MODULE:** GET VALID TIME PERIOD AND ROOM

**PURPOSE:** To get a VALID TIME PERIOD and VALID ROOM for a given course/course segment and lab.

**USES:** SCREEN INDICATOR  
COURSE SEGMENT SCREEN INFO

**RETURNS:** VALID TIME PERIOD  
VALID ROOM

**FUNCTIONAL DETAILS:**

```
Begin
  Call DISPLAY COURSE/LAB SCHEDULING SCREEN
    (COURSE SEGMENT SCREEN INFO, SCREEN INDICATOR)

  Call VALIDATE AND ECHO COURSE/LAB SCHEDULING
                                SCREEN
  Return (VALID TIME PERIOD, VALID ROOM)
End
```

**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR  
INSTRUCTOR  
SCHEDULE COURSES w/ LARGE # OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES  
SCHEDULE ACCELERATED COURSES  
SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS  
SCHEDULE COURSES REQUIRING SPECIAL ROOMS  
SCHEDULE COURSES W/ 3 HOUR LABS  
SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME  
PERIOD  
SCHEDULE COURSES W/ DIVERSITY OF MAJORS  
SCHEDULE COURSES W/ TEACHING TEAMS  
SCHEDULE REMAINING COURSES

**MODULE:** MANAGE EVENT/COURSE SCHEDULING

**PURPOSE:** To manage the scheduling of semi-permanent events and courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call GET VALID EVENT/COURSE SCHEDULING
                                     TRANSACTION
    Case VALID TRANSACTION
      When VALID TRANSACTION = CREATE
        Call CREATE NEW SCHEDULES
      When VALID TRANSACTION = REVIEW
        Call REVIEW OLD SCHEDULE FILE
      When VALID TRANSACTION = PRINT
        Call PRINT FILE, RECORD, REPORT
      When VALID TRANSACTION = DELETE
        Call DELETE SCHEDULE FILE
    End Case
  End loop
End
```

**CALLED BY:** NPS SCHEDULING SYSTEM

**MODULE:**       MODIFY DATA RECORD

**PURPOSE:**     To modify a data record in the given file.

**USES:**        VALID FILE

**RETURNS:**     N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Modify a record in the VALID FILE.

**CALLED BY:**   UPDATE DATABASE FILES

**MODULE:** NPS SCHEDULING SYSTEM

**PURPOSE:** To coordinate the scheduling of NPS events, courses and final exams, and associated schedules, reports, graphs and data maintenance.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  CALL GET VALID PASSWORD
  If flag = ENTER
    Loop
      Call GET VALID NPS SCHEDULING SYSTEM
        TRANSACTION
      Case VALID TRANSACTION
        When VALID TRANSACTION = DATA MAINTENANCE
          Call SCHEDULING DATA MAINTENANCE
        When VALID TRANSACTION = EVENT/COURSE
          SCHEDULING
          Call MANAGE EVENT/COURSE SCHEDULING
        When VALID TRANSACTION = FINAL EXAM
          SCHEDULING
          Call MANAGE FINAL EXAM SCHEDULING
        When VALID TRANSACTION = MASTER INSTRUCTION
          SCHEDULE
          Call MANAGE MASTER INSTRUCTION SCHEDULE
        When VALID TRANSACTION = DATA GRAPH
          Call MANAGE SCHEDULING DATA GRAPH
      End case
    End loop
  End if
End
```

**CALLED BY:** N/A

**MODULE:** PRINT

**PURPOSE:** To print the VALID ITEM.

**USES:** VALID ITEM

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Print the VALID ITEM.

