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ARPA POLICY-FORMULATION INTERROGATION NETWORK

Paul Baran, et al

Institute for the Future

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13. ABSTRACT

This report summarizes the first year's results of a project to develop a group-via-computer interrogation network. Most of the effort to date has been devoted to programming and preliminary system tests with up to five terminals. The current version (Release 3) of the interrogation network computer program has been completed according to the specifications given in the previous semiannual report.

Three documents attached to this report provide greater detail on the architecture and operation of the interrogation network computer program (Release 3). These are (1) the Programmer's Guide, which describes the system programs and file structures; (2) the Chairman's Guide, which describes and provides instructions for the running of an inquiry via the interrogation network; and (3) the Respondent's Guide, which gives simplified instructions for participation in such an inquiry.

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Semiannual Technical Report

5 April 1973

ARPA POLICY-FORMULATION INTERROGATION NETWORK

Contract No. DAHC 15 72 C 0165

Sponsored By:

Advanced Research Projects Agency

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Contractor:	Institute for the Future 2725 Sand Hill Road Menlo Park, CA 94025
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CONTENTS

I. PROJECT ACCOMPLISHMENTS

This is the second Semiannual Technical Report describing work in progress on a two-year project concerned with the development of a group interrogation network for policy formulation. Together with the first such report, submitted on 5 October 1972, the present report summarizes the work completed during the project's first year (6 March 1972 - 6 March 1973).

INTERROGATION PROGRAM, RELEASE 3

Release 3 of the program package which controls the operation of the interrogation network became operational on 10 January 1973 and is now resident at both the USC-ISI (formerly RAND) and BBN PDP-10 sites as a working program. Technical characteristics of this program are described in the Programmer's Guide, attached, while its operational philosophy and instructions for its use may be found in the Chairman's Guide and Respondent's Guide, also attached.

Basically, the interrogation program performs three major functions. First, it guides the chairman of an inquiry in setting up, in advance, the files necessary for conducting the inquiry. When the set-up process is complete, these files contain highly structured information about the group of intended participants, the agenda of topics and questions to be treated, and the specific information elicitation, processing, and feedback activities to be undertaken. Second, the program performs the routine functions of administering the inquiry: providing instructions to inquiry participants, leading them through the agenda, posing questions, storing and processing answers, and presenting summaries of results--all according to the chairman's specifications. And third, the program allows inquiry participants to interrupt their activities and call for special functions such as review of instructions or substantive background, communication with other participants,

deviation from the agenda, alteration of the agenda, and monitoring of both the accumulated data and the status of participants.

In its specific characteristics, Release 3 reflects the plans described in the previous semiannual report. It therefore contains the following features, detailed in the earlier report: command languages, interrupt capability, adaptive instructions, type-ahead capability, message handling, loss-of-carrier response, editing of text input, and synchronous conversational capability. Several other key features have been added to the control program as of Release 3 which were not anticipated in the earlier report. These include use of linked-allocation "tree" indexes in most of the files; improved handling of unexpected or faulty user input; and an extended command repertoire for the expert and chairman.

INITIAL SYSTEM TESTS

Informal shake-down tests of the interrogation network have been conducted using up to five terminals, including participants in remote locations (e.g., across town, in Los Angeles, etc.). Four leased terminals are currently available on the Institute's premises and two more are on order, allowing somewhat more elaborate tests to be conducted in the future.

On the whole, the new features in Release 3 have been found to perform adequately. Some problems have been encountered, however, particularly with the synchronous conference feature; these are discussed in Section II of this report. The communications services provided by the ARPANET computer-communication network, including the interface with the USC computer where most of our work has been done, have been entirely satisfactory during the past few months. Reliability of the USC computer has also improved recently, with substantially less down-time than heretofore. Unfortunately, perhaps because of the computer's improved reliability, it has become much more heavily loaded with users, especially during working hours of the day. As a result, performance of the interrogation network program has become somewhat slower, with the inquiry participant sometimes having to wait several seconds for the computer to respond to his input. Attention is now being given to possible ways of minimizing this difficulty.

SPECIFICATIONS FOR PARALLEL CALLED-UP VOICE CIRCUIT

As called for by the project contract, preliminary design specifications for a voice-conferencing system appropriate for use as an adjunct to the on-line interrogation network were prepared and submitted on 1 March 1973. Five separate models were hypothecated, differing from one another in several dimensions to permit consideration of various system parameters. Detailed block and circuit diagrams and rough cost estimates were prepared. Because the Institute is without hardware development capability and facilities, final design and fabrication of any such system would have to be performed elsewhere and outside the present contract.

II. CURRENT PLANS:
GENERAL PROBLEM AREAS

LOGIC OF SYNCHRONOUS COMMUNICATION

Initial tests of the interrogation network have demonstrated certain difficulties with the synchronous conference mode of operation.

The present design of this feature allows any agenda item to be designated in advance as a "conference" item. As inquiry participants progress through their assigned activities, eventually someone will reach the item, at which point the chairman is automatically informed of the fact. Since not all participants needed for the conference are ready for it yet, however, the first-arriving participant is allowed to go on to subsequent activities for the time being. As soon as a sufficient number of participants have reached the item (i.e., a quorum), the chairman issues his *CALL CONFERENCE* command, thus summoning all members of the quorum "into the conference". Each of the conferees is shown the topic or question to be discussed and then is invited to type his initial response, comment, or whatever. As soon as he has indicated that he has finished typing, he is automatically shown all other inputs received so far from the other conferees. Should he wish to react to one of the other conferees' comments, he may either wait until output ceases (i.e., he has seen all other comments) or he may start typing his reply, interrupting this output, at the end of the comment being printed currently. In either case, his input will be filed at the end of the queue.

With a small number of conferees, this system works fairly well, having much the same spirit and timing as a face-to-face conversation. Trouble arises, however, when the participants are more numerous. If there are, say, five participants in the conversation, each time one conferee finishes entering a comment he will have to examine roughly four other comments (probably quite unrelated to his) before he can place another comment into the queue. Hence if he wishes to react to the first comment he sees, his

response will be seen by other participants only after two or three other comments have intervened. And this of course can get very confusing after only two or three such iterations.

One of the major logical problems now being considered, therefore, is that of how to coordinate each comment with that (or those) to which it refers. A number of approaches to this problem are imaginable, but the complexities are great and more work in this area clearly is required.

NEED FOR OTHER MEDIA

Initial system tests with participants who are not computer specialists have demonstrated that such individuals often find it confusing and uncomfortable to have to communicate via a computer terminal. Although many features have been and will continue to be incorporated into the interrogation network to minimize confusion, some of the discomfort frequently persists, especially when a user is first getting acquainted with the interrogation network or when a failure (e.g., computer crash) causes the network to behave in an unexpected manner (e.g., not at all). Furthermore, most individuals ultimately expected to participate in inquiries are management or academic personnel accustomed to having secretarial support for converting their thoughts into clear language text. Unless continued efforts to improve the man/computer interaction prove more successful than is currently anticipated, it would appear that additional media will be needed for comfortable communication via the interrogation network.

Among the imaginable alternative media, two-way voice is probably the simplest and most readily achievable. As discussed earlier, specifications for some possible voice systems have been submitted as part of this project. Release 5 of the interrogation network program is tentatively expected to include some provision for coordination with a voice circuit.

III. CURRENT PLANS:
FUTURE RELEASES

RELEASE 4

Because some of the features previously planned for Release 4 of the interrogation network program have already been incorporated into Release 3, the present plans for Release 4 include some features originally scheduled for Release 5. Release 4, currently under development, will include the following main features:

- Capability to hold many inquiries concurrently
- Automatic assignment of a participant to the correct inquiry
- Automatic assistance to the chairman in creating an inquiry
- Definition and implementation of umpire's role: responds to information and "help" requests, resolves procedural disputes, and monitors status of whole inquiry at all times (suggesting desirability of his having a second terminal, on which an inquiry-status display would be continually updated)
- Definition and implementation of editor's role: examines and edits text input, forwards messages to appropriate participants, procedures for aggregating text input, use of an intelligent text editor
- Preparation of simple Robert's Rules program which will monitor all respondent inputs and respond to any "motions" detected. Procedure will be roughly as follows. If "motion" input is expected (e.g., respondent has been invited to make motion, or has indicated [perhaps by typing some special interrupt character] that he wishes to make a motion), input will go directly to editor for classification as to type of motion. If some other type of input is expected, error routines (e.g., checking for Y/N or number) will recognize

possible motion and send to editor as above. Once editor has classified a given motion, the system will proceed to handle it according to a prespecified hierarchy of what-may-interrupt-what; if the motion is out of order at the moment, the respondent will be told so and invited to withdraw motion or let it wait for appropriate moment (i.e., enter motion in queue). Initial version will have severely limited set of available motions (2 or 3 perhaps), to be extended later.

- Elicitation and processing of list information, including ranking and weighting
- Elicitation and processing of trend estimates
- Full implementation of ? command to obtain information of what is required at any point in the inquiry
- Anonymity option for inquiry
- Optional time clock on expert activities
- Improved economy of storage use by mapping files into core only as needed (including programs themselves)
- Conversion of all programs to reentrant code to minimize core usage and increase efficiency
- File backup and control transfer programs using BBN; this will include (1) program at USC to send copies of files to second computer periodically, (2) program at second computer to poll USC periodically and take over command if USC goes dead, (3) program at both computers to poll TIPs and IMPs used by respondents and inform chairman if anybody's entry device goes dead (so that he can give that user a phone call telling him how to find alternative entry point).

ARPA POLICY-FORMULATION INTERROGATION NETWORK

PROGRAMMER'S GUIDE

Release 3

INSTITUTE FOR THE FUTURE
2725 Sand Hill Road
Menlo Park, California

April 1973

PREFACE

This Programmer's Guide is a broad technical description of the ARPA policy-formulation interrogation network program, Release 3. Although this guide may be of interest to persons who merely intend to use the interrogation network, it is directed primarily toward assembly programmers who plan to modify or add to the program itself. Whereas the Program and File Specifications Notebook provides detailed specifications for each file and routine in the system, the Programmer's Guide places the files and routines in their logical and operational context. Of particular interest may be the indices, which clarify many of the terms used with specialized meaning here and in other documentation on the interrogation network.

Other documentation available on the interrogation network is as follows:

Respondent's Reference Cards
Chairman's Reference Cards
Respondent's Guide
Chairman's Guide
Program and File Specifications Notebook

ACKNOWLEDGEMENTS

The design and implementation of the policy-formulation interrogation network has been and is currently being performed by the research staff of the Institute for the Future. This effort is supported by the Advanced Research Projects Agency, Information Processing Technology Division, under contract DAH-C15-72-C-0165.

CONTENTS

I. INTRODUCTION: AN OVERVIEW OF THE INTERROGATION NETWORK

The ARPA policy-formulation interrogation network is a computer intermediary which assists in conducting on-line group inquiries. The computer, in conjunction with the ARPANET computer communications network, serves as a data collection, processing, and routing device which enables a geographically separated group of respondents to interact in a number of ways. The participants in such an inquiry comprise a control team and some number of respondents (say, between 5 and 30).

A. THE PARTICIPANTS

The control team is also referred to as the CUE team, since it will eventually consist of a Chairman, an Umpire, and an Editor; in the present version of the interrogation network computer program (Release 3), however, the control team is represented by the chairman alone.

The chairman is the initiator, leader, and overseer of an inquiry. It is the chairman who organizes the inquiry, prepares background information, has the final decision concerning the questions to be asked, and decides who is to be a respondent. The chairman is entitled to participate in che conference as a respondent, while his aides on the CUE team (the umpire and editor) will not be allowed to act as respondents.

The umpire will be the parliamentarian and second-in-command for the inquiry. It is the umpire who carries out participants' requests for information or for help in some aspect of the conference. The umpire handles procedural matters as much as possible so as to free the chairman to concentrate on the substantive matters of the inquiry.

The editor will be in charge of correcting, collating, and filtering the various types of input from all participants. It is the editor who must aggregate various kinds of text so as to make the information usable to the chairman, the umpire, and the respondents.

The respondents in a full-fledged inquiry will normally be experts on a particular subject, although the interrogation network is intended to be usable by other types of groups as well. Further, the respondents will normally remain anonymous from one another during the course of the inquiry.

B. CREATING AN AGENDA

The first step in conducting an inquiry is for the chairman to prepare an agenda, using one of the network's component programs. In essence, the agenda consists of a series of activities which the computer is to undertake for the respondent--such as print background information, elicit numerical estimate, print a summary of group estimates, and call a conference to discuss results. In its physical representation in the computer, the agenda follows a tree structure, each node of which is referred to as an agenda item, or simply item. Two types of items are distinguished:

1. Topics, which are included for information value only and are not intended to be "answerable."
2. Questions, which are by definition answerable and hence require respondents to contribute estimates or whatever data is desired.

Every item is assigned an item number of the form N.N.N.N.N, where N is a number between 0 and 99. This number designates the node's position in the tree structure relative to other items. To give an example of an agenda, one might have an inquiry concerning an issue such as "Crimes of Violence in the United States." Suppose that in this inquiry one wishes to consider a series of topics such as "Crimes of Violence in San Francisco", with subtopics such as "Armed Robbery in San Francisco." Under this last subtopic, the chairman might wish to pose to the respondents the question, "What is your estimate of the number of armed robberies that will occur in San Francisco in 1980?" Table 1 might then represent the sequence of agenda items as the respondent would see it.

Figure 1 shows this same set of agenda items in tree format, reflecting the agenda's inherent logical structure. In an inquiry, the computer program

ITEM #	TITLE AND TYPE
1	"Crimes of Violence in the United States" - Topic Item
1.1	"Crimes of Violence in Los Angeles" - Topic Item
1.1.1	. . .
1.1.2	. . .
1.2	"Crimes of Violence in Sacramento" - Topic Item
1.2.1	. . .
1.3	"Crimes of Violence in San Francisco" - Topic Item
1.3.1	"Armed Robbery in San Francisco" - Topic Item
1.3.1.1	"What is your estimate of the number of armed robberies that will occur in San Francisco in 1980?" - Question Item
1.3.2	"Homocide in San Francisco" - Topic Item
.	
.	
.	
etc.	

TABLE 1. SEQUENCE OF AGENDA ITEMS

traces each branch of the tree structure to its conclusion (end node), and then turns to the next branch--resulting in precisely the same sequence of items as in Table 1.