**CALLED BY:** PRINT FILE, RECORD, REPORT

**MODULE:** PRINT FILE, RECORD, REPORT

**PURPOSE:** To coordinate printing of files, records and reports.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call GET VALID ITEM TO PRINT
    Call PRINT (ITEM)
  End loop
End
```

**CALLED BY:** SCHEDULING DATA MAINTENANCE  
MANAGE EVENT/COURSE SCHEDULING

**MODULE:** PUT ALTERNATIVE SELECTION TO SCHED RECORDS

**PURPOSE:** To put the alternative selected to the related  
SCHED RECORDS.

**USES:** SCHED RECORDS  
UPDATED SCHED INFO

**RETURNS:** UPDATED SCHED RECORDS

**FUNCTIONAL DETAILS:** (Pre-defined)

1. For each SCHED RECORD, put appropriate SCHED  
INFO in the slot where UPDATED SCHED INFO.TIME  
PERIOD = SCHED RECORD.TIME PERIOD.

**CALLED BY:** RESOLVE SCHEDULE RECORD CONFLICTS  
RESOLVE UPDATE CONFLICTS

**MODULE:** PUT COURSE/LAB SCHEDULING SCREEN

**PURPOSE:** To display the COURSE/LAB SCHEDULING SCREEN on the CRT.

**USES:** COURSE/LAB SCHEDULING SCREEN  
INVALID TIME PERIOD MESSAGE  
INVALID ROOM MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the COURSE/LAB SCHEDULING SCREEN on the CRT screen.
2. Display INVALID TIME PERIOD MESSAGE or INVALID ROOM MESSAGE when appropriate.

**CALLED BY:** DISPLAY COURSE/LAB SCHEDULING SCREEN  
VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN

**MODULE:** PUT FILE SCREEN

**PURPOSE:** To display the FILE SCREEN on the CRT.

**USES:** FILE SCREEN  
INVALID FILE MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the FILE SCREEN on the CRT screen.
2. DISPLAY INVALID FILE MESSAGE when appropriate.

**CALLED BY:** DISPLAY FILE SCREEN  
VALIDATE AND ECHO FILE SCREEN

**MODULE:** PUT HELP SCREEN

**PURPOSE:** To display the help screen on the CRT.

**USES:** HELP SCREEN

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the given HELP SCREEN on the CRT screen.

**CALLED BY:** DISPLAY HELP SCREEN

**MODULE:** PUT PASSWORD SCREEN

**PURPOSE:** To display the password screen on the CRT.

**USES:** PASSWORD SCREEN  
INVALID PASSWORD MESSAGE 1  
INVALID PASSWORD MESSAGE 2

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the password screen on the CRT screen.
2. DISPLAY INVALID PASSWORD MESSAGE 1 or INVALID PASSWORD MESSAGE 2 when appropriate.

**CALLED BY:** DISPLAY PASSWORD SCREEN  
VALIDATE AND ECHO PASSWORD SCREEN

**MODULE:** PUT PRINT SCREEN

**PURPOSE:** To display the print screen on the CRT.

**USES:** PRINT SCREEN  
INVALID PRINT MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the PRINT SCREEN on the CRT screen.
2. Display INVALID PRINT MESSAGE when appropriate.

**CALLED BY:** DISPLAY PRINT SCREEN  
VALIDATE AND ECHO PRINT SCREEN

**MODULE:** PUT SCHEDULE CONFLICT/ALTERNATIVES SCREEN

**PURPOSE:** To display the SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN on the CRT.

**USES:** SCHEDULE CONFLICT/ALTERNATIVES SCREEN  
INVALID SELECTION MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN on the CRT screen.
2. Display INVALID SELECTION MESSAGE when  
appropriate.

**CALLED BY:** DISPLAY SCHEDULE CONFLICT/ALTERNATIVES SCREEN  
VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN

**MODULE:** PUT SCHEDULE RECORD SCREEN

**PURPOSE:** To display the SCHEDULE RECORD SCREEN on the CRT.

**USES:** SCHEDULE RECORD SCREEN  
INVALID SCHEDULE RECORD MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the SCHEDULE RECORD SCREEN on the CRT screen.
2. Display INVALID SCHEDULE RECORD MESSAGE when appropriate.

**CALLED BY:** DISPLAY SCHEDULE RECORD SCREEN  
VALIDATE AND ECHO SCHEDULE RECORD SCREEN

**MODULE:** PUT TRANSACTION SCREEN

**PURPOSE:** To display the TRANSACTION SCREEN on the CRT screen.

**USES:** TRANSACTION SCREEN  
INVALID TRANSACTION MESSAGE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Display the TRANSACTION SCREEN on the CRT screen.
2. Display the INVALID TRANSACTION MESSAGE when appropriate.

**CALLED BY:** DISPLAY TRANSACTION SCREEN  
VALIDATE AND ECHO TRANSACTION SCREEN

**MODULE:** READ COURSE FILE

**PURPOSE:** To read the COURSE FILE.

**USES:** NULL STATUS  
REFRESHER COURSE  
COURSE REQUIRED TIME  
INSTRUC REQUIRED TIME  
COURSE TYPE  
COURSE NUMBER  
SIMULTANEOUS SCHED COURSE  
ACCELERATED COURSE  
SPECIAL ROOM REQUIREMENT  
LAB HRS  
REQUIRED LAB ROOM  
DIVERSITY OF MAJORS

**RETURNS:** COURSE INFO

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the next COURSE RECORD, until EOF where the given data matches the COURSE RECORD data and where COURSE RECORD.STATUS is NULL STATUS.
2. Read the next COURSE RECORD, until EOF, where COURSE RECORD.COURSE TYPE and COURSE RECORD.COURSE NUMBER equals the given COURSE TYPE and COURSE NUMBER, respectively.
3. Return the desired COURSE INFO.

**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR INSTRUCTOR  
SCHEDULE COURSES w/ LARGE # OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES  
SCHEDULE ACCELERATED COURSES  
SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS  
SCHEDULE COURSES REQUIRING SPECIAL ROOMS  
SCHEDULE COURSES W/ 3 HOUR LABS  
SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME PERIOD  
SCHEDULE COURSES W/ DIVERSITY OF MAJORS  
SCHEDULE COURSES W/ TEACHING TEAMS  
SCHEDULE REMAINING COURSES

**MODULE:** READ COURSE SEGMENT FILE

**PURPOSE:** To read the COURSE SEGMENT FILE.

**USES:** COURSE TYPE  
COURSE NUMBER  
NULL STATUS  
SEGMENT STUDENTS  
INSTRUC CODE  
DESIGNATED STUDENT COURSE GRP  
TEACHING TEAM

**RETURNS:** COURSE SEGMENT RECORD  
EOF

**FUNCTIONAL DETAILS:** (Pre-defined)

```
Begin
  Read next COURSE SEGMENT RECORD
  For COURSE SEGMENT RECORD.COURSE TYPE = COURSE
    TYPE and COURSE SEGMENT RECORD.COURSE
      NUMBER = COURSE NUMBER
    Return COURSE SEGMENT RECORD
  For COURSE SEGMENT RECORD.STATUS = NULL STATUS
    and COURSE SEGMENT.SEGMENT STUDENTS >=
      SEGMENT STUDENTS
    Return COURSE SEGMENT RECORD
  For COURSE SEGMENT RECORD.INSTRUC CODE = INSTRUC
    CODE and COURSE SEGMENT RECORD.STATUS =
      NULLSTATUS
    Return COURSE SEGMENT RECORD
  For COURSE SEGMENT RECORD.STATUS = NULL STATUS
    and COURSE SEGMENT.DESIGNATED STUDENT
      COURSE GRP not null
    Return COURSE SEGMENT RECORD
  For COURSE SEGMENT RECORD.STATUS = NULL STATUS
    and COURSE SEGMENT.TEACHING TEAM not null
    Return COURSE SEGMENT RECORD
  For EOF
    Return EOF
End
```

**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR  
INSTRUCTOR  
SCHEDULE COURSES w/ LARGE # OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES  
SCHEDULE ACCELERATED COURSES  
SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS  
SCHEDULE COURSES REQUIRING SPECIAL ROOMS  
SCHEDULE COURSES W/ 3 HOUR LABS  
SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME  
PERIOD  
SCHEDULE COURSES W/ DIVERSITY OF MAJORS  
SCHEDULE COURSES W/ TEACHING TEAMS  
SCHEDULE REMAINING COURSES

**MODULE:** READ FILE

**PURPOSE:** To read the given file.

**USES:** FILENAME

**RETURNS:** FILE

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the FILE that matches the  
FILENAME given.

**CALLED BY:** VALIDATE AND ECHO FILE SCREEN

**MODULE:** READ HELP INSTRUCTION FILE

**PURPOSE:** To read the file containing help instructions for system screen displays.

**USES:** HELP SCREEN INDICATOR

**RETURNS:** HELP INSTRUCTIONS

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the file containing the HELP INSTRUCTIONS.
2. RETURN the HELP INSTRUCTIONS for the given HELP SCREEN INDICATOR.

**CALLED BY:** DETERMINE HELP INSTRUCTIONS

**MODULE:** READ INSTRUC SCHED FILE

**PURPOSE:** To read the INSTRUC SCHED FILE and find the related  
INSTRUC SCHED RECORDS.

**USES:** INSTRUC CODE

**RETURNS:** INSTRUC SCHED RECORD  
EOF (flag)

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the INSTRUC SCHED FILE and return the related INSTRUC SCHED RECORDS pertaining to the given INSTRUC CODE.
2. Read the Instructor schedule file and return all the INSTRUC SCHED RECORDS for saving to master schedule file.

**CALLED BY:** DETERMINE MBRSHS SCHEDS AND ROOM SCHED  
DETERMINE RELATED SCHEDULE RECORD CONFLICTS  
SAVE TO MASTER SCHEDULE FILE

**MODULE:** READ INSTRUCTOR FILE

**PURPOSE:** To read the Instructor file.

**USES:** DEPT CHAIR OR DEAN

**RETURNS:** FACULTY CODE  
DEPT LTR CODE

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the next Instructor record and return the FACULTY CODE and DEPT LTR CODE for the Instructor that has a DEPT CHAIR OR DEAN indicator.

**CALLED BY:** SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN

**MODULE:** READ M/F E-Z CLASS DEMAND LIST FILE

**PURPOSE:** To read the mainframe file containing course information.

**USES:** N/A

**RETURNS:** COURSE TYPE  
COURSE NUMBER  
LECT HRS  
LAB HRS

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the mainframe file containing course information.

**CALLED BY:** UPDATE COURSE/COURSE SEGMENT FILES

**MODULE:** READ M/F PROFESSOR LISTING FILE

**PURPOSE:** To read the mainframe file containing Faculty information.

**USES:** N/A

**RETURNS:** FACULTY NAME  
FACULTY CODE  
DEPT LTR CODE

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the mainframe file containing Faculty information.

**CALLED BY:** UPDATE FACULTY FILE

**MODULE:** READ M/F SCG SECT FILE

**PURPOSE:** To read the mainframe file containing STUDENT  
COURSE GRP records.

**USES:** COURSE TYPE  
COURSE NUMBER

**RETURNS:** SECT SCG RECORD  
EDF (flag)  
SCG CARD NUMBER

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the mainframe file containing STUDENT  
COURSE GRP records.

**CALLED BY:** UPDATE STUDENT COURSE CROUP FILE  
UPDATE COURSE/COURSE SEGMENT FILES

**MODULE:** READ M/F STUDENT SECT FILE

**PURPOSE:** To read the mainframe file containing student records.

**USES:** N/A

**RETURNS:** EOF  
SECT STUDENT RECORD

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the mainframe file containing student records.

**CALLED BY:** UPDATE STUDENT FILE

**MODULE:** READ ROOM SCHED FILE

**PURPOSE:** To read the ROOM SCHED FILE and find the related ROOM SCHED RECORD.

**USES:** ROOM

**RETURNS:** ROOM SCHED RECORD  
EOF (flag)

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the ROOM SCHED FILE and return the related ROOM SCHED RECORD pertaining to the given ROOM.
2. Read the ROOM schedule file and return all ROOM SCHED RECORDS to save to master schedule file.

**CALLED BY:** DETERMINE MBRSHS SCHEDS AND ROOM SCHED  
DETERMINE RELATED SCHEDULE RECORD CONFLICTS  
SAVE TO MASTER SCHEDULE FILE

**MODULE:** READ SCG SCHED FILE

**PURPOSE:** To read the SCG SCHED FILE and find all related SCG SCHED RECORDS.

**USES:** DESIGNATED STUDENT COURSE GRP'S

**RETURNS:** SCG SCHED RECORD  
EOF (flag)

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the SCG SCHED FILE and return all the related SCG SCHED RECORDS pertaining to the given DESIGNATED STUDENT COURSE GRP'S.
2. Read the SCG schedule file and return all SCG SCHED RECORDS to be saved to master schedule file.

**CALLED BY:** DETERMINE MBRSHP SCHEDS AND ROOM SCHED  
DETERMINE RELATED SCHEDULE RECORD CONFLICTS  
SAVE TO MASTER SCHEDULE FILE

**MODULE:** READ SCHEDULE RECORDS

**PURPOSE:** To read the schedule records pertaining to the  
SCHEDULE RECORD QUERY.

**USES:** SCHEDULE RECORD QUERY

**RETURNS:** SCHED RECORDS  
NOT FOUND (flag)

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the SCHED RECORDS that pertain to the  
given SCHEDULE RECORD QUERY.

**CALLED BY:** VALIDATE AND ECHO SCHEDULE RECORD SCREEN

**MODULE:** READ SCREEN

**PURPOSE:** To read the screen currently displayed on the CRT.

**USES:** N/A

**RETURNS:** FLAG TYPE (flag)  
PRINT SCREEN  
PASSWORD SCREEN  
COURSE/LAB SCHEDULING SCREEN  
PASSWORD HELP SCREEN  
TRANSACTION SCREEN  
FILE SCREEN  
SCHEDULE CONFLICT/ALTERNATIVES SCREEN  
SCHEDULE RECORD SCREEN

**FUNCTIONAL DETAILS:** (Pre-defined)

1. READ the screen and return user designated FLAG TYPE entry.

**CALLED BY:** VALIDATE AND ECHO PASSWORD SCREEN  
DETERMINE HELP INSTRUCTIONS  
VALIDATE AND ECHO TRANSACTION SCREEN  
VALIDATE AND ECHO FILE SCREEN  
VALIDATE AND ECHO PRINT SCREEN  
VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN  
VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN  
VALIDATE AND ECHO SCHEDULE RECORD SCREEN

**MODULE:** RI SEMI-PERM EVENT FILE

**PURPOSE:** To read the SEMI-PERM EVENT FILE.

**USES:** N/A

**RETURNS:** EOF (flag)  
SEMI-PERM EVENT RECORD

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the SEMI-PERM EVENT FILE and return SEMI-PERM EVENT RECORD each time called until EOF is reached.

**CALLED BY:** DETERMINE SEMI-PERM EVENT AND EVENT MBRSHIP

**MODULE:** READ SEMI-PERM EVENT MBRSHF FILE

**PURPOSE:** To read the SEMI-PERM EVENT MBRSHF FILE

**USES:** EVENT TYPE  
EVENT NAME

**RETURNS:** MBRSHF

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the SEMI-PERM EVENT MBSHF FILE and return all the MBRSHF RECORDS that relate to the given event.

**CALLED BY:** DETERMINE SEMI-PERM EVENT AND EVENT MBRSHF

**MODULE:** READ SYSTEM PASSWORD FILE

**PURPOSE:** To read the system password.

**USES:** N/A

**RETURNS:** SYSTEM PASSWORD

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Read the file containing the system password.

**CALLED BY:** VALIDATE AND ECHO PASSWORD SCREEN



**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR  
INSTRUCTOR  
SCHEDULE COURSES w/ LARGE # OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES  
SCHEDULE ACCELERATED COURSES  
SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS  
SCHEDULE COURSES REQUIRING SPECIAL ROOMS  
SCHEDULE COURSES W/ 3 HOUR LABS  
SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME  
PERIOD  
SCHEDULE COURSES W/ DIVERSITY OF MAJORS  
SCHEDULE COURSES W/ TEACHING TEAMS  
SCHEDULE REMAINING COURSES

**MODULE:** RESOLVE UPDATE CONFLICTS

**PURPOSE:** To resolve the conflicts pertaining to updates made to SCHED RECORDS.

**USES:** SCHED INFO  
SCHEDULE CONFLICT  
SCHED RECORDS

**RETURNS:** UPDATED SCHED RECORDS

**FUNCTIONAL DETAILS:**