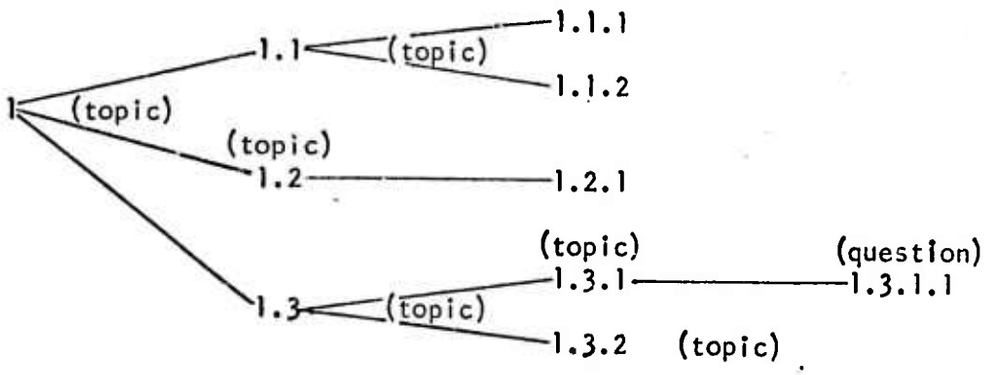


FIGURE 1

Each of the topic items in the agenda just described has two activities associated with it: (1) to print out the text of the topic so that the respondent knows the subject or issue to be addressed, and (2) to print any background information associated with that item. Question items such as Item 1.3.1.1 call for at least three activities, these being: (1) to print out the question, (2) to print any background information, and (3) to elicit (i.e., request, accept, and store in the computer) the respondent's reply. As indicated earlier, a question is an agenda item which calls for an answer. Four types of questions are currently allowed in an inquiry, in keeping with the following types of input data which can be accepted and processed.

1. Text in response to a specific question
2. Text contributions to an open-ended debate
3. Single-number estimates (integer, decimal, or floating point)

4. Probability distributions (represented by three single-number estimates corresponding to 1%, 50%, and 99% probability levels)

C. ASSIGNING AN AGENDA TO RESPONDENTS

In the simplest inquiry, the chairman can assign the entire agenda to the entire panel of respondents. All respondents thus pass through the same sequence of activities (unless individuals elect to exercise their option to deviate deliberately from the order that is set in the agenda, a capability which we shall discuss presently). It is also possible, however, for the chairman to assign different responsibilities to various respondents. In the current release of the network controlling program, he does this by:

- setting up a master agenda containing all items in which he is interested
- assigning it to one group of respondents
- altering the master agenda by deleting and inserting items
- assigning the revised agenda to a different group of respondents

During the ensuing inquiry, the interrogation network simply follows the partial agenda assigned to each respondent, even if this means that no two respondents see any of the same topics or questions. In the sample inquiry described earlier, one respondent (perhaps a criminologist from Los Angeles) might be assigned Items 1.1 through 1.1.2 while another respondent or group of respondents (San Francisco criminologists) would be assigned Items 1.3 through 1.3.2.

Commands are available whereby the chairman can modify either the master agenda or the participants' individual agendas by deleting or inserting items after the initial creation process. So long as the chairman makes these alterations before starting the inquiry, no complications arise. But if he tries to alter the agendas of respondents who have already begun work, some confusion can result. Special provisions will be included in later releases to facilitate agenda changes at any time, but for now the chairman is

encouraged to decide on his complete agenda assignments before starting the inquiry.

Once the chairman has set up an inquiry, he "opens" it for the respondents to begin their participation. Thereafter he may choose to declare himself a respondent and proceed to enter his own substantive contributions just as the other respondents do. Second, he may exercise a variety of commands to monitor the course of the inquiry, obtaining status reports on the participants, data summaries, and so forth. And finally, although this is not recommended, it is possible for him to alter the agenda for any or all respondents. He can do this by preparing a modified agenda, assigning it to the desired set of respondents, and then informing them that their agendas have been changed. They, in turn, execute a *CONTINUE* command (described later) and proceed with the revised agenda.

D. THE RESPONDENT'S PARTICIPATION

Having surveyed the interrogation network's operation from the chairman's viewpoint, one should also consider the respondent and his participation after the chairman initiates an inquiry. After logging into the network inquiry at the appointed time, the respondent is asked to identify himself, is assigned a respondent number, and begins his assigned activities. The program, meanwhile, begins storing not only the information which he deliberately inputs in response to the questions of the inquiry, but also some information about him. For instance, a status word is created for him, containing (a) a set of flags which indicate whether he is presently engaged in some activity within the network, has a message waiting for him, etc., and (b) a skill rating, which records his evident familiarity with the network programs as indicated by the frequency with which he makes errors (i.e., makes inputs which deviate from the controlling program's expectations). The purpose of this rating is to determine the amount of detail to be included in the instructions and error messages which the respondent receives.

Four modes of operation are possible for the respondent. The first and simplest is the question and answer mode (Q & A mode), in which the respondent simply follows the instructions which the controlling program gives him,

reads whatever is presented to him, and answers whatever is asked. An inquiry in which this inquisitorial mode is used exclusively is actually an "on-line questionnaire." Use of the other modes of operation imply interaction between respondents.

The second mode is the synchronous discussion mode. Unlike Q & A mode, in which it is entirely possible for no two respondents to be working on the same agenda item at the same time, discussion mode provides for simultaneous consideration of and conversation about a single item by two or more respondents. A conference consisting entirely of the discussion mode would be nearly equivalent to a face-to-face group conversation and, hence, would require all participants to be on-line at the same time and to proceed no faster than their slowest colleague. To avoid these restrictions as much as possible, inquiries can have both synchronous and asynchronous portions, respondents being allowed to proceed at their own pace most of the time and being called together for synchronous discussion only when necessary. To facilitate such "mixed-mode" inquiries, the interrogation network contains a mechanism for interrupting a respondent who is working asynchronously and summoning him into the required synchronous discussion. This mechanism minimizes disruption of the respondent's train of thought by (a) waiting to interrupt him until he reaches a "good stopping place", i.e., the end of the agenda item on which he is currently working, and (b) sending him back to the appropriate point in his asynchronous activities as soon as the discussion is over.

Third is command mode. Any participant may escape from his prearranged sequence of activities and enter command mode by pressing the ESC or ESCAPE (or ALT) key on his terminal at any time. From command mode, he can call for a variety of special actions by typing commands such as *HELP* or *RESTART*. For additional detail on the respondent's available commands, refer to the program descriptions in the Index of Respondent's Commands.

Finally, the respondent can be in link mode, communicating directly with one other inquiry participant via a hardware "link" between their terminals. All characters which are printed out on the one respondent's terminal--including those which he himself types--are simultaneously printed out on all linked terminals. Because of the confusion which could result

from an undesired link, each participant is ordinarily protected against link attempts by a "refuse links" flag in the system. Someone seeking to link to him issues a link-request command to the system, which in turn rings a bell on our respondent's terminal. He then may accept the link by halting whatever he is currently doing, going into command mode, and issuing an accept-links command; or, if he prefers not to be bothered, he may refuse the link request by simply ignoring the bell. If the link is established, conversation continues until one or the other party returns to command mode, thus breaking the link; both parties then resume their activities by issuing appropriate commands.

II. FILE STRUCTURE

Turning now to the program's architectural details, we may begin by describing its data storage and retrieval facilities. When the chairman sets up a conference, four files are automatically created. These are:

- The Instruction File, containing background information on the interrogation network, on the subject of the inquiry, etc. This information is offered to the respondent when he first joins the inquiry, and may subsequently be accessed by the respondent via his *INFORMATION* commands.
- The Topic File, containing the complete agenda and information associated with each agenda item (such as background information on that item and processed results of completed activities regarding that item).
- The Text File, in which all raw (i.e., unprocessed) respondent inputs are stored for subsequent retrieval and processing.
- The Control File, containing the system's own information about each respondent (such as his status word and his personalized agenda).

These files remain as the only disk resident artifacts of a particular inquiry. The interrogation network program (actually a family of programs) constitutes a fifth file. Thus for any full-fledged inquiry, five distinct files exist as the constituting elements. Since all five files are "shared" files, the individual respondent's participation does not require any personal secondary storage (i.e., disk, tape, etc.) All respondents use the same disk-resident topic file, text file, control file and instruction file. Thus there exist five files for an inquiry of five respondents as well as for an inquiry of thirty respondents.

The Tenex time-share executive under which the network programs run does not require entire files to reside physically in core. Rather, it

saves core space by allowing files to be mapped into core--i.e., program references to those locations in core where the file would be if it had been physically brought in are referred instead to the corresponding locations on the disk. Only those pages of the file (512-word blocks) actually being referenced are physically transferred into core.

Communication among the participants' programs is conducted through the files mentioned above, which are shared by all of the participants. That is, the four files are mapped into each participant's address space (the area of virtual core assigned to him), so that each copy of the interrogation network control program can use these files exactly as if it had sole possession of them. This arrangement poses one serious problem, namely, the danger that one participant's program may try to modify (i.e., write into) a file at the same time that another participant's program is trying to use (i.e., write into or read from) the same part of the same file. The program features designed to prevent this problem are discussed in the section on FILREF utility programs in Chapter IV.

A. FILE INDEXING

All entries in the four files used by the controlling program are indexed for efficient access as well as easy insertion, deletion and rearrangement of entries. Two basic index structures are used.

The first, outlined in Figure 2, uses linked allocations to create a tree structure which is logically equivalent to the item numbering system described earlier (see Section I, Creating an Agenda). Each entry in an index of this type corresponds to a node on the tree and contains, among other things, the addresses (relative to the first word in the file) of the index entries for adjacent nodes. Thus the index entry for item 1.1 tells where to find the entries for items 1.1.0 and 1.2. Data is stored in a file of this type by simply writing a block of data into the file starting at the current first free location (i.e., one word beyond the end of the last thing previously written in the file), then updating the "free file word" (pointer to the next word in which to store data) so that the

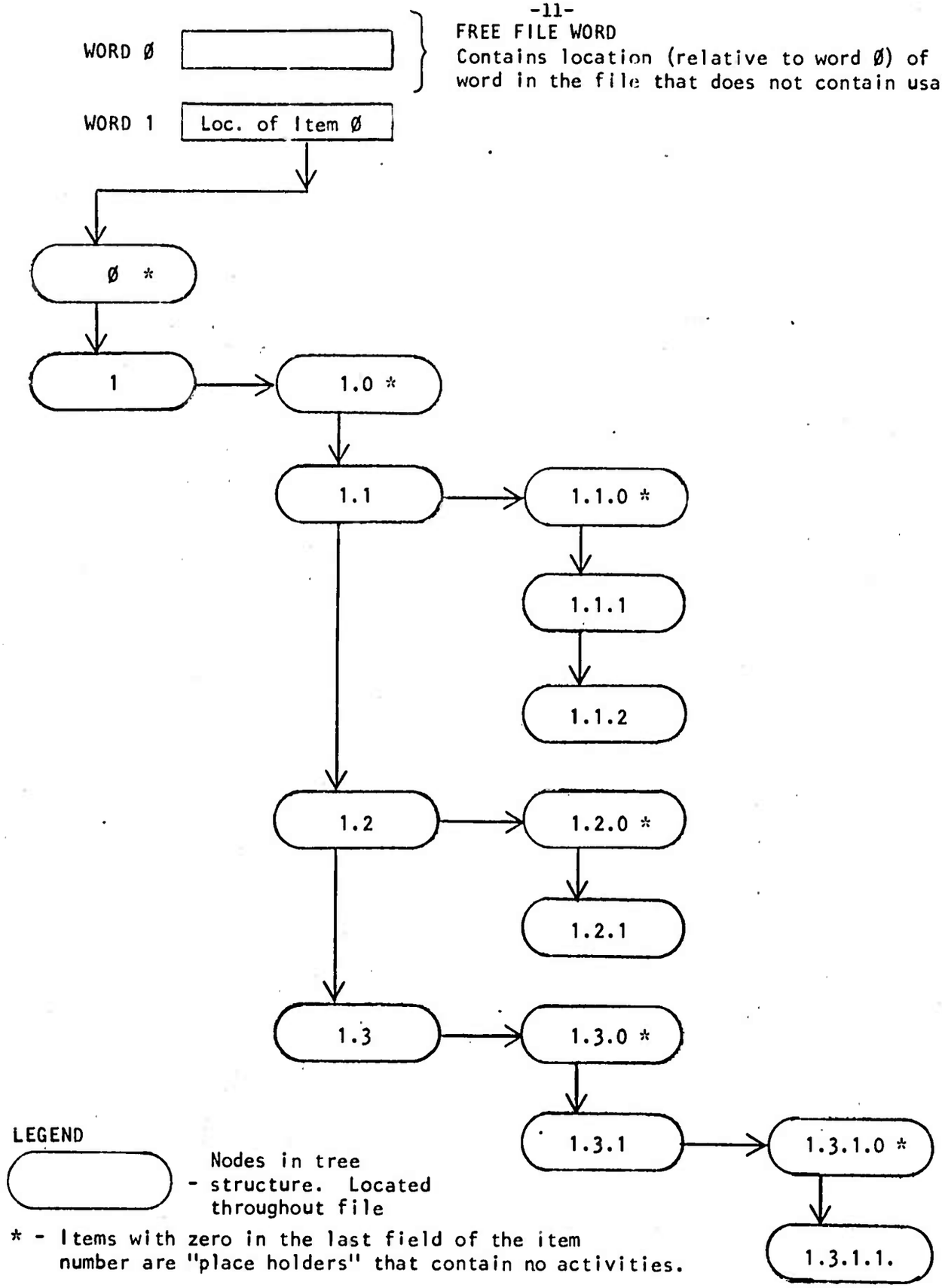
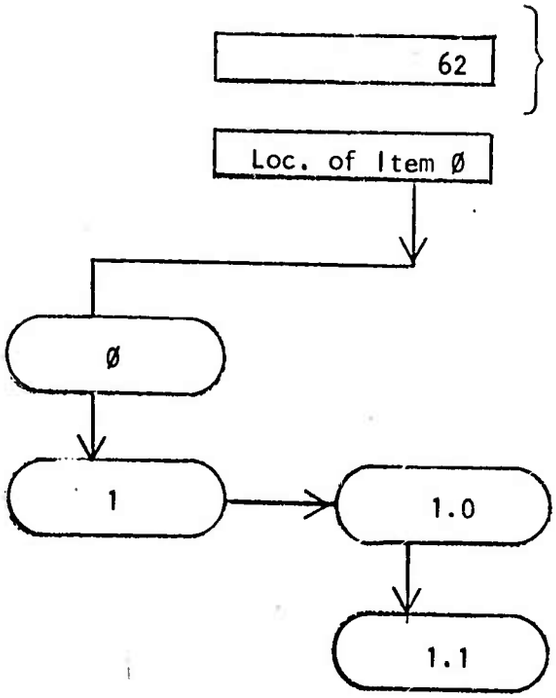

WORD Ø
WORD 1
Loc. of Item Ø
FREE FILE WORD
Contains location (relative to word Ø) of the next word in the file that does not contain usable data
Ø *
1
1.0 *
1.1
1.1.0 *
1.1.1
1.1.2
1.2
1.2.0 *
1.2.1
1.3
1.3.0 *
1.3.1
1.3.1.0 *
1.3.1.1.
LEGEND
Nodes in tree - structure. Located throughout file
* - Items with zero in the last field of the item number are "place holders" that contain no activities.

FIGURE 2

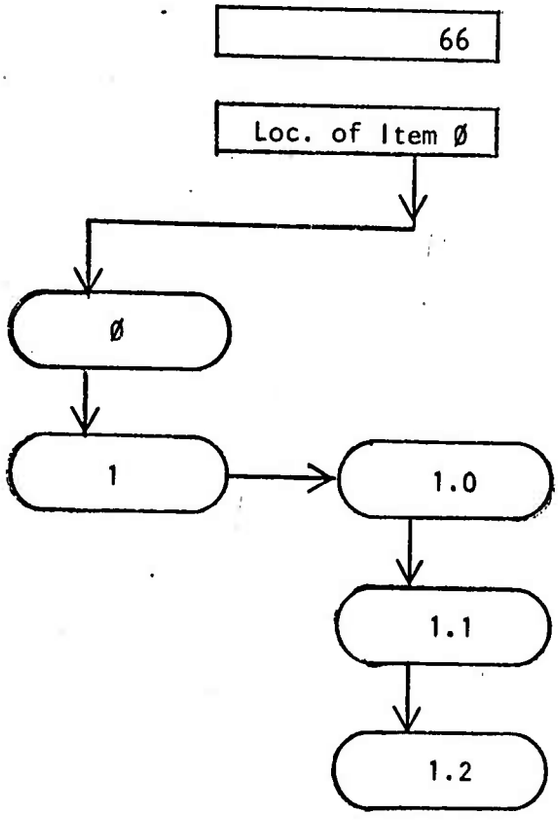
next data entry is not written over the entry just stored. The address (relative to word Ø of the file) of the starting word of the entry just made is used as a pointer and is placed in the appropriate node. The following figure depicts graphically the sequence of events in adding an entry to a file. At time t+2, an entry is made and the location or address of the entry is the address formerly kept in the free file word.



Time = t+1

Null pointer - no Item 1.2 exists.

At time t+2, someone creates entry 1.2 which takes four words of storage. The FREE FILE WORD is updated.



Time = t+3

Newly added entry - uses four words of storage. Placed at word 62.

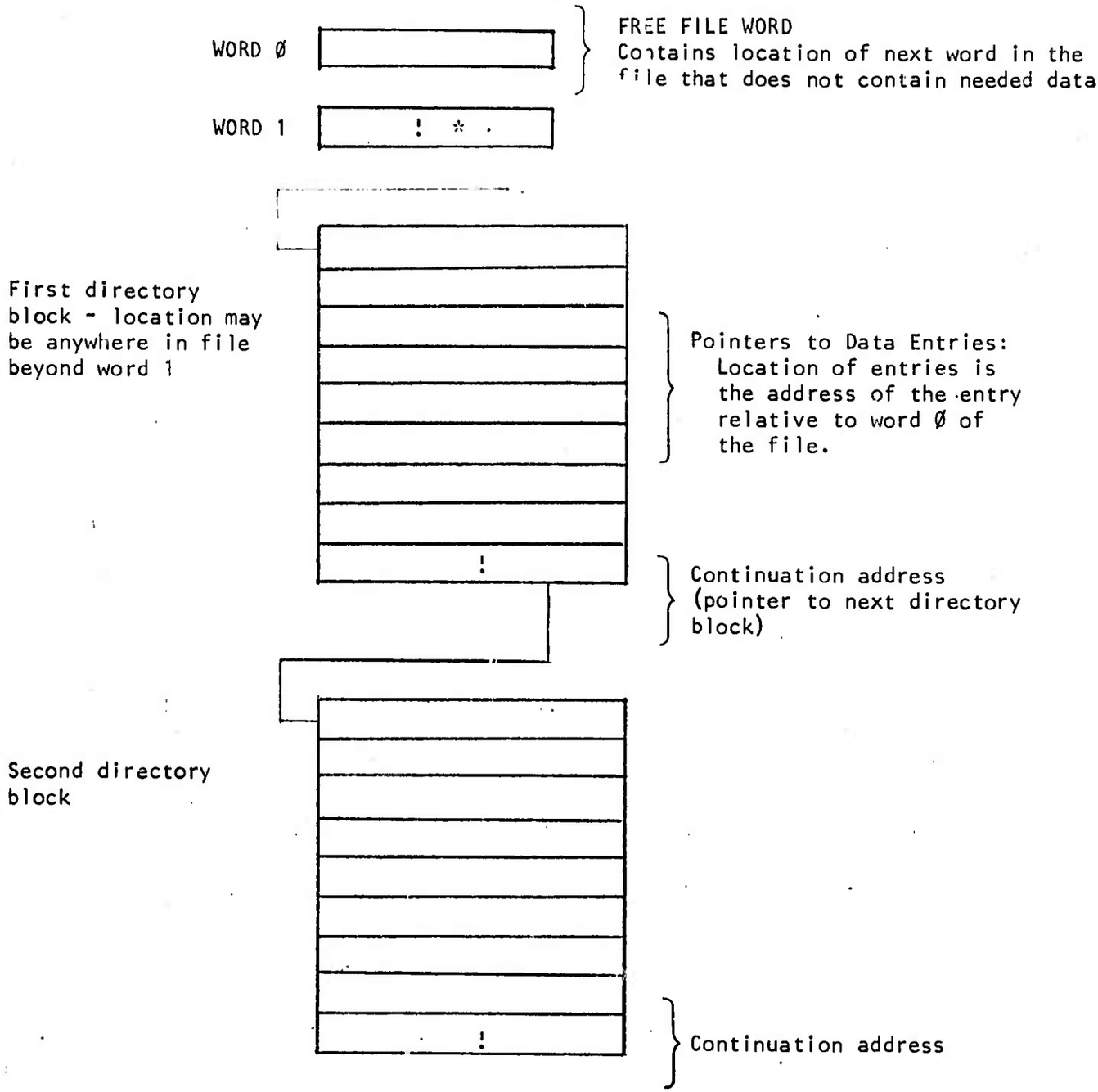
Null pointer - no Item 1.3 exists.

FIGURE 3

The other basic index structure illustrated in Figure 4, uses a directory block to store identifying information and starting addresses of data blocks in the file.

As in the first index structure, data is stored by writing it at the current first free location and then creating the appropriate index entry. Retrieval, however, in this case requires searching the directory for one or more entries whose identifying information matches some specified pattern. Rather than reserve an inordinately large directory area in the file at the outset, only one eight-word directory block is set aside at a time; when this block becomes full, another is created at the current first free location, and its address is stored in what would have been the ninth location of the previous directory block.

The physical size of the files obviously varies with the size and complexity of the conference, the number of participants, the amount of input received, and so forth. Upper bounds on file size are set by the size of the memory blocks allocated to them in the programs--10,000 words each for the Instruction and Topic Files, 20,000 words for the Text File, 30,000 words for the Control File. Since Tenex is able to recognize that a file is smaller than the space theoretically allocated to it, no more core or disk space is used by the files than is really needed.



LEGEND

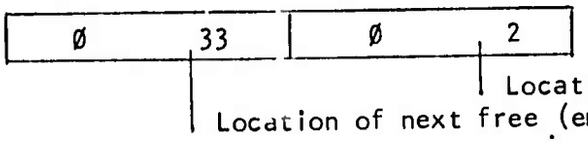
* - This word contains in the left halfword a count of the number of saved entries in this series of directory blocks

! - This word contains the address (relative to word Ø) of the next directory block containing pointers to entries

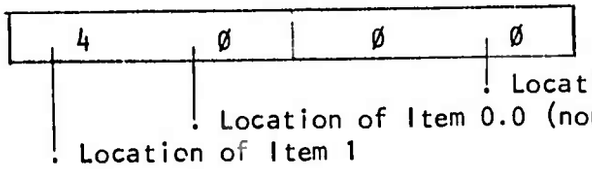
FIGURE 4

B. INSTRUCTION FILE

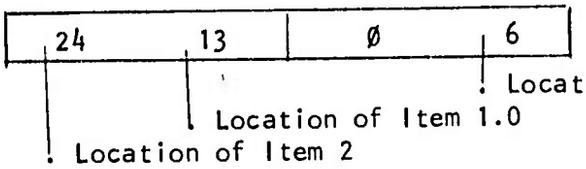
Figure 5 shows the detailed structure of the tree-indexed Instruction File, hypothetically containing three items of "instruction" text (1, 1.1, and 2) plus placeholders required by the tree logic (for empty items 0 and 1.0). Note that each word in the file consists of two half-words (18 bits each); that textual information is stored five characters per whole word (seven bits per character with one bit left blank at the end of the word), with each block of text terminated by a null byte; and that pointers (i.e., addresses) to any item which does not exist even as a place holder (e.g., Items 1.0.0, 1.1.0, 1.2, 2.0, and 3) are set to zero. Item numbers (such as 1.1) are not physically stored in the file, but are inherent in the sequencing of the index entries which are stored. For convenience, however, each node in the tree-structure may be referred to by its item number. Item numbers have five fields, and each field may take on any of ninety-nine levels; thus, item 1.1 is uniquely defined as the first level of field 2 for the first level of field 1.



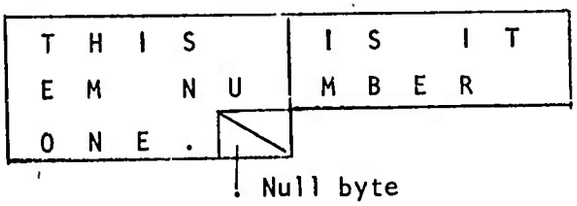
WORDS Ø & 1



WORDS 2 & 3

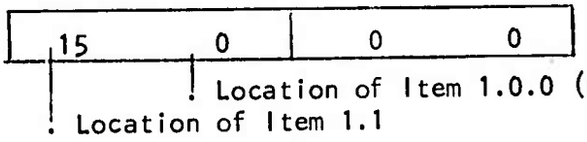


WORDS 4 & 5
(Item 1)

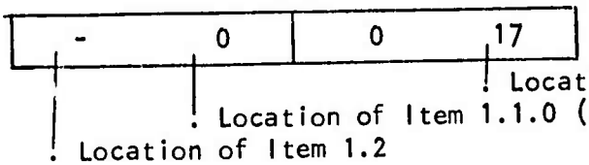


7-bit bytes
1 ASCII character/byte

WORDS 6 - 12
(text of Item 1)

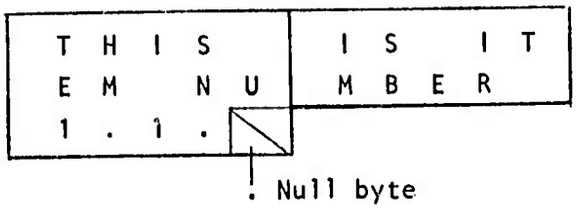


WORDS 13 & 14
(Item 1.0)

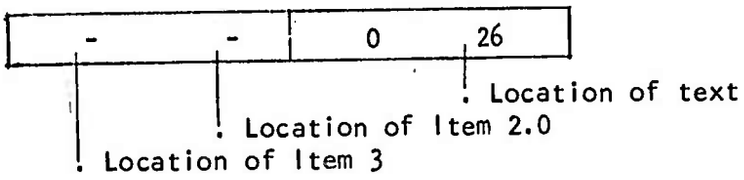


WORDS 15 & 16
(Item 1.1)

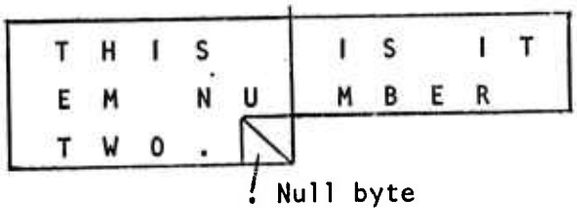
FIGURE 5. INSTRUCTIONS FILE



WORDS 17 - 23
(text of Item 1.1)



WORDS 24 & 25
(Item 2)



WORDS 26 - 32
(text of Item 2)

FIGURE 5. INSTRUCTIONS FILE (continued)

C. TOPIC FILE

Figure 6 describes the Topic File, which is triply indexed--a tree index leading to a particular agenda item, a directory, then cataloguing the files informational entries for that item, and finally an activity stack template identifying the overall conference activities scheduled for the item. In the illustrative example, a conference has been set up with two agenda items, numbered 1 and 1.1. Item 1 is a "topic"--i.e., it calls for no extraction of information from respondents but instead merely prints out two pieces of information (referenced in the Item 1 directory but not shown in the figure). Item 1.1 is a "question" which prints out three pieces of information (see Item 1.1 directory, locations 12-22), and then prints out results to date, extracts four kinds of information, (as shown in the Item 1.1 activity stack template, locations 67-100).