```
Begin
  Call SEARCH FOR ALTERNATIVES (SCHED RECORDS)
  Call DISPLAY SCHEDULE/ALTERNATIVES SCREEN
    (ALTERNATIVES, SCHEDULE CONFLICT)
  Call VALIDATE AND ECHO SCHEDULE
    CONFLICT/ALTERNATIVES SCREEN
  SCHED INFO.TIME PERIOD := VALID ALTERNATIVE
    SELECTION
  UPDATED SCHED INFO := SCHED INFO
  Call PUT ALTERNATIVE SELECTION TO SCHEDULE
    RECORDS (UPDATED SCHED INFO, SCHED RECORDS)
  Return (UPDATED SCHED RECORDS)
End
```

**CALLED BY:** UPDATE SCHEDULE RECORDS

**MODULE:** SAVE TO MASTER SCHEDULE FILE

**PURPOSE:** To coordinate saving created schedule records to a master schedule file.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call GET VALID FILE NAME
  Call VALIDATE AND ECHO FILE SCREEN
  Call READ INSTRUC SCHED FILE
  Call READ ROOM SCHED FILE
  Call READ STUDENT COURSE GRP SCHED FILE
  Call WRITE MASTER SCHEDULE FILE (VALID FILE NAME,
                                   SCHED RECORDS)
End
```

**CALLED BY:** CREATE NEW SCHEDULES



**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR  
INSTRUCTOR  
SCHEDULE COURSES w/ LARGE # OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES  
SCHEDULE ACCELERATED COURSES  
SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS  
SCHEDULE COURSES REQUIRING SPECIAL ROOMS  
SCHEDULE COURSES W/ 3 HOUR LABS  
SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME  
PERIOD  
SCHEDULE COURSES W/ DIVERSITY OF MAJORS  
SCHEDULE COURSES W/ TEACHING TEAMS  
SCHEDULE REMAINING COURSES

**MODULE:** SCHEDULE ACCELERATED COURSES

**PURPOSE:** To coordinate scheduling of courses that are accelerated courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, ACCELERATED
                          COURSE)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                          SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                              INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                          SCHED RECORDS, VALID TIME PERIOD,
                                          NO OF SEGMENTS, COURSE TYPE,
                                          COURSE NUMBER)
    End loop
  End loop
End
```

**CALLED BY:** SCHEDULE MIDDLE PRIORITY COURSES

**MODULE:** SCHEDULE COURSES REQUIRING SPECIAL ROOMS

**PURPOSE:** To coordinate scheduling courses requiring special rooms for instruction.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, SPECIAL
                          ROOM REQUIREMENT)
  Loop until Course Segment EOF
    Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                  COURSE NUMBER)
    Call GET VALID TIME PERIOD AND ROOM (COURSE
    SEGMENT SCREEN INFO, SCREEN INDICATOR)
    Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
    INFO)
    Call SAVE TO PERTINENT FILE/RECORD (UPDATED
    SCHED RECORDS, VALID TIME PERIOD,
    NO OF SEGMENTS, COURSE TYPE,
    COURSE NUMBER)

  End loop
End loop
End
```

**CALLED BY:** SCHEDULE MIDDLE PRIORITY COURSES

**MODULE:** SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN

**PURPOSE:** To coordinate scheduling courses taught by a Dean or Department Chairman.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ INSTRUCTOR FILE (DEPT CHAIR OR DEAN)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (NULL STATUS,
                                     INSTRUC CODE)
      Call READ COURSE FILE (COURSE TYPE, COURSE
                             NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                           SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                               INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                           SCHED RECORDS, VALID TIME PERIOD,
                                           NO OF SEGMENTS, COURSE TYPE,
                                           COURSE NUMBER)
    End loop
    If COURSE RECORD.SIMULTANEOUS SCHED COURSE not
                                     null
      Call UPDATE SIMULTANEOUS SCHEDULED COURSE
        (SIMULTANEOUS SCHED COURSE, VALID ROOM,
         VALID TIME PERIOD)
    Endif
  End loop
End
```

**CALLED BY:** SCHEDULE MIDDLE PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ 3 HOUR LABS

**PURPOSE:** To coordinate scheduling courses that have 3 hour laboratories.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, LAB HRS>/3)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                     COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                           SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                              INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                          SCHED RECORDS, VALID TIME PERIOD,
                                          NO OF SEGMENTS, COURSE TYPE,
                                          COURSE NUMBER)
    End loop
  End loop
End
```

**CALLED BY:** SCHEDULE LOWER PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ DESIGNATED STUDENT COURSE GRPS

**PURPOSE:** To coordinate scheduling of courses that have designated Student Course Groups.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until COURSE SEGMENT EOF
    Call READ COURSE SEGMENT FILE (NULL STATUS,
                                   DESIGNATED STUDENT COURSE GRP)
    Call READ COURSE FILE (COURSE TYPE, COURSE
                           NUMBER)
    Call GET VALID TIME PERIOD AND ROOM (COURSE
                                         SEGMENT SCREEN INFO, SCREEN INDICATOR)
    Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                             INFO)
    Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                         SCHED RECORDS, VALID TIME PERIOD,
                                         NO OF SEGMENTS, COURSE TYPE,
                                         COURSE NUMBER)
  End loop
End
```

**CALLED BY:** SCHEDULE MIDDLE PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ DIVERSITY OF MAJORS

**PURPOSE:** To coordinate scheduling of courses that have a diversity of majors in its enrollment.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, DIVERSITY
                          OF MAJORS)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                    SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                    INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                    SCHED RECORDS, VALID TIME PERIOD,
                                    NO OF SEGMENTS, COURSE TYPE,
                                    COURSE NUMBER)
    End loop
  End loop
End
```

**CALLED BY:** SCHEDULE LOWER PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ LARGE # OF STUDENTS

**PURPOSE:** To coordinate scheduling courses that have a large enrollment.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE SEGMENT FILE (NULL STATUS,
                                   SEGMENT STUDENTS)
    Call READ COURSE FILE (COURSE TYPE, COURSE
                           NUMBER)
    Call GET VALID TIME PERIOD AND ROOM (COURSE
                                         SEGMENT SCREEN INFO, SCREEN INDICATOR)
    Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                             INFO)
    Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                         SCHED RECORDS, VALID TIME PERIOD,
                                         NO OF SEGMENTS, COURSE TYPE,
                                         COURSE NUMBER)
  End loop
  If COURSE RECORD.SIMULTANEOUS SCHED COURSE not null
    Call UPDATE SIMULTANEOUS SCHEDULED COURSE
      (SIMULTANEOUS SCHED COURSE, VALID ROOM,
       VALID TIME PERIOD)
  Endif
End loop
End
```

**CALLED BY:** SCHEDULE TOP PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ REQUIRED LAB ROOM AND TIME PERIOD

**PURPOSE:** To coordinate scheduling courses that require a specific laboratory at a specific time.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, REQUIRED
                          LABROOM)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                    SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                    INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                    SCHED RECORDS, VALID TIME PERIOD,
                                    NO OF SEGMENTS, COURSE TYPE,
                                    COURSE NUMBER)
    End loop
  End loop
End
```