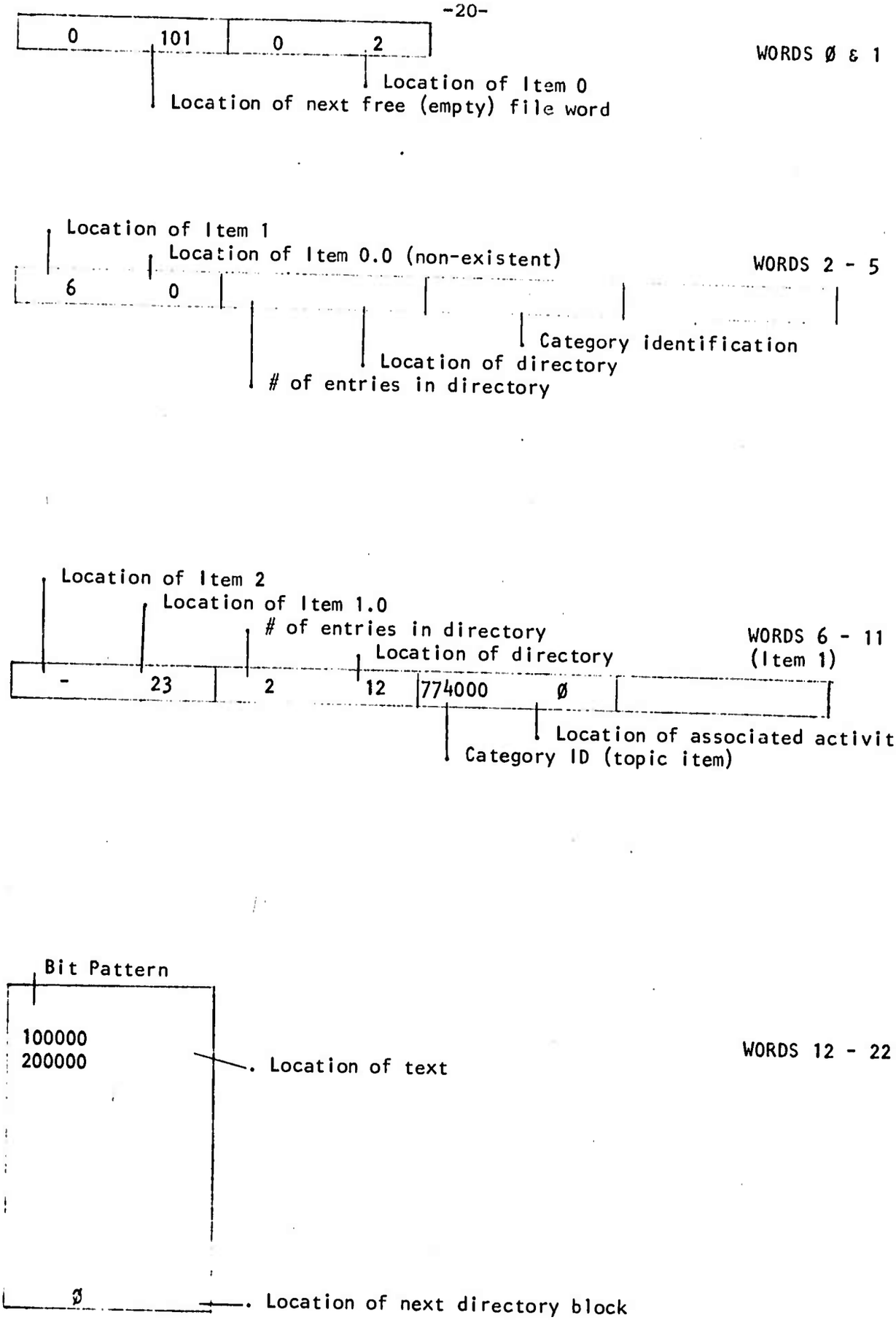


FIGURE 6. TOPIC FILE

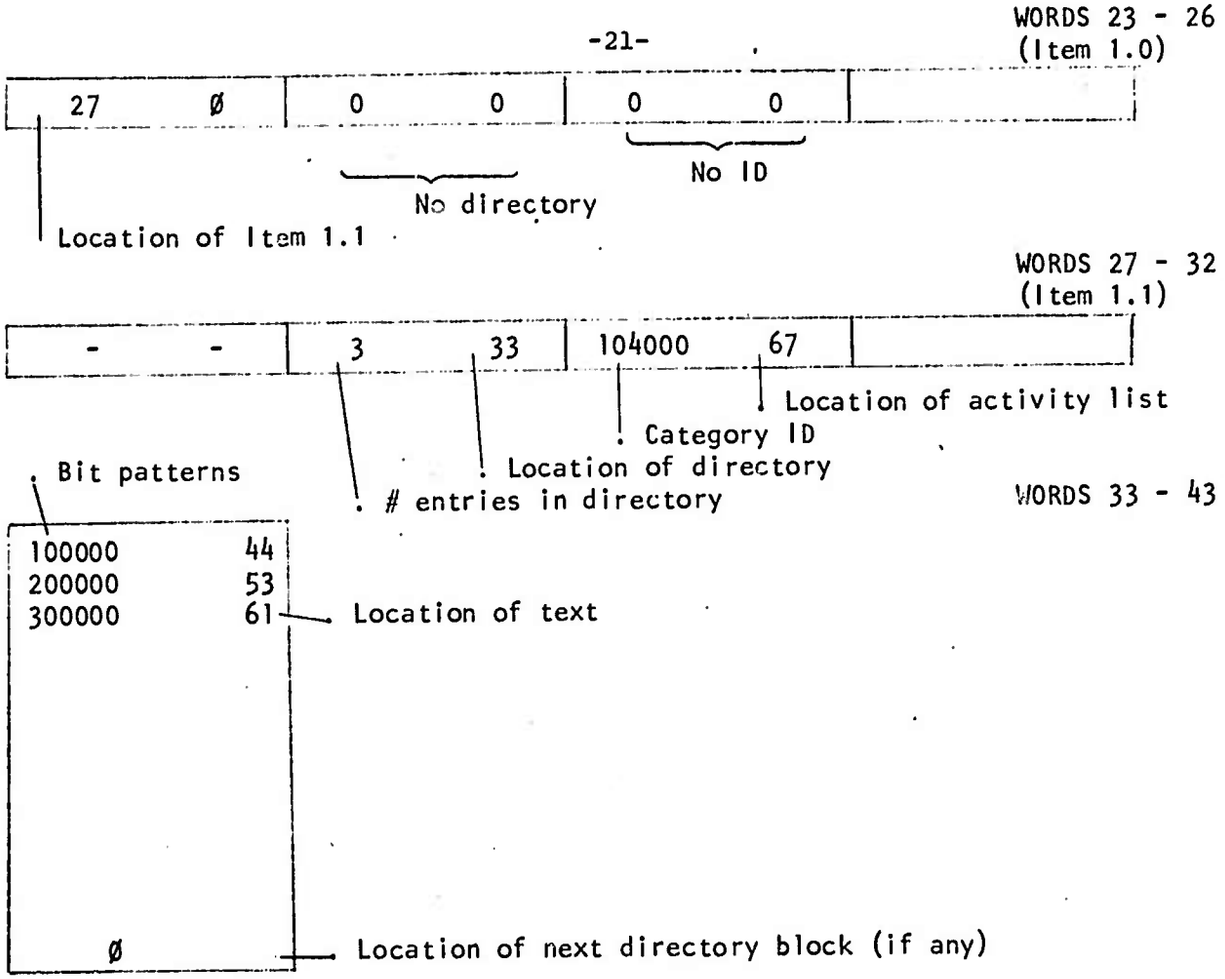
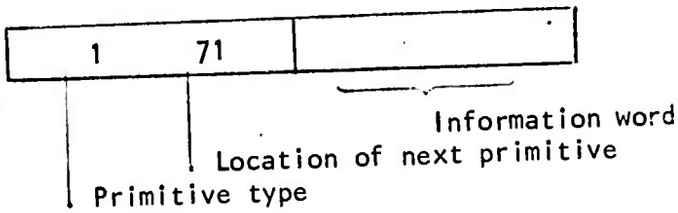
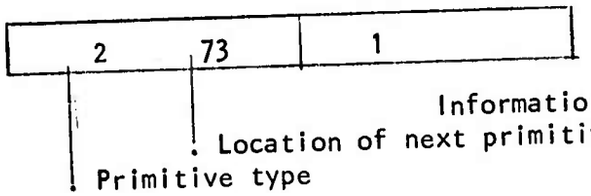


FIGURE 6. TOPIC FILE (continued)

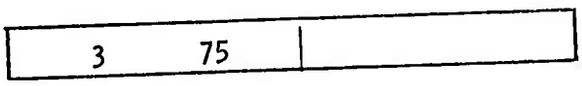
Activity List



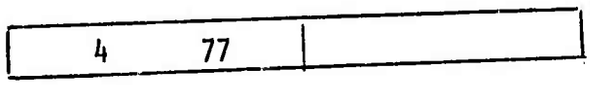
WORDS 67 & 70 (extraction type = 1 - text answer)



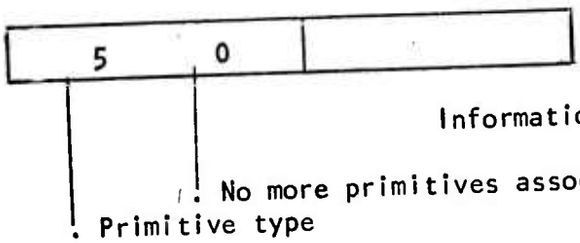
WORDS 71 & 72 (- conference)



WORDS 73 & 74 (single numerical variable)



WORDS 75 & 76 (probability estimate)



WORDS 77 & 100 (print results)

FIGURE 6. TOPIC FILE (continued)

D. TEXT FILE

The Text File, shown in Figure 7, is doubly indexed, with a tree index for finding a given item and directories for finding particular types of text (raw participant input). Two agenda items are shown in the example: Item 1 which asks for estimates of the sum of two and three, and Item 1.1 which asks for the respondent's last name. There are ten respondents, and at the moment the "snapshot" of Figure 5 is taken, all respondents have finished answering Item 1, but only Respondents 1 and 5 have answered Item 1.1. The next respondent who answers will have the text of his input stored in the file starting at the first free word (in this case word 64). One interesting feature of this illustration is that it shows a directory which has overflowed its initial eight-word block (locations 6-16) and for which a second such block has, therefore, been created (locations 45-55).

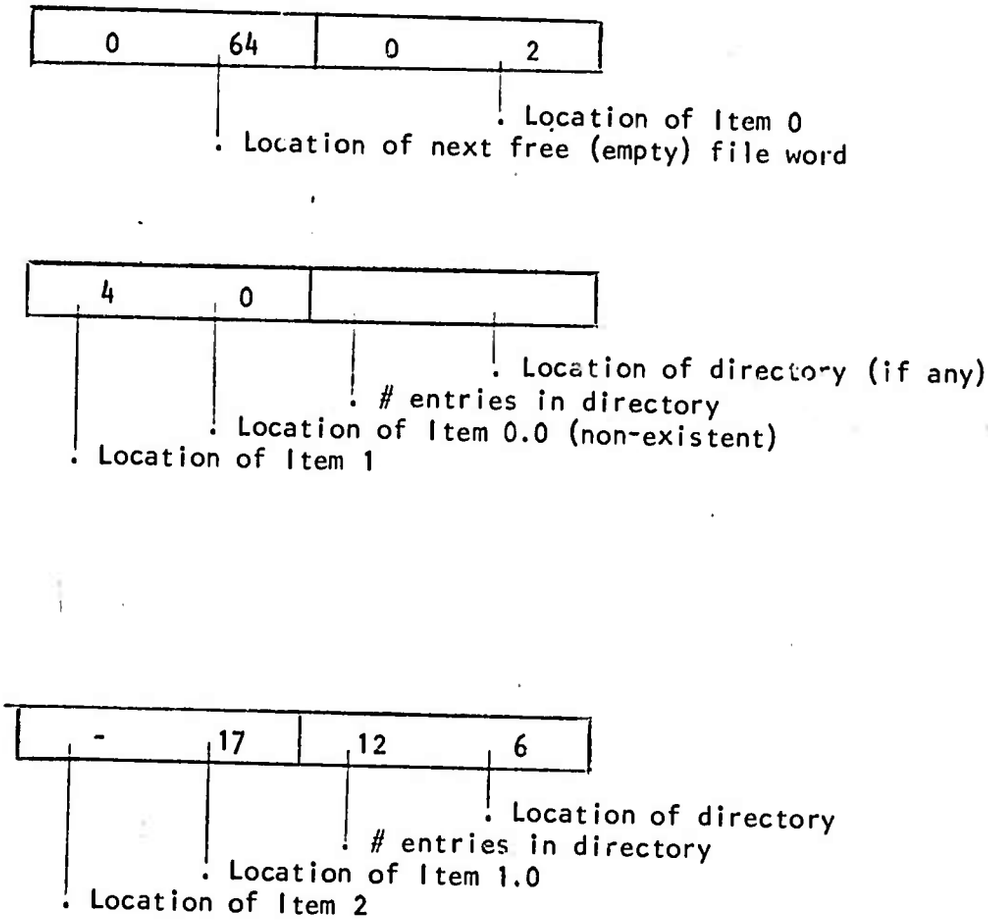
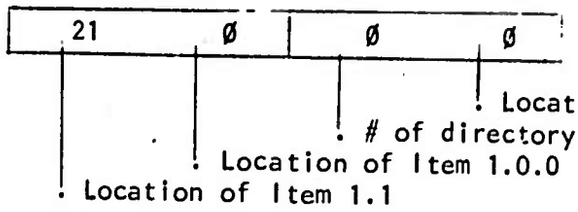
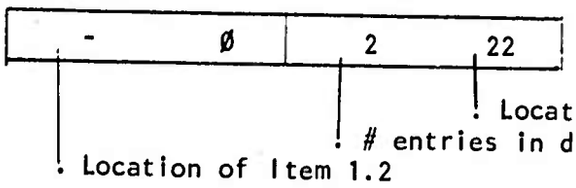


FIGURE 7. TEXT FILE



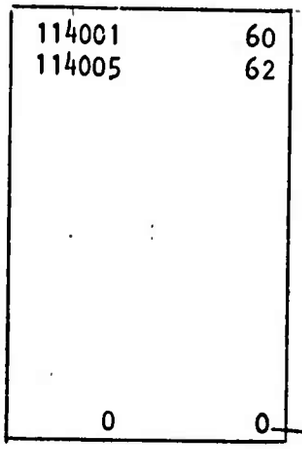
Location of directory
# of directory entries
Location of Item 1.0.0 (non-existent)
Location of Item 1.1

WORDS 17 & 10
(Item 1.0)



Location of directory
entries in directory
Location of Item 1.2

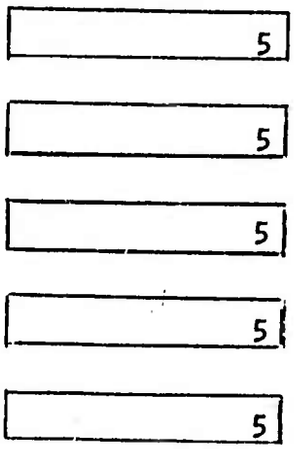
WORDS 21 & 22
(Item 1.1)



Left halfword = bit pattern
Right halfword = location of input text

Location of next directory block (non-existent)

WORDS 23 - 32
(one directory block for Item 1.1)



Input text for various respondents in response to question for single numerical variable

WORD 33

WORD 34

WORD 35

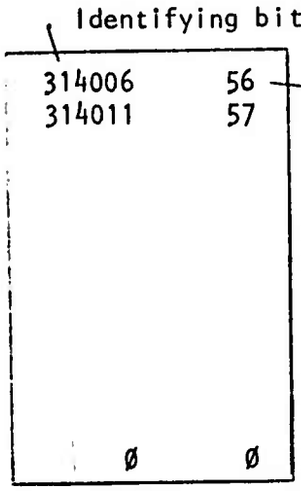
WORD 36

WORD 37

.
.
.