**CALLED BY:** SCHEDULE LOWER PRIORITY COURSES

**MODULE:** SCHEDULE COURSES w/REQUIRED TIME PERIOD

**PURPOSE:** To schedule courses with required times of instruction.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, COURSE
                          REQUIRED TIME)
  Loop until EOF
    Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                  COURSENUMBER)
    Call GET VALID TIME PERIOD AND ROOM (COURSE
    SEGMENT SCREEN INFO, SCREEN INDICATOR)
    Call RESOLVE SCHED RECORD CONFLICTS (SCHED
    INFO)
    Call SAVE TO PERTINENT FILE/RECORD (UPDATED
    SCHED RECORDS, COURSE TYPE,
    COURSE NUMBER, VALID TIME PERIOD,
    NO OF SEGMENTS)
  Endloop
  If COURSE RECORD.SIMULTANEOUS SCHED COURSE
                                notnull
    Call UPDATE SIMULTANEOUS SCHEDULED COURSE
    (SIMULTANEOUS SCHED COURSE,
    VALID ROOM, VALID TIME PERIOD)
  End if
Endloop
End
```

**CALLED BY:** SCHEDULE TOP PRIORITY COURSES

**MODULE:** SCHEDULE COURSES w/REQUIRED TIME PERIOD FOR INSTRUCTOR

**PURPOSE:** To schedule courses that require Instructor to teach at specific TIME PERIODS.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS, INSTRU
                          REQUIRED TIME)
    Loop until COURSE SEGMENT EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSENUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                          SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                              INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                          SCHED RECORDS, COURSE TYPE,
                                          COURSE NUMBER, VALID TIME PERIOD,
                                          NO OF SEGMENTS)
    End loop
    If COURSE RECORD SIMULTANEOUS SCHED COURSE no
                                     null
      Call UPDATE SIMULTANEOUS SCHEDULED COURSE
        (SIMULTANEOUS SCHED COURSE, VALID
        ROOM, VALID TIME PERIOD)
    Endif
  Endloop
End
```

**CALLED BY:** SCHEDULE TOP PRIORITY COURSES

**MODULE:** SCHEDULE COURSES W/ TEACHING TEAM

**PURPOSE:** To coordinate scheduling courses that are taught by teaching teams.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until COURSE SEGMENT EOF
    Call READ COURSE SEGMENT FILE (NULL STATUS,
                                   TEACHING TEAM)
    Call READ COURSE FILE (COURSE TYPE, COURSE
                           NUMBER)
    Call GET VALID TIME PERIOD AND ROOM (COURSE
                                         SEGMENT SCREEN INFO, SCREEN INDICATOR)
    Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                             INFO)
    Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                         SCHED RECORDS, VALID TIME PERIOD,
                                         NO OF SEGMENTS, COURSE TYPE,
                                         COURSE NUMBER)
  End loop
End
```

**CALLED BY:** SCHEDULE LOWER PRIORITY COURSES

**MODULE:** SCHEDULE LOWER PRIORITY COURSES

**PURPOSE:** To coordinate the scheduling of lower priority courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call SCHEDULE COURSES W/ 3 HOUR LABS
  Call SCHEDULE COURSES W/ REQUIRED LAB ROOM AND
                                TIME PERIOD
  Call SCHEDULE COURSES W/ DIVERSITY OF MAJORS
  Call SCHEDULE COURSES W/ TEACHING TEAM
  Call SCHEDULE REMAINING COURSES
End
```

**CALLED BY:** CREATE NEW SCHEDULES

**MODULE:** SCHEDULE MIDDLE PRIORITY COURSES

**PURPOSE:** To coordinate the scheduling of middle priority courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

Begin

Call SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN

Call SCHEDULE SIMULTANEOUS SCHEDULED COURSES

Call SCHEDULE ACCELERATED COURSES

Call SCHEDULE COURSES W/ DESIGNATED STUDENT  
COURSE GRPS

Call SCHEDULE COURSES REQUIRING SPECIAL ROOMS

End

**CALLED BY:** CREATE NEW SCHEDULES

**MODULE:** SCHEDULE REFRESHER COURSES

**PURPOSE:** To schedule Refresher Courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ COURSE FILE (NULL STATUS, REFRESHER
                          COURSE)
    Loop until EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                          SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS
                                          (SCHED INFO)
      Call SAVE TO PERINTENT FILE/RECORD (UPDATED
                                          SCHED RECORDS, COURSE TYPE,
                                          COURSE NUMBER, VALID TIME PERIOD,
                                          NO_OF_SEGMENTS)
    Endloop
    If COURSE RECORD.SIMULTANEOUS SCHED COURSE
                                not null
      Call UPDATE SIMULTANEOUS SCHEDULED COURSE
                (SIMULTANEOUS SCHED COURSE, VALID ROOM,
                VALID TIME PERIOD)
    End if
  End loop
End
```

**CALLED BY:** SCHEDULE TOP PRIORITY COURSES

**MODULE:** SCHEDULE REMAINING COURSES

**PURPOSE:** To coordinate the scheduling of courses that have yet to be scheduled for the academic quarter.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS)
    Loop until Course Segment EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                     COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                           SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                              INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                         SCHED RECORDS, VALID TIME PERIOD,
                                         NO OF SEGMENTS, COURSE TYPE,
                                         COURSE NUMBER)
    End loop
  End loop
End
```

**CALLED BY:** SCHEDULE LOWER PRIORITY COURSES

**MODULE:** SCHEDULE SEMI-PERM EVENTS

**PURPOSE:** To automatically schedule semi-permanent events.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call DETERMINE SEMI-PERM EVENT AND EVENT MBRSH
    Call DETERMINE MBRSH SCHED AND ROOM SCHED
      (MBRSH, ROOM)

    Call ASSIGN SEMI-PERM EVENT TO SCHEDULES (SCHED
      RECORDS, SEMI-PERMEVENT RECORD)