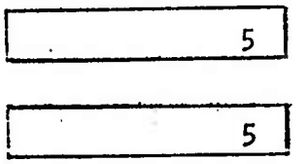
WORD 42

FIGURE 7. TEXT FILE (continued)



Location of input text

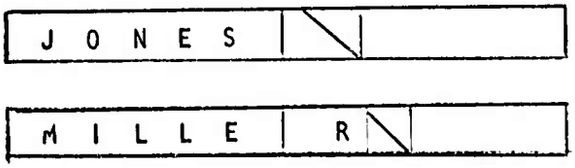
WORDS 45 - 55
(second directory
block for Item 1)



Answers to Question Item 1
for respondents 6 and 9

WORD 56

WOFD 57



Text entries made by
respondents 1 and 5

WORDS 60 & 61

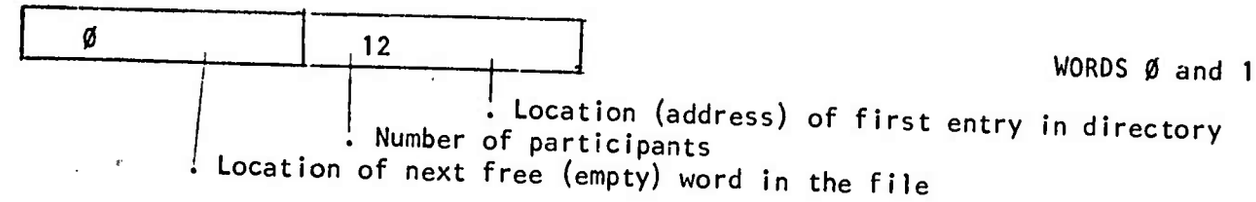
WORDS 62 & 63

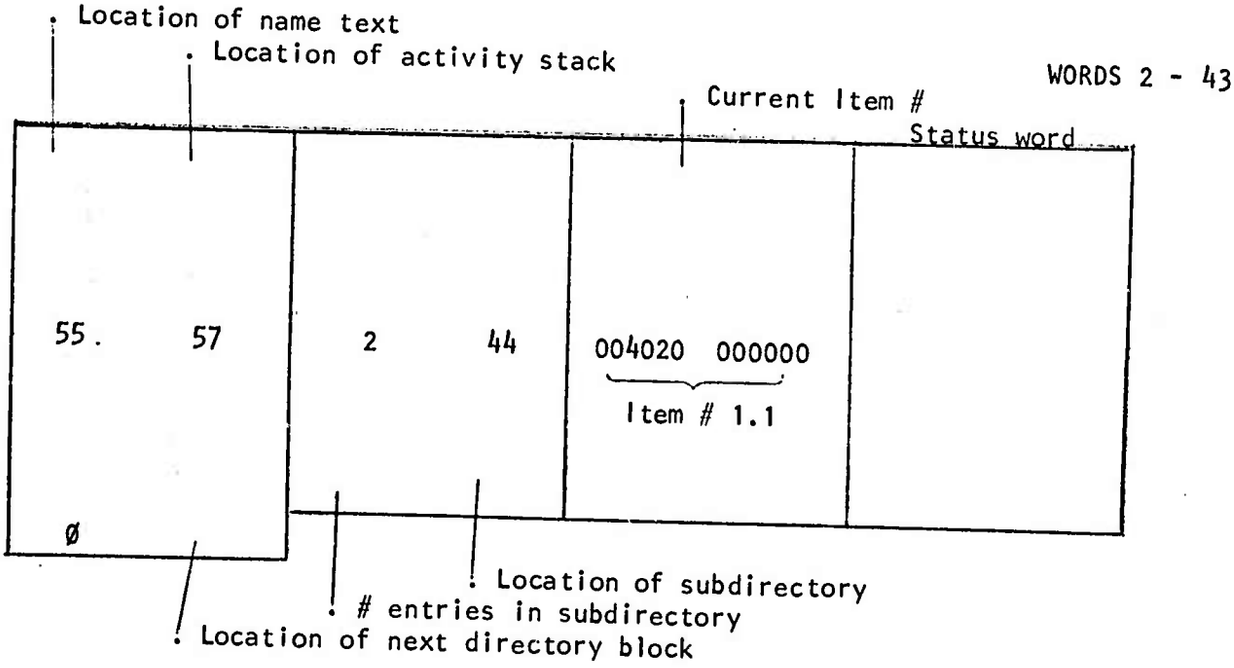
(text ends with null byte)

FIGURE 7. TEXT FILE (continued)

E. CONTROL FILE

Finally, Figure 8 shows the Control File. This file is indexed first by respondent number, using a thirty-six-word directory block with four adjacent words per respondent. This directory shows, for each respondent, where to find the text of his name, his personal activity stack (copied from the activity stack templates held in the Topic File), and the subdirectory which points to messages and other miscellaneous materials stored for this respondent in the Control File. The specific example illustrated in the figure shows all entries for one respondent, whose internal participant number is 5, corresponding to an external participant number of 101 (the CUE team having internal numbers 1-3 while respondents have internal numbers 4,5,...and external numbers 100,101...). Respondent 5 (= 101), named Miller, has received an activity stack based on the templates seen previously, and has one message in his directory (bit pattern 424 _____) from participant number 1 (the chairman).





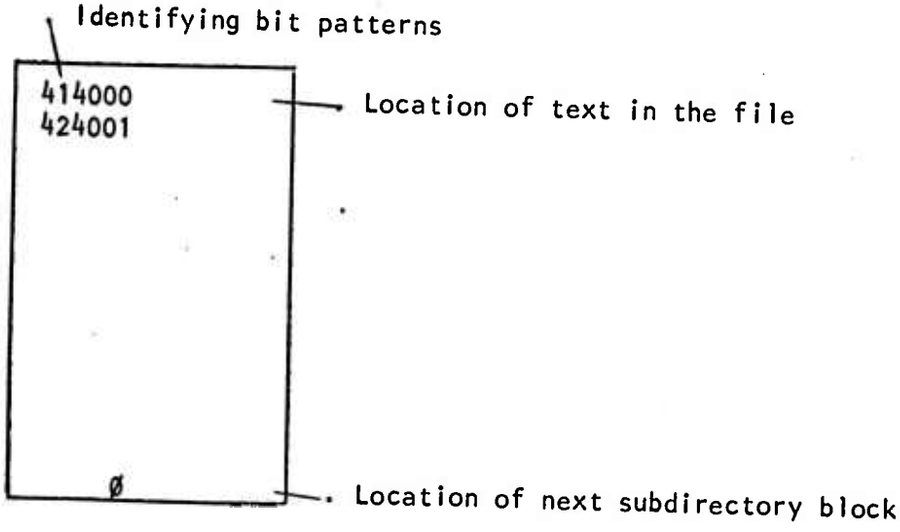
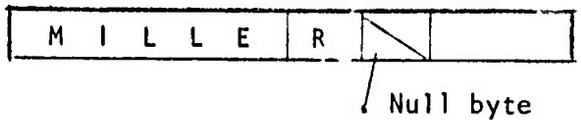
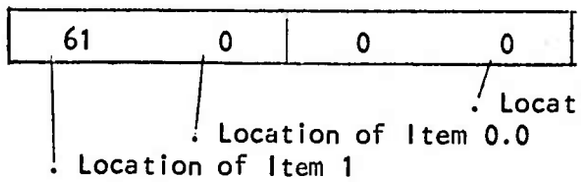


FIGURE 8. CONTROL FILE

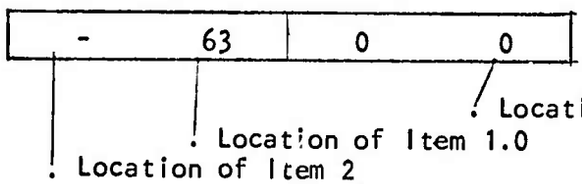


7-bits per byte
1 ASCII character/byte

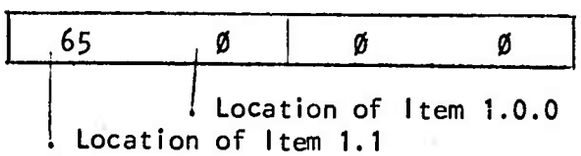
WORDS 55 & 56



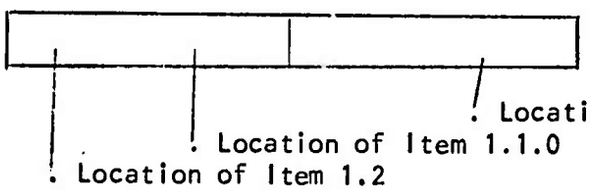
WORDS 57 & 60



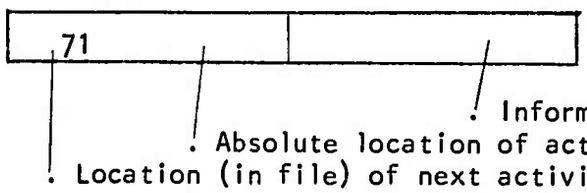
WORDS 61 & 62
(node designator)



WORDS 63 & 64
(node designator)

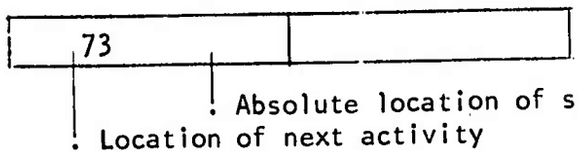


WORDS 65 & 66
(node designator)

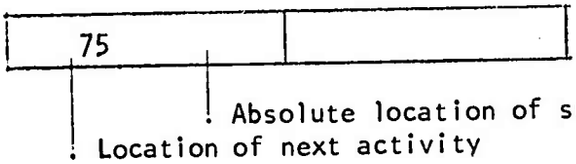


(Activities for
Item 1.1)
WORDS 67 & 70
(first activity
entry)

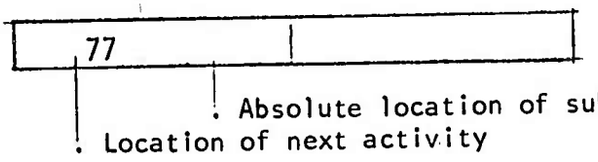
FIGURE 8. CONTROL FILE (continued)



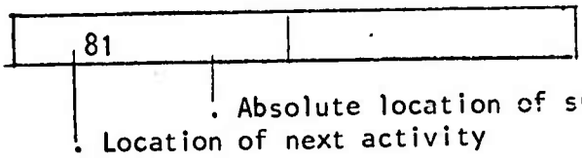
WORDS 71 & 72 (second activity entry)



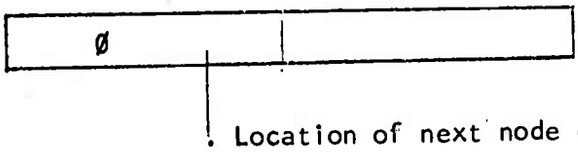
WORDS 73 & 74



WORDS 75 & 76



WORDS 77 & 80



WORDS 81 & 82 (end of activity entries)

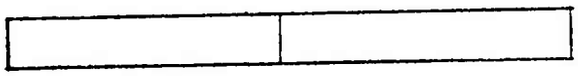


FIGURE 8. CONTROL FILE (continued)

III. INPUT/OUTPUT

All input to and output from the interrogation network is performed via remote terminals connected with the computer through the ARPA computer-communication network (ARPANET).

Basic input/output (I/O) operations (byte and string transfer, number conversions, etc.) are performed by Tenex JSYSs (monitor calls) under program control. Since the interrogation network has a variety of specialized I/O needs, additional routines which expand upon the I/O JSYSs have been included in the TERMIO utility library.

Since each conference participant is given his own copy of the program file when he logs in, all I/O activities focus on the participant's terminal, which is the primary input/output device in this system. Currently the core usage of the individual's program file is approximately 30 Tenex pages of 512 words (1000 octal). Whenever communication between two or more participants' terminals is called for, routines in the CMNCTN subsystem are used.

Because the interrogation network is intended to make the participant's task as simple and foolproof as possible, the program always "prompts" the participant when it expects input. Various kinds of prompts are used, ranging from lengthy and explicit requests (e.g., "PLEASE TYPE YOUR LAST NAME FOLLOWED BY A CARRIAGE RETURN") to simple herald characters (e.g., *, >, and #).

The program expects each line of input to be terminated by a carriage return (CR) and instructs the participant accordingly. If only a one-line input is required, the CR is also interpreted as the end of input; the program proceeds as soon as the CR has been received. If a multi-line input is expected, the program will respond to each CR with another prompt (i.e., herald character); requests for input will terminate only when a CR is typed on a blank line, immediately following the herald character.

All input is placed temporarily in an input buffer to allow for editing of typographical errors before the input is entered into the system for storage in a file and distribution to other respondents. Control characters are used to perform desired editing functions, according to the following code:

CTRL-A	Deletes the last character typed
CTRL-Q	Deletes the current line
CTRL-R	Types out the current line
CTRL-W	Deletes the last word typed on the current line
CTRL-X	Deletes the whole input (same as CTRL-Q if input is only one line)
CTRL-Y	Types out the whole input (same as CTRL-R if input is only one line)

When a participant is in command mode, his input is handled somewhat differently. Any time he terminates a single word of input by typing a space (or CR, which in this case is not treated as an input-terminator), the word is "looked up" in a command table. If the word of input exactly matches an entry in the command table, the command reader program either transfers control to the corresponding subroutine or turns to a subcommand table, whichever is appropriate for the particular command word received. If the original word matches part of an entry in the table, the remainder of the entry will be printed out and action will be taken as if the complete command had been typed. If the typed word matches part of two or more table entries, the participant's terminal bell is rung to indicate that the system requires additional input to resolve the ambiguity. Finally, if no match whatever is found in the table (i.e., the word is not a valid command), the system will make a complete list of valid commands available to the participant.

If the participant has a hard-copy terminal, all output to his terminal is paginated, with page size automatically determined according to the type of terminal being used. (This is ascertained by routine TRMTYP when the participant logs in.) Output is broken at regular intervals with a descriptive heading, date and time, and page number at the top of each new page. No such headings are used if the terminal is a CRT; but special provisions

are made to prevent information from scrolling off the screen before the participant has had a chance to read it. In the case of the CRT display, output ceases as soon as the screen is full; the participant is asked to type a CR as soon as he is ready to proceed. When he does so, terminal-control codes are transmitted to clear the screen, and output resumes. All of these paging functions are performed by a software paging monitor which maintains an output line counter and compares it (at each CR) with the page depth of the participant's terminal.

Some of the interrogation network I/O functions utilize special Tenex terminal-oriented facilities which should be mentioned here. The link mechanism allows output destined for a particular terminal to be sent to another as well. The terminal mode word maintained by Tenex carries a variety of information about a given terminal, such as an accept links bit which indicates whether or not the participant is willing to let another participant link to him. (This bit is normally off, to prevent unwanted interruptions; it is turned on by the ACTLNK routine, which is called by the *ACCEPT LINK* command.)

Of considerable importance is the Tenex pseudo-interrupt (PSI) capability, whereby program execution can be halted instantaneously. For example, when any of several prespecified terminal keys are pressed, control passes to whatever routine has been designated to handle PSIs on that particular PSI channel.

Finally, Tenex is able to perform certain conversions on special characters (e.g., control characters) in the output stream according to specifications recorded in the Tenex-maintained output control words.

IV. SYSTEM PROGRAMS

The interrogation network, Release 3, consists of 135 separate assembly-language programs organized into two executive programs, five subsystems, and three utility libraries. The general relationships among the programs are shown in Figures 11-15, which for clarity, omit the utility programs. In these figures, labeled lines originating at the top of the figures show the subroutine calls available as options to the chairman and respondent via their respective command languages; lines originating from the bottom of the figures show subroutine calls which happen automatically; and broken lines show utility subroutine calls.

The programs communicate with one another by means of the PDP-10's twenty accumulators, the shared files described in Section II, a hardware-implemented push-down stack indexed by accumulator 17 (reserved for this purpose), and the memory space allocated to the current job on the PDP-10. Certain locations in the memory space are given labels recognized by more than one program, so that these locations can easily be used for passing arguments. These global labels are listed and defined in Table 2, which also shows in what program file each routine is physically located.