  Endloop
End
```

**CALLED BY:** CREATE NEW SCHEDULE FILE

**MODULE:** SCHEDULE SIMULTANEOUS SCHEDULED COURSES

**PURPOSE:** To coordinate scheduling of courses that must be scheduled simultaneously with other courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ COURSE FILE (NULL STATUS,
                          SIMULTANEOUS COURSE)
    Loop until COURSE SEGMENT EOF
      Call READ COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSE NUMBER)
      Call GET VALID TIME PERIOD AND ROOM (COURSE
                                          SEGMENT SCREEN INFO, SCREEN INDICATOR)
      Call RESOLVE SCHEDULE RECORD CONFLICTS (SCHED
                                              INFO)
      Call SAVE TO PERTINENT FILE/RECORD (UPDATED
                                          SCHED RECORDS, VALID TIME
                                          PERIOD, NO OF SEGMENTS,
                                          COURSE TYPE, COURSE NUMBER)
    End loop
    If COURSE RECORD.SIMULTANEOUS SCHED COURSE not
                                          null
      Call UPDATE SIMULTANEOUS SCHEDULED COURSE
        (SIMULTANEOUS SCHED COURSE, VALID ROOM,
        VALID TIME PERIOD)
    Endif
  End loop
End
```

**CALLED BY:** SCHEDULE MIDDLE PRIORITY COURSES

**MODULE:** SCHEDULE TOP PRIORITY COURSES

**PURPOSE:** To coordinate the scheduling of top priority courses.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call SCHEDULE REFRESHER COURSES
  Call SCHEDULE COURSES w/REQUIRED TIME PERIOD
  Call SCHEDULE COURSES w/LARGE ATTENDANCE
  Call SCHEDULE COURSES TAUGHT BY DEPT CHAIR/DEAN
End
```

**CALLED BY:** CREATE NEW SCHEDULES

**MODULE:** SCHEDULING DATA MAINTENANCE

**PURPOSE:** To coordinate the maintenance of data files for the  
NPS SCHEDULING SYSTEM.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call GET VALID DATA MAINTENANCE TRANSACTION
    Case VALID TRANSACTION
      When VALID TRANSACTION = COPY FILES
        Call COPY MAINFRAME FILES
      When VALID TRANSACTION = UPDATE
        Call UPDATE DATA FILES
      When VALID TRANSACTION = PRINT
        Call PRINT FILE, RECORD, REPORT
    End Case
  End loop
End
```

**CALLED BY:** NPS SCHEDULING SYSTEM

**MODULE:** SEARCH DATABASE

**PURPOSE:** To search the database for an ITEM based on the  
ITEM QUERY.

**USES:** ITEM QUERY

**RETURNS:** ITEM

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Search database for the ITEM matching the ITEM  
QUERY.

**CALLED BY:** VALIDATE AND ECHO PRINT SCREEN

**MODULE:** SEARCH FOR ALTERNATIVES

**PURPOSE:** To search the given SCHED RECORDS for an alternative TIME PERIOD slot that has no conflict.

**USES:** SCHED RECORDS

**RETURNS:** ALTERNATIVES

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Search the given SCHED RECORDS and find all the alternative TIME PERIOD slots, to schedule the course, where NO CONFLICT exists between the given SCHED RECORDS.
2. Return all TIME PERIODs where INSTRUC SCHED RECORD.TIME PERIOD + ROOM SCHED RECORD.TIME PERIOD + STUDENT COURSE GRP.TIME PERIOD = null.

**CALLED BY:** RESOLVE SCHEDULE RECORD CONFLICTS  
RESOLVE UPDATE CONFLICTS

**MODULE:** UPDATE COURSE/COURSE SEGMENT FILES

**PURPOSE:** To update the COURSE/COURSE SEGMENT FILES with data  
from the mainframe E-Z Class Demand List File.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ M/F E-Z CLASS DEMAND LIST FILE
    Call READ M/F SCG SECT FILE (COURSE TYPE,
                                COURSE NUMBER)
    Call WRITE COURSE FILE (COURSE TYPE, COURSE
                            NUMBER, LECT HRS, LAB HRS, SCG CARD NUMBER)
    Call WRITE COURSE SEGMENT FILE (COURSE TYPE,
                                    COURSENUMBER)
  End loop
End
```

**CALLED BY:** COPY MAINFRAME FILES

**MODULE:** UPDATE COURSE RECORD

**PURPOSE:** To update the status of a given course.

**USES:** STATUS  
COURSE TYPE  
COURSE NUMBER

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. For the given COURSE TYPE and COURSE NUMBER, update COURSE RECORD.STATUS to the given STATUS.

**CALLED BY:** SAVE TO PERTINENT FILE/RECORD

**MODULE:** UPDATE COURSE SEGMENT RECORD

**PURPOSE:** To UPDATE the STATUS, DAY and PERIOD of a given COURSE SEGMENT.

**USES:** STATUS  
TIME PERIOD  
COURSE TYPE  
COURSE NUMBER

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. For the given COURSE TYPE and COURSE NUMBER, update COURSE SEGMENT RECORD.STATUS with STATUS, COURSE SEGMENT RECORD.DAY with DAY and COURSE SEGMENT RECORD.PERIOD with PERIOD.

**CALLED BY:** SAVE TO PERTINENT FILE/RECORD

**MODULE:** UPDATE DATABASE FILES

**PURPOSE:** To coordinate the updating of NPS<sup>3</sup> database files.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call GET VALID FILE
    Call GET VALID UPDATE TRANSACTION
    Case VALID TRANSACTION
      When VALID TRANSACTION = ADD
        Call ADD DATA RECORD
      When VALID TRANSACTION = MODIFY
        Call MODIFY DATA RECORD
      When VALID TRANSACTION = DELETE
        Call DELETE DATA RECORD
    End Case
  End loop
End
```

**CALLED BY:** SCHEDULING DATA MAINTENANCE

**MODULE:** UPDATE FACULTY FILE

**PURPOSE:** To update the Faculty File with data from the  
mainframe Professor Listing File.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ M/F PROFESSOR LISTING FILE
    Call WRITE FACULTY FILE (FACULTY NAME, DEPT
                           LTR CODE, FACULTY CODE)
  End loop
End
```

**CALLED BY:** COPY MAINFRAME FILES

**MODULE:** UPDATE SCHEDULE FILE

**PURPOSE:** To coordinate updating an old master schedule file.

**USES:** VALID FILE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call GET VALID SCHEDULE RECORDS TO UPDATE
    Call UPDATE SCHEDULE RECORDS (VALID SCHED
                                RECORDS)
  End loop
End
```

**CALLED BY:** REVIEW OLD SCHEDULE FILE

**MODULE:** UPDATE SCHEDULE RECORDS

**PURPOSE:** To update schedule records.

**USES:** VALID SCHED RECORDS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Call GET DATE
  Call GET SCHEDULE CHANGES
  Call DETERMINE CONFLICTS (SCHED INFO, SCHED
                           RECORDS)
  If SCHEDULE CONFLICTS returned
    Call RESOLVE UPDATE CONFLICTS (SCHED INFO,
                                   SCHEDULE CONFLICT, SCHED RECORDS)
    Call WRITE TO FILE (UPDATED SCHED RECORDS)
  Elseif UPDATED SCHED RECORDS returned
    Call WRITE TO FILE (UPDATED SCHED RECORDS)
  End if
End
```

**CALLED BY:** UPDATE SCHEDULE FILE

**MODULE:** UPDATE SIMULTANEOUS SCHEDULED COURSE RECORD

**PURPOSE:** To update a simultaneously scheduled course with the VALID ROOM and VALID TIME PERIOD.

**USES:** SIMULTANEOUS SCHEDULED COURSE  
VALID ROOM  
VALID TIME PERIOD

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. For the given simultaneous scheduled COURSE TYPE and COURSE NUMBER, update COURSE SEGMENT RECORD.DAY with VALID DAY, COURSE SEGMENT RECORD.PERIOD with VALID PERIOD, COURSE SEGMENT RECORD.BUILDING CODE with VALID BUILDING CODE and COURSE SEGMENT RECORD.ROOM NUMBER with VALID ROOM NUMBER.
2. Change COURSE SEGMENT RECORD.STATUS and COURSE RECORD.STATUS for the given simultaneous scheduled COURSE TYPE and COURSE NUMBER to DONE.

**CALLED BY:** SCHEDULE REFRESHER COURSES  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD  
SCHEDULE COURSES w/ REQUIRED TIME PERIOD FOR  
INSTRUCTOR  
SCHEDULE COURSES w/ LARGE NUMBER OF STUDENTS  
SCHEDULE COURSES TAUGHT BY DEAN/CHAIRMAN  
SCHEDULE SIMULTANEOUS SCHEDULED COURSES

**MODULE:** UPDATE STUDENT COURSE GRP FILE

**PURPOSE:** To update the STUDENT COURSE GRP FILE with data from the mainframe SECT file.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ M/F SCG SECT FILE
    Call WRITE SCG SCHED FILE (SECT SCG RECORD)
  End loop
End
```

**CALLED BY:** COPY MAINFRAME FILES

**MODULE:** UPDATE STUDENT FILE

**PURPOSE:** To update the STUDENT FILE with data from the  
mainframe SECT file.

**USES:** N/A

**RETURNS:** N/A

**FUNCTIONAL DETAILS:**

```
Begin
  Loop until EOF
    Call READ M/F STUDENT SECT FILE
    Call WRITE STUDENT FILE (SECT STUDENT
                           RECORDS)
  End loop
End
```

**CALLED BY:** COPY MAINFRAME FILES

**MODULE:** VALIDATE AND ECHO COURSE/LAB SCHEDULING SCREEN

**PURPOSE:** To validate the time period and room entered by the system user for a given course/lab.

**USES:** N/A

**RETURNS:** VALID TIME PERIOD  
VALID ROOM

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ SCREEN
    If FLAG TYPE = QUIT
      Exit system
    ElseIf FLAG TYPE=HELP
      Call DETERMINE HELP INSTRUCTIONS (COURSE/LAB
                                         SCHEDULING SCREEN)

    ElseIf FLAG TYPE = RETURN
      GO TO previous menu
    End if
    Call GET TIME PERIOD
    Call GET ROOM
    If TIME PERIOD and ROOM are valid
      Return (VALID TIME PERIOD, VALID ROOM)
    Else Call PUT COURSE/LAB SCHEDULING SCREEN
          (COURSE/LAB SCHEDULING SCREEN, INVALID TIME
           PERIOD MESSAGE AND/OR INVALID ROOM MESSAGE)
    End if
  End Loop
End
```

**CALLED BY:** GET VALID TIME PERIOD AND ROOM

**MODULE:** VALIDATE AND ECHO FILE SCREEN

**PURPOSE:** To get a VALID FILE to update.

**USES:** N/A

**RETURNS:** VALID FILE  
VALID FILE NAME

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ SCREEN
    If FLAG TYPE = HELP
      Call DETERMINE HELP INSTRUCTIONS (FILE
                                         SCREEN)

    ElseIf FLAG TYPE = QUIT
      Exit system
    ElseIf FLAG TYPE = RETURN
      GO TO previous menu
    Endif
    Call GET FILE NAME
    When updating, reviewing or deleting
      Call READ FILE (FILE NAME)
      If FILENAME Exists as a FILE
        Return (VALID FILE)
      Else Call Put FILE SCREEN (FILE SCREEN,
                                INVALID FILE MESSAGE)
      Endif
    When creating file
      Return (VALID FILE NAME)
      Exit loop
    End loop
  End
```

**CALLED BY:** GET VALID FILE

**MODULE:** VALIDATE AND ECHO PASSWORD SCREEN

**PURPOSE:** To get a valid system password.

**USES:** N/A

**RETURNS:** VALID PASSWORD (flag)

**FUNCTIONAL DETAILS:**

```
Begin
  Count := 1
  Loop while Count 1 = 3
    Call READ SCREEN
    If FLAGTYPE = HELP
      Call Determine HELP INSTRUCTIONS (PASSWORD
                                         SCREEN)

    ElseIf FLAG TYPE = QUIT
      EXIT SYSTEM
    End if
    Call GET USER PASSWORD
    Count = Count + 1
    Call READ SYSTEM PASSWORD
    If SYSTEM PASSWORD = USER PASSWORD
      Return VALID PASSWORD
    Else Call Put PASSWORD SCREEN (PASSWORD
                                   SCREEN, INVALID PASSWORD MESSAGE 1)
    Endif
  End loop
  Call PUT PASSWORD SCREEN (PASSWORD SCREEN,
                           INVALID PASSWORD MESSAGE 2)

  EXIT SYSTEM
End
```

**CALLED BY:** GET VALID PASSWORD

**MODULE:** VALIDATE AND ECHO PRINT SCREEN

**PURPOSE:** To get a valid item to print

**USES:** N/A

**RETURNS:** VALID ITEM

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ SCREEN
    IF FLAG TYPE = HELP
      Call DETERMINE HELP INSTRUCTIONS (PRINT
                                         SCREEN)

    ElseIf FLAG TYPE = QUIT
      Exit system
    ElseIf FLAG TYPE = RETURN
      GO TO previous menu
    Endif
    Call GET ITEM PRINT QUERY
    Call SEARCH DATABASE (ITEM QUERY)
    If ITEM exists for ITEM QUERY
      Return VALID ITEM
    Else Call PUT FILE SCREEN (FILE SCREEN,
                              INVALID FILE MESSAGE)