A. THE EXECUTIVE PROGRAMS

The executive programs, CHAIR and EXPERT, are the first to begin execution when a participant logs in. Their main purpose is to initialize the complete conferencing programs of the chairman and respondent respectively. To do this, they:

- initialize the paging monitor for control of output displays
- set the Tenex terminal mode and output control words, in particular turning the link-accept bit off so as to refuse link attempts
- map the four shared files into this participant's memory space

TABLE 2. GLOBAL LABELS

Label	Program File in which Located	Definition
ACTSTV	PGMCTL	Location of activity stack
CMDTBL	CHAIR or EXPERT	Table of top-level commands, with pointers to subcommand tables or routines as appropriate
CRT	TERMIO	Terminal type (0=hardcopy, 1=Hazeltine, etc.--see program TRMTYP)
CRTLFL	CHAIR or EXPERT	Control File
INBUF	CHAIR, EXPERT, or CINSTF	General purpose input buffer (1,000 words)
INFTBL	INFMTN	Table of subcommands for the top-level command *INFORMATION*
INSTFL	CHAIR or EXPERT	Instruction File
INSTBL	SETUP	Table of subcommands for the top-level command *INSERT*
NUMBUF	CHAIR or EXPERT	Special purpose number buffer (100 words)
PDL	CHAIR or EXPERT	Pushdown list (100 words) used for passing arguments and keeping track of nested subroutine calls
PRTTBL	RSLTS	Table of subcommands for the top-level command *PRINT*
RESPND	CHAIR, EXPERT, or CINSTF	Internal respondent number (1, 2, ...)
SCRBUF	CHAIR or EXPERT	General purpose "scratch" buffer (4,000 words)
STPTBL	SETUP	Table of subcommands for the top-level command *SETUP*
SVTBL	RSLTS	Table of subcommands for the top-level command *SAVE*
TBLADR	PGMCTL	Location of current command table or subtable
TOPBUF	CHAIR or EXPERT	Special purpose topic buffer (100 words)
TOPDSG	PGMCTL	Topic designator (i.e., number of current agenda item)
TOPFL	CHAIR or EXPERT	Topic File
TXTFL	CHAIR or EXPERT	Text File

- initialize this participant's control-file parameters, such as the location of his name text, time of log-in, and location of his activity schedule
- enable the pseudo-interrupt system for:
  - escape, the universal interrupt giving access to command mode
  - loss of carrier, for automatic log-off and bookkeeping in the event that communication with the participant should fail
  - space character, to fill in uncompleted commands

In addition, EXPERT and CHAIR contain the main command tables which constitute the repertoire of commands available to the respondent and chairman, respectively.

The two executives differ in some respects, however. The EXPERT executive begins by asking the respondent to type in his last name, this recognition procedure being intended to allow correct control-file initialization as well as protection from unauthorized users. CHAIR, on the other hand, dispenses with this step on the assumption that the chairman need not go through such a recognition procedure. Both programs next ask what type of terminal the participant is using. Then EXPERT transfers control to the dispatcher program which uses the respondent's activity stack to guide him through his assigned schedule of conference activities, beginning at the first item or, if this respondent has been in the conference before, at the first item which he has not yet completed. CHAIR instead transfers control to the command reader program, thus leaving the chairman free to do whatever he wishes within the constraints of his command language.

Figures 9 and 10 are control flow diagrams for the CHAIR and EXPERT executives, showing those command functions and activities which (a) are called by the command reader and return control to it; (b) are called by the command reader but return control to the dispatcher; or (c) are called by and return control to the dispatcher.

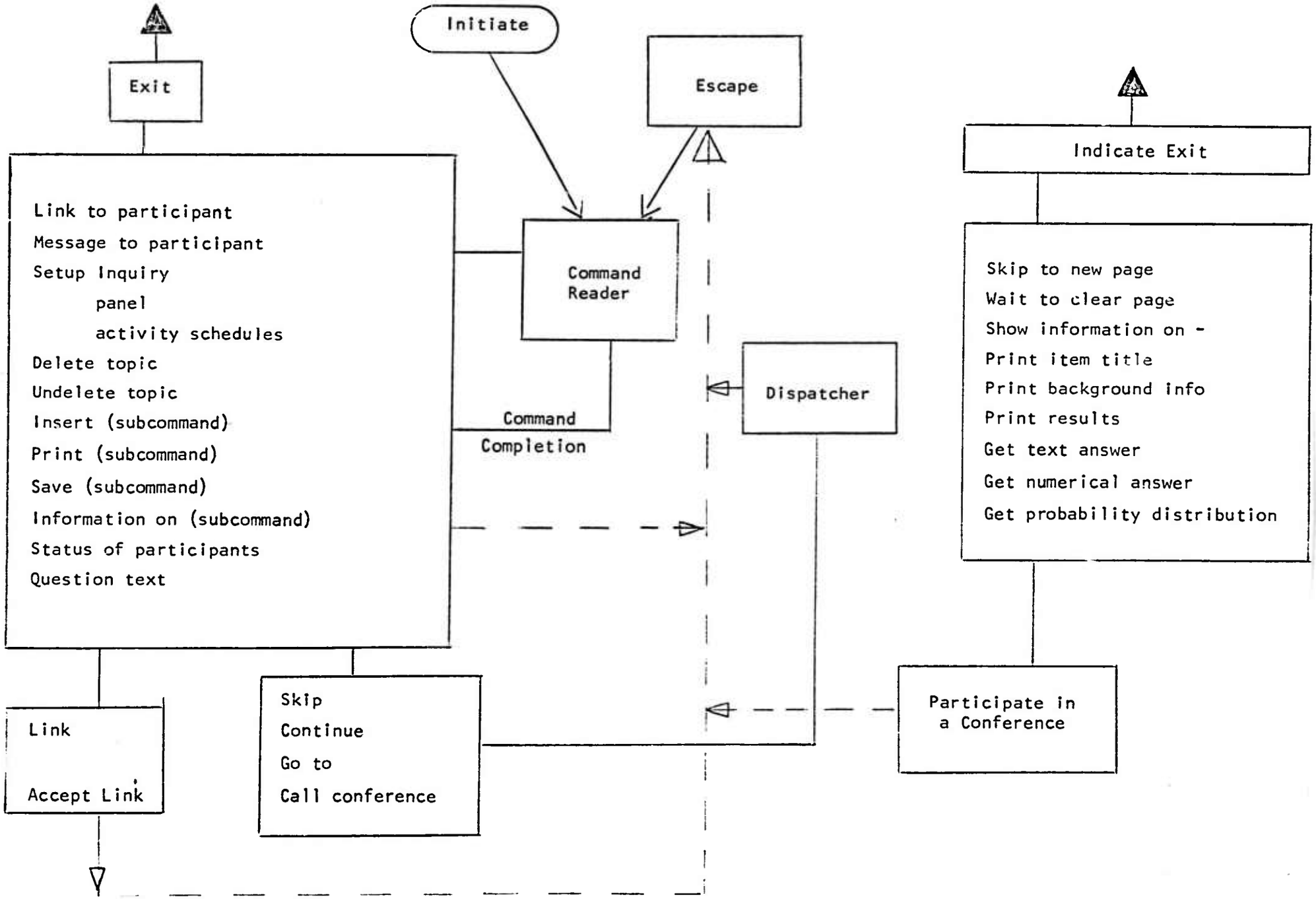


FIGURE 9. STATE DIAGRAM OF CHAIRMAN

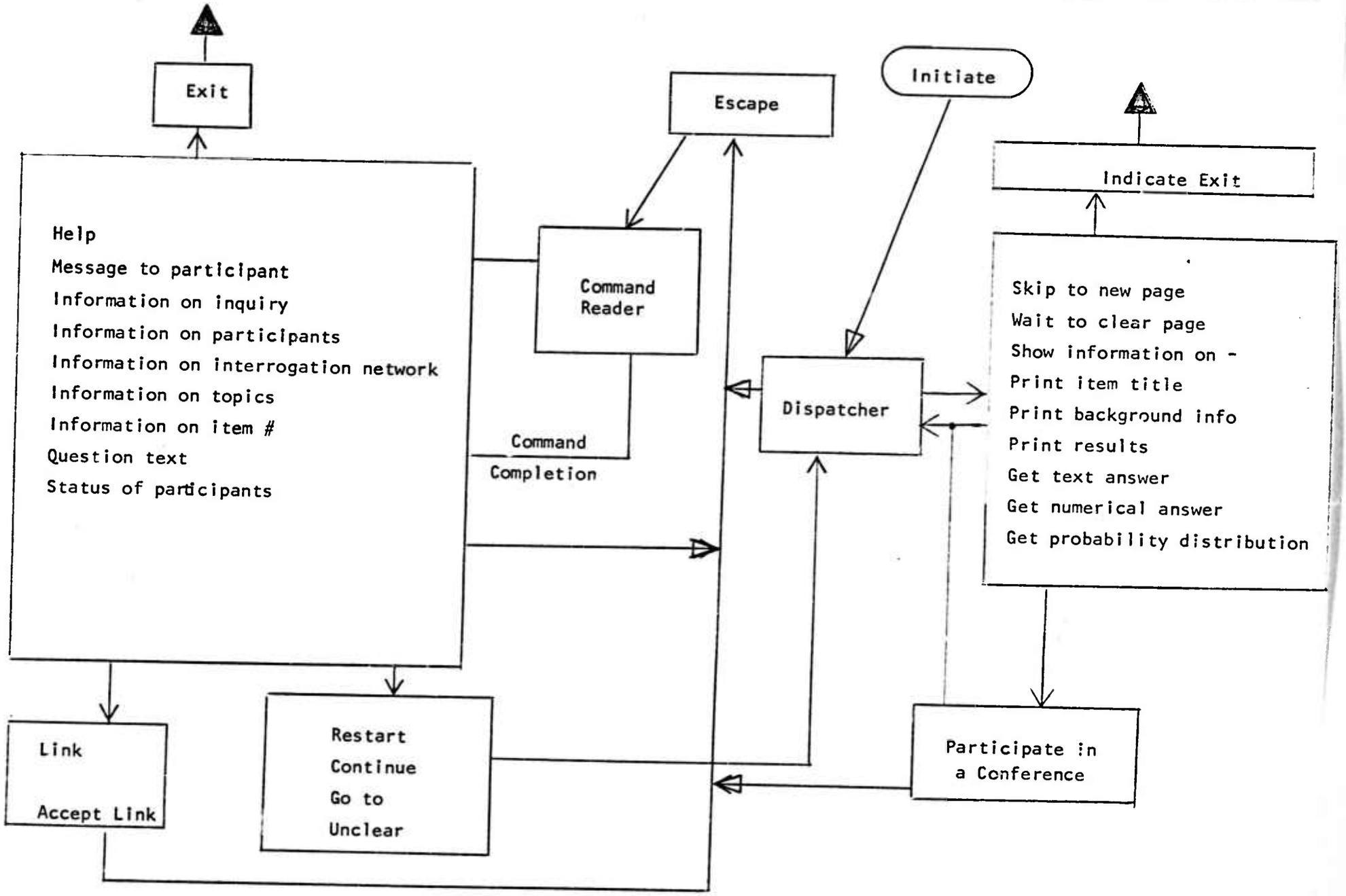


FIGURE 10. STATE DIAGRAM OF EXPERT

B. THE SUBSYSTEMS

SETUP

Overview. The SETUP subsystem is a set of routines called by the chairman to initiate an inquiry. SETUP consists of three main commands from the chairman's point of view (i.e., three separate high-level commands).

- *SETUP PANEL* allows the chairman to list by name the persons who will be the control team (i.e., chairman, umpire, editor) as well as the respondents to be included in the inquiry. In response to this command, the program STPPNL creates the Control and Text Files (see Section II), assigns respondent numbers to all participants, and creates a list of authorized names for gaining entry into the system.
- *SETUP INQUIRY* calls upon program STPINQ to construct the agenda for an inquiry by interrogating the chairman. The result of completing *SETUP INQUIRY* is a template agenda located in the Topic File. This template can then serve as a model for all respondents or can be altered by the chairman for specific respondents. (See the Topic File description in Section II.)
- *SETUP ACTIVITY SCHEDULES* causes the STPACT program to take the most recent version of the template residing in the Topic File and ask the chairman to whom this schedule of activities should be assigned. The result within the system of executing this command is the following:
  a) A skeletal version of the template agenda (a binary tree structure) and a copy of all the activities associated with each node in this tree structure are copied into the Control File for the respondents designated by the chairman.
  b) The structure is modified to permit "motion" through the tree structure by a respondent who wishes to have control over the agenda scheduling and does not wish to follow the present order. (See the description of the Control File in Section II.)

Thus, after *SETUP PANEL* (which creates a Control File and assigned participants their respondent numbers), *SETUP INQUIRY* (which creates a template of activities) and *SETUP ACTIVITY SCHEDULES* (which gives a copy of the agenda to each respondent specified), the inquiry preparation is complete; that is, a respondent may now log in and start his schedule of activities.

SETUP Subsystem

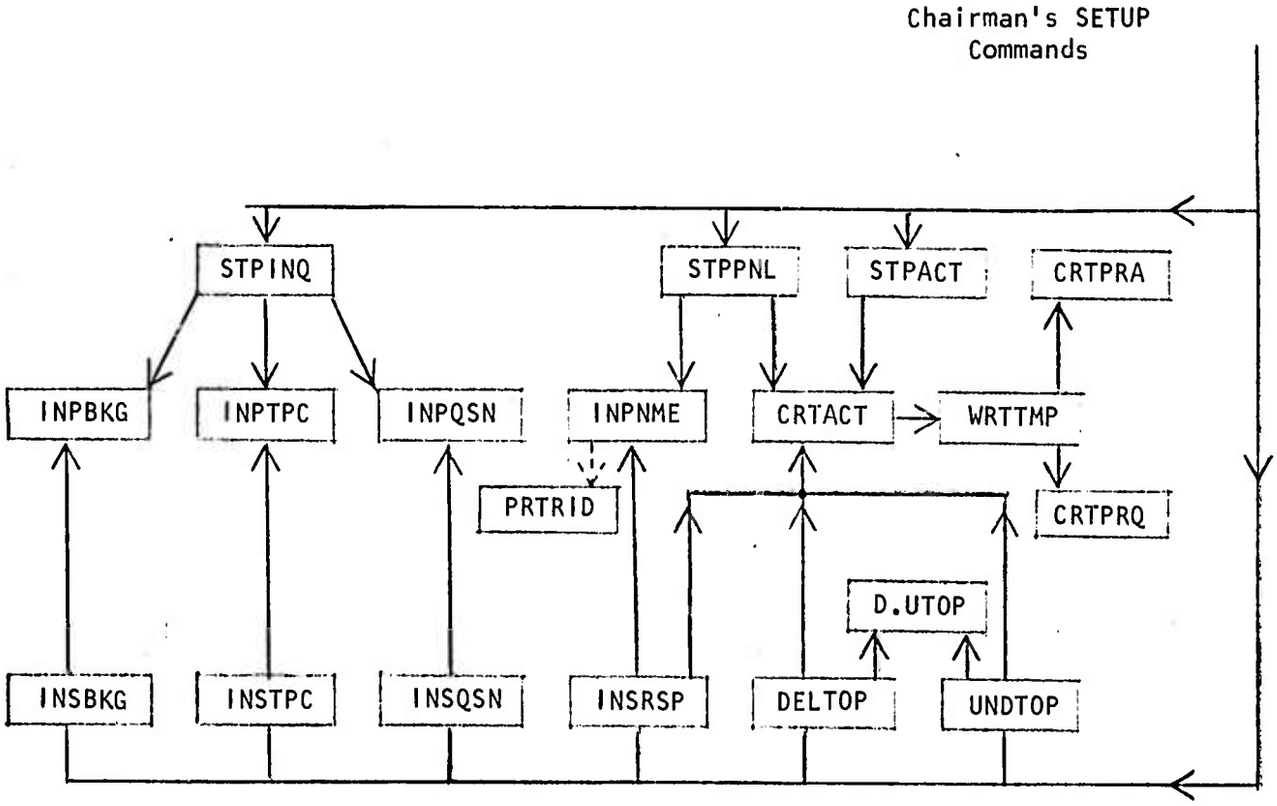


FIGURE 11

After an inquiry has been set up, the chairman may modify the existing inquiry with the following commands:

INSERT TOPIC

INSERT QUESTION

INSERT BACKGROUND

DELETE ITEM

UNDELETE ITEM

The first three commands modify only the template as existing in the Topic File. In order for the respondents to receive a revised schedule of activities, the chairman must then issue the command *SETUP ACTIVITY SCHEDULES*. The last two commands above allow the chairman the option of directly modifying the activity schedules of specified respondents.