    Endif
  End loop
End
```

**CALLED BY:** GET VALID ITEM TO PRINT

**MODULE:** VALIDATE AND ECHO SCHEDULE CONFLICT/ALTERNATIVES  
SCREEN

**USES:** N/A

### FUNCTIONAL DETAILS:

**CALLED BY:** RESOLVE SCHEDULE RECORD CONFLICT  
RESOLVE UPDATE CONFLICTS

**MODULE:** VALIDATE AND ECHO SCHEDULE RECORD SCREEN

**PURPOSE:** To coordinate getting VALID SCHED RECORDS to update.

**USES:** N/A

**RETURNS:** VALID SCHED RECORDS

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ SCREEN
    IF FLAG TYPE = HELP
      Call DETERMINE HELP INSTRUCTIONS (SCHEDULE
                                         RECORD SCREEN)
    ElseIf FLAG TYPE = QUIT
      Exit system
    ElseIf FLAG TYPE = RETURN
      GO TO previous menu
    Endif
    Call GET SCHEDULE RECORD QUERY
    Call READ SCHED RECORDS (SCHEDULE RECORD QUERY)
    If SCHED RECORDS exist
      Return VALID SCHED RECORDS
    ElseIf NOT FOUND returned
      Call PUT SCHEDULE RECORD SCREEN (SCHEDULE
                                       RECORD SCREEN,
                                       INVALID SCHEDULE RECORD MESSAGE)
    End if
  End loop
End
```

**CALLED BY:** GET VALID SCHEDULE RECORDS TO UPDATE

**MODULE:** VALIDATE AND ECHO TRANSACTION SCREEN

**PURPOSE:** To get a valid transaction.

**USES:** N/A

**RETURNS:** VALID TRANSACTION

**FUNCTIONAL DETAILS:**

```
Begin
  Loop
    Call READ SCREEN
    If FLAG TYPE = HELP
      Call DETERMINE HELP INSTRUCTIONS (TRANSACTION
                                         SCREEN)
    ElseIf FLAG TYPE = QUIT
      Exit system
    ElseIf FLAG TYPE = RETURN
      GO TO previous menu
    Endif
    Call GET TRANSACTION
    If TRANSACTION is a VALID TRANSACTION
      Return VALID TRANSACTION
    Else Call PUT TRANSACTION SCREEN (TRANSACTION
                                       SCREEN, INVALID TRANSACTION MESSAGE)
    Endif
  End loop
End
```

**CALLED BY:** GET VALID NPS SCHEDULING SYSTEM TRANSACTION  
GET VALID DATA MAINTENANCE TRANSACTION  
GET VALID FILE UPDATE TRANSACTION  
GET VALID EVENT/COURSE TRANSACTION

**MODULE:** WRITE COURSE FILE

**PURPOSE:** To write a Course file for the NPS<sup>3</sup> from the E-Z  
Class Demand List File and the SCG SECT File.

**USES:** COURSE TYPE  
COURSE NUMBER  
LECT HRS  
LAB HRS  
SCG CARD NUMBER

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the course information to Course File.

**CALLED BY:** UPDATE COURSE/COURSE SEGMENT FILES

**MODULE:** WRITE COURSE SEGMENT FILE

**PURPOSE:** To write a Course Segment File for the NPS<sup>3</sup> from  
the E-Z Class Demand List File.

**USES:** COURSE TYPE  
COURSE NUMBER

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the course information to Course Segment  
File.

**CALLED BY:** UPDATE COURSE/COURSE SEGMENT FILES

**MODULE:** WRITE FACULTY FILE

**PURPOSE:** To write a FACULTY FILE for the NPS<sup>3</sup> from the Professor Listing File.

**USES:** FACULTY NAME  
FACULTY CODE  
DEPT LTR CODE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the Faculty information to FACULTY FILE.

**CALLED BY:** UPDATE FACULTY FILE

**MODULE:** WRITE INSTRUC SCHED FILE

**PURPOSE:** To write the UPDATED INSTRUC SCHED RECORD to the  
INSTRUC SCHED FILE.

**USES:** UPDATED INSTRUC SCHED RECORD  
DATE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the UPDATED INSTRUC SCHED RECORD to the  
INSTRUC SCHED FILE.

**CALLED BY:** ASSIGN SEMI-PERM EVENT TO SCHEDULES  
SAVE TO PERTINENT FILE/RECORD

**MODULE:** WRITE MASTER SCHEDULE FILE

**PURPOSE:** To write the SCHED RECORDS to a master schedule file.

**USES:** VALID FILE NAME  
SCHED RECORDS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write all SCHED RECORDS to the designated named file.

**CALLED BY:** SAVE TO MASTER SCHEDULE FILE

**MODULE:** WRITE NPS<sup>3</sup> SCG SCHED FILE

**PURPOSE:** To write a SCG SCHED FILE for the NPS<sup>3</sup> from SECT  
SCG RECORDS.

**USES:** SECT SCG RECORD

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the SECT SCG RECORD to the NPS<sup>3</sup> SCG  
SCHED FILE.

**CALLED BY:** UPDATE STUDENT COURSE GROUP FILE

**MODULE:** WRITE ROOM SCHED FILE

**PURPOSE:** To write the UPDATED ROOM SCHED RECORD to the ROOM SCHED FILE.

**USES:** UPDATED ROOM SCHED RECORD  
DATE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the UPDATED ROOM SCHED RECORD to the ROOM SCHED FILE.

**CALLED BY:** ASSIGN SEMI-PERM EVENT TO SCHEDULES  
SAVE TO PERTINENT FILE/RECORD

**MODULE:** WRITE SCG SCHED FILE

**PURPOSE:** To write the UPDATED SCG SCHED RECORD to the SCG SCHED FILE.

**USES:** UPDATED SCG SCHED RECORD  
DATE

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the UPDATED SCG SCHED RECORD to the SCG SCHED FILE.

**CALLED BY:** ASSIGN SEMI-PERM EVENT TO SCHEDULES  
SAVE TO PERTINENT FILE/RECORD

**MODULE:** WRITE STUDENT FILE

**PURPOSE:** To write a STUDENT FILE for the NPS<sup>3</sup> from SECT  
STUDENT RECORDS.

**USES:** SECT STUDENT RECORDS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the SECT RECORD to the STUDENT FILE.

**CALLED BY:** UPDATE STUDENT FILE

**MODULE:** WRITE TO FILE

**PURPOSE:** To write the UPDATED SCHED RECORDS to the file  
being updated.

**USES:** UPDATED SCHED RECORDS

**RETURNS:** N/A

**FUNCTIONAL DETAILS:** (Pre-defined)

1. Write the UPDATED SCHED RECORDS to the master  
schedule file being updated.

**CALLED BY:** UPDATE SCHEDULE RECORDS

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