Description of Subroutines. Of the eighteen programs in subsystem SETUP (as shown in the Index of Subroutines), nine are of direct interest to the chairman and are described below. The other nine are called by these first nine.

STPPNL — creates a new Control File and a new Text File. It asks for the participants' names and assigns them respondent numbers.

STPINQ — creates a new Topic File. Starting at the highest levels of the inquiry schedule and working down to the most specific, it asks for:

- the purpose of the inquiry background information for the inquiry
- an agenda (main subdivisions) and background on the agenda
- questions (to be placed in particular spots in the agenda)
- background information for the questions

STPACT — creates new activity schedules in the Control File for the respondents designated by the chairman.

INSRSP — inserts respondents into the inquiry without creating a new Control File. This does not set up an activity schedule for the inserted respondent.

INSQSN	inserts questions that are placed in the Topic File at the designated item # (node in the tree structure). By inserting a question in the Topic File, only the master copy (the template) is altered. The respondent's activity schedules remain unchanged unless STPACT is called again.
INSBKG	inserts background information at the item # designated (node in the tree structure). Again, the change is made only in the Topic File and not in the activity schedules of respondents.
INSTPC	inserts one-line titles for "topic" agenda items into the Topic File at the specified nodes in the tree structure.
DELTOP	deletes specific item numbers in the Topic File and updates the activity stacks for specified respondents.
UNDTOP	restores a previously deleted item for the respondents designated by the chairman.

Communication

Overview. The communication subsystem (CMNCTN) is a library of subroutines available to all participants in an inquiry (i.e., the CUE team and the respondents) for communication among themselves.

There are two "modes" of communication:

1. The direct link
2. The stored and forwarded message

The direct link enables two terminals to act as if they were one; thus, any character typed on one terminal is immediately displayed on the other, and vice versa. Thus, the direct link is the creation of a shared display space at the terminal. There are no restrictions or rules of organization involved once the direct link is created.

The use of messages is the second mode of communication. The message text is placed in the Control File and a message flag bit is turned on for the intended recipient of the message. The recipient will receive the text of the message when he logs into the system, at his next entry into the command mode, or when he begins a new item in his schedule of activities. There are no

COMMUNICATION Subsystem

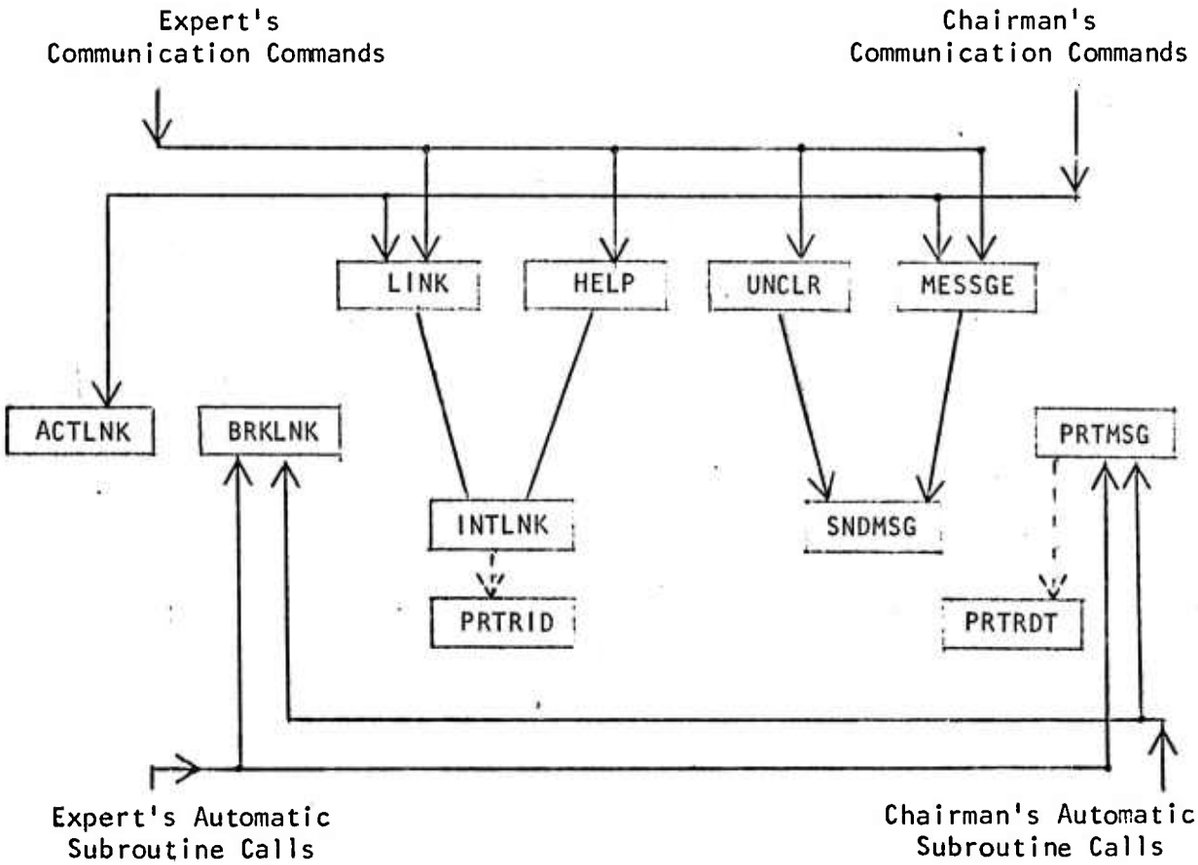


FIGURE 12

limits as to the size of the message and distribution of a message need not be limited to only one participant.

These two modes of communication are initiated from the command reader by means of the following commands:

LINK	sets up a direct link with the respondent specified.
ACCEPT (LINK)	accepts a link attempt from another participant.
HELP	sets up a direct link with the chairman. This is used when the aid provided automatically by the system is not sufficient and a participant needs further aid.
MESSAGE	sends a message to the respondent specified.
UNCLEAR	sends a message to the chairman informing him that the respondent is having some problem.

After the communication is completed, control is transferred back to the command reader for all commands except *UNCLEAR*. In this latter case, the respondent skips to the next item in his sequence of activities.

Description of Subroutines. The nine subroutines in the CMNCTN subsystem are described below.

LINK	ascertains the number of the participant to whom a link is desired, then transfers control to INTLNK.
INTLNK	sets up a direct link with the respondent specified. If he is not available, it asks if the initiator would like to leave a message.
ACTLNK	accepts a link attempt.
HELP	sets up a direct link with a chairman.
MESSGE	is the generalized message-sending subroutine which asks for the text of the message and the participant(s) to whom the message is to be sent.
UNCLR	is the subroutine called by a participant when he wishes to inform the CUE team of some problem in clarity or simply to input complaints. This subroutine leaves a special message (i.e., recognized as a complaint) in the chairman's directory.

BRKLNK — breaks links from all participants. It is called automatically when one of the linked participants strikes the ESCAPE key to end the direct link connection.

SNDMSG — writes a message entry in the subdirectory of a respondent and turns on the message flag.

PRTMSG — checks the message flag. If it is on, it resets the flag to off, finds the messages, and prints them on the recipient's terminal. After printing each message, it sets the "delete bit" in the "message identifier" (i.e., identifying bit-pattern) in the participant's control-file subdirectory.

Information

Overview. The information subsystem (INFMTN) contains the subroutines for displaying information to the participant either by direct command (through the command *INFORMATION*) or under program control. Although the same information is displayed by either the user-directed or the program-directed subroutines, the necessity for having the distinction arises from the tutorial needs for the novice user. For example, the neophyte respondent may not know enough about using the command language to access the information he needs. For this reason, the first order of business for every inquiry is to display the various types of information that are available.

There are six basic types of information which are accessible via these subroutines. These are:

1. "Information on the remote interrogation system," which gives the participant a choice of seeing any or all of the information concerning the use of the interrogation network. This information is essentially a machine-resident copy of the system users' guide.
2. "Information on inquiry," which displays the title or purpose of the inquiry (one-line) and any general background information that has been input at the time the inquiry was set up.
3. "Agenda information," which consists of the basic framework for the inquiry that is currently in progress. The highest divisioning of the topics is printed out, with a single line of description for each.

INFORMATION Subsystem

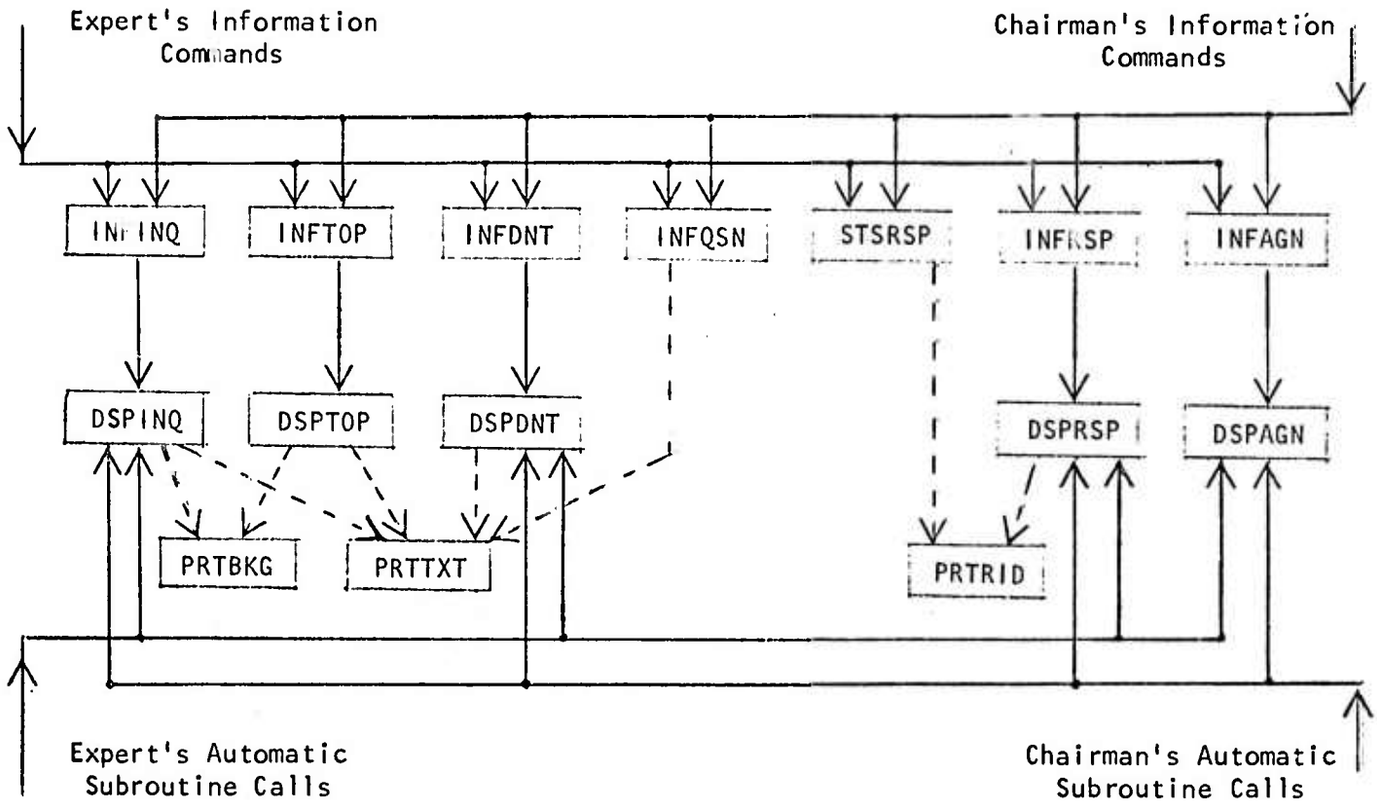


FIGURE 13

4. "Information on item(s)" will display the one-line title and multi-line text of the specified topic(s) of question(s), and any associated background information.
5. "Information on participants" consists of a listing of the people who are involved in the inquiry. For the respondent, the CUE team is identified and a list of the last names of the other participants is given. For the chairman, the CUE team is identified and each participant is associated with a respondent number. The respondent does not receive a respondent number associated with the other participants so that anonymity among respondents can be preserved.
6. "Status of participants" consists of a listing by respondent number of the participants in the inquiry indicating whether each is on or off line.

Description of Subroutines. For displaying most types of information there are two related subroutines. Those starting with the letters DSP are called under program control and perform the desired action; those starting with INF are called from the command mode, use the corresponding DSP routine, and then return control back to the command reader.

INFDNT, DSPDNT	displays information on the remote conferencing network.
INFINQ, DSPINQ	displays information on the inquiry.
INFAGN, DSPAGN	displays information on the agenda.
INFTOP, DSPTOP	displays information on a particular item in the inquiry.
INFQSN	is called by the command *QUESTION TEXT* and prints the text of and background information on the current question under consideration. Thus, during long and involved tasks, the respondent may easily recall the exact specifications for the task.
INFRSP, DSPRSP	lists the names of the people participating in the inquiry.
STSRSP	shows the status of the people participating in the inquiry.

Extract Information

Overview. The extract-information subsystem (EXTINF) contains the subroutines for extraction of text and numerical information from respondents under program control. There are four main information-extraction tasks which may be posed to the respondent:

1. provide a text answer
2. participate in a conference on a particular subject
3. provide a numerical answer
4. provide a probability distribution on a random variable

Description of Subroutines. The following subroutines represent types of information that are elicited by the remote conferencing system:

EXTANS	is used to extract all textual input and store it appropriately.
EXTCNF	is used to control a synchronous conference among a group of participants.
INPTXT	elicits text input generally and is used by EXTANS and EXTCNF.
EXTSNV	elicits a single numerical variable (integer, decimal, real, etc.)
EXTPDF	elicits through a CAI-type dialogue and Q & A method the 1%, 50%, and 99% points of an individual's conception of a probability distribution.
INPDCN	elicits a decimal number.
INPFPN	elicits and tests an input string for acceptability as a floating point number.

Results

Overview. The results subsystem (RSLTS) contains the subroutines used for processing, saving, and printing processed information either by command from a participant or by program control. From the command mode, these functions are implemented by the following commands:

EXTRACT INFORMATION Subsystem

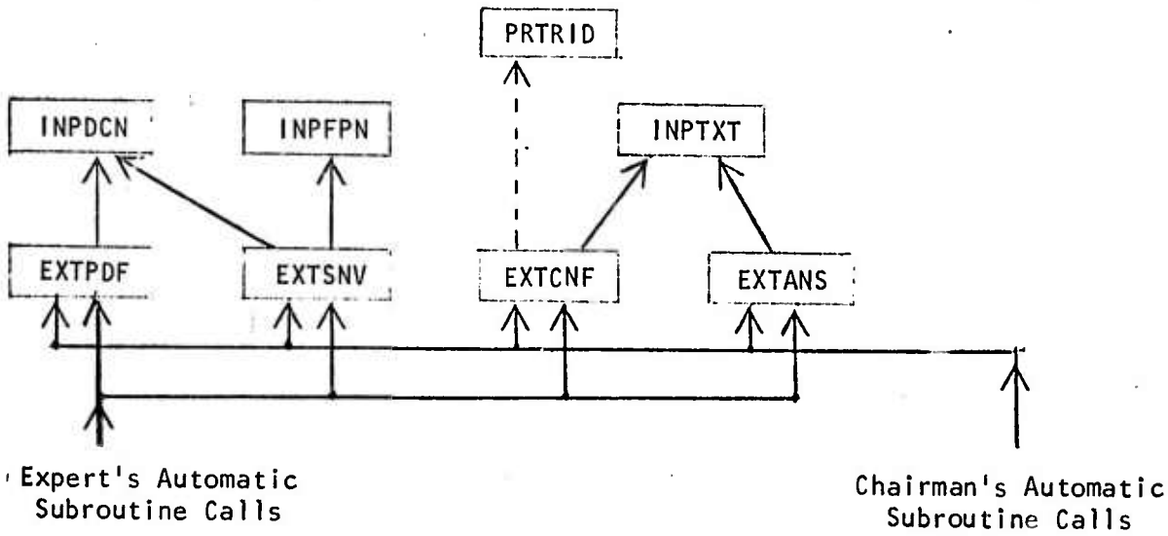


FIGURE 14

RESULTS Subsystem

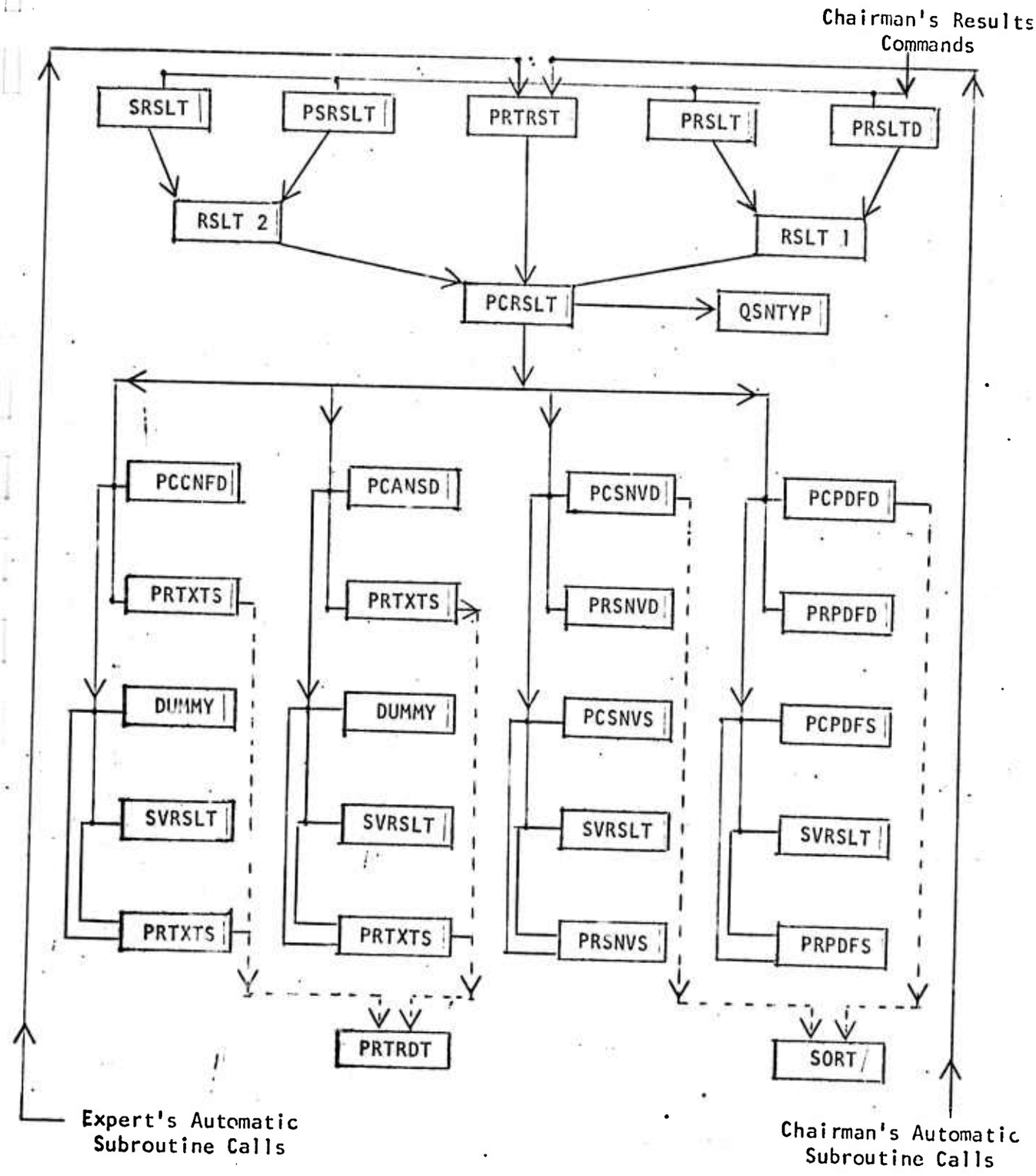


FIGURE 15

PRINT RESULTS

PRINT DETAILED RESULTS

PRINT SAVE RESULTS or SAVE PRINT RESULTS

SAVE RESULTS

The type of processing is determined by the type of information, as described below.

Type of Information	Type of Processing
text answer	compilation of all answers, identified by respondent number
conference input	compilation of all inputs, identified by respondent number
numerical estimate	number of estimates, low value, mean value, high value, and standard deviation
probability distribution	group probability density graph, as well as number of estimates, low estimate, median estimate, high estimate, expected value, and standard deviation

Description of Subroutines. The RSLTS subroutine library consists of 4 levels (0-3) of subroutines. Levels 0-2 consist of specialized functions such as printing background information, converting certain results to output formats, processing, etc. The fourth and highest level (level 3) contains controlling subroutines which take the specifications and call preset sequences of subroutines from the lower levels according to the inputs given by the participant from command mode or by program control from the dispatcher.

The following are the top-level subroutines.

PRTRST (print results) which is called by the dispatcher according to instructions provided by the participant's activity schedule. This routine transfers control to the more general subroutine PCRSLT.

Level	Action Requested: Print Summary	Print Detailed	Print & Save Summary	Save Summary	Function of subroutine
3	prslt	prsltd	psrslt	srslt	Assign processing, printing, and saving routines from level 0 according to capability desired.
2	rslt 1		rslt 2		Get item number for processing and item number for saving (if appropriate).
1	pcrslt				Determine mode of information and call lower subroutines in order.
0	(See FIGURE 9)				

FIGURE 16. MAIN SUBROUTINES IN SUBSYSTEM RESULTS

Level	Mode of Information				Function
	Answer	Con-ference	Numerical	Proba-bility	
0	pcansd	pccnfd	pcsnvd	pcpdfd	Process information in detailed form.
0	prtxts	prtxts	prsnvd	prpdfd	Print detailed information.
0	dummy	dummy	pcsnvs	pcpdfs	Aggregate information into summary form.
0	svrslt	svrslt	svrslt	svrslt	Save results.
0	prtxts	prtxts	prsnvs	prpdfs	Print summary statistics.

FIGURE 17. LOWEST LEVEL SUBROUTINES IN SUBSYSTEM RESULTS

PRSLT	(print results) prints the processed results in summary form for a number of topics.
PRSLTD	(print results in detailed form) prints the results in detailed form for a number of topics.
PSRSLT	(print and save results) prints and saves in the Topic File the results in summary form for a number of topics.
SRSLT	(save results) saves the results in summary form for a number of questions in the Topic File under the items specified.

All of these routines, except PRTRST, assign the subroutines necessary to process, print, and/or save the results. These subroutines are catalogued and called on the basis of question type. In order to present a guide to the lower levels of results processing, Figures 9 and 10 describe the level structure and functions of the subroutines.

C. THE UTILITIES

Terminal Input/Output

Overview. The terminal I/O (TERMIO) library contains subroutines for handling input from and output to a terminal. The TERMIO utility thus has several main functions in the system.

1. Since the output from the system is formatted differently for hard-copy and CRT display and since the types of CRT display differ, it must ask the user for, and set parameters according to the type of terminal used.
2. Both input and output are paged (broken into physical pages at appropriate intervals). Some types of output (e.g., graphs) must not be broken by page boundaries. To deal with these functions, a paging monitor is constantly in use.
3. There are special subroutines which accept as input:
   - command strings which may be incomplete
   - single lines of text (e.g., titles for agenda items which are limited to one line)
   - multiple-line input

4. All input is subject to a group of editing functions (see editing commands section in the Respondent's Guide).
5. Besides the standard numerical inputs, a common numerical input is the item number which has different formats externally (i.e., when displayed) and internally (i.e., when used as a search or tree traversal key). Input and output conversion routines for item numbers reside in the TERMIO utility.

Description of Subroutines. TRMTYP asks for and sets parameters for the type of terminal used by a respondent. This is either the first or second subroutine called after a participant's log-in. It accepts specific parameters for hardcopy terminals (60 lines per page) and the following CRT display terminals:

Hazeltine 2000	(27 lines per page)
Tektronix 4010	(35 lines per page)
Datapoint 3300	(25 lines per page)
Computek 400	(40 lines per page)
Beehive	(20 lines per page)

All others are treated as hardcopy terminals.

The three main forms of input use the following subroutines:

- INTXT1 outputs an EOL (end of line) and a herald character, accepts a single line of text input, and ends on an EOL.
- INTXT2 accepts multiple-line input from a terminal and terminates on two consecutive carriage returns. Each line is preceded by a herald character.
- Both INTXT1 and INTXT2 use a generalized input routine called GTSTR1 which accepts input from a terminal, terminating with an EOL.
- For input of command strings, GTSTRØ is used. This subroutine accepts input from the terminal and terminates on a carriage return. The major difference between GTSTR1 and GTSTRØ is that GTSTRØ enables a pseudo-interrupt when the "space" character is typed, and if the input buffer is not empty, GTSTRØ puts an EOL in the input stream and resumes processing. The "space" character is thus used to fill out the remainder of unambiguous commands in the command reader. (See Executive section.)

The subroutine EDTCHR checks for and implements editing functions on all terminal input, including all input of numerical text.

Output is controlled at the highest level by the subroutine BLKPRT, which outputs text to the primary terminal, keeps count of the line number on the current display page, and skips to a new page of display when necessary (see subroutine NEWPGE). If a break in the output occurs due to a page skip and if the terminal is a CRT (as determined by TRMTYP), BLKPRT uses the subroutine PGWAIT.

PGWAIT outputs the message:

"Type CR to continue"

and waits for the user to hit a carriage return before clearing the CRT screen and continuing with the output. Thus, the loss of output caused by scrolling off of the top of the CRT screen is avoided.

The subroutines TNIN and TNOUT handle, respectively, the input and output (as well as the conversion to and from internal format) of item numbers which have the external format:

N.N.N.N.N.

where $0 \leq N \leq 99$

Internal format consists of 5 seven-bit fields.

File Referencing

Overview. The file referencing utility (FILREF) consists of a set of subroutines for storing text in and retrieving text from the indexed files used in the inquiry. As described previously, the two basic methods for indexing text in the files are by linked-entry tree structures and by linked ten-entry directory blocks. Since the files are indexed, the major work of the file referencing subroutines is to create and find these directory entries.

Description of Subroutines.

CRTKF	creates a tree-index entry in a file at the node specified if the entry does not already exist.
CTRNF	creates an entry in a directory index. If the directory block does not exist, it is created.

FNDKF	finds a tree-index entry in a file at the node specified.
FNDNF	finds a directory-index entry of a specified type.
MAPF	maps a file from the disk into core.
SVTXTF	saves text in a file by updating the next-free-file-word pointer and then copying the text to the file.
CRTDBL	creates a tree-index entry for a text block of specified length by updating the next-free-file-word pointer and saving the address of the new entry in the continuation location of the previous entry.

Program Control

Overview. The program-control subsystem (PGMCTL) contains two high-level controlling functions:

1. The command reader
2. The dispatcher

The command reader calls specific subroutines according to the participant's command input. A specified number of commands are available to the participant. The number and power of these commands vary depending on whether the participant is a respondent or a member of the control team. The command reader is effectively part of the executive and maintains the highest "priority" in the user's system. Thus, a pseudo-interrupt (in this case, the ESCAPE key) will always return one to the command reader.

The dispatcher calls specific subroutines according to a predetermined schedule or agenda set up by the chairman in the individual's activity stack. The dispatcher traverses the tree structure defined by the individual participant's activity schedule (see the Control File description in the File Structure section, as well as the SETUP subsystem description). The dispatcher traverses the tree structure in a post-order fashion by "visiting" a node (item) in the tree and calling in sequence the subroutines designated by a linked list of "primitives." Having completed the calls, the dispatcher moves on to the next node in the schedule of activities. At any point, the user may strike the ESCAPE key to initiate a pseudo-interrupt and thus go into command mode (i.e., the command reader). The location in the activity schedule is

kept in a status word in the Control File. Thus, one may return from the command reader and restart the activity-stack traversal at the exact point where one was working previously.

A skill rating for each participant is kept by the program-control utility. This rating is stored in the status word of a respondent's Control File entry and is determined by the number of successful command requests or numerical inputs and the number of unsuccessful inputs of the same type.

Description of Subroutines. The command reader (CMDRDR) is the highest level subroutine in the PGMCTL library. Its function is to call any of a series of subroutines according to the user's command input. CMDRDR accepts input from the user's terminal (prompting for such input when command mode is achieved by another subroutine or by the user enabling a pseudo-interrupt). It then compares the input against a command table (assembled separately) and "responds appropriately." The possible responses are as follows:

If user types:	Command reader:
?	Gives list of acceptable commands
Text + ↑Q (i.e., cancel)	Starts over with a prompt
Unrecognized text	Types "unrecognized command" and starts over
Ambiguous text (first part of more than one legal command)	Gives bell and waits for more input
Unambiguous but incomplete command	Echoes rest of command and, if necessary, waits for missing parameters to be input
Complete command	If subcommands are expected, starts over with subcommand table; if not, transfers control to routine specified by the matched command-table entry.

Figure 18 illustrates the logical sequence of steps taken by CMDRDR in processing a command string.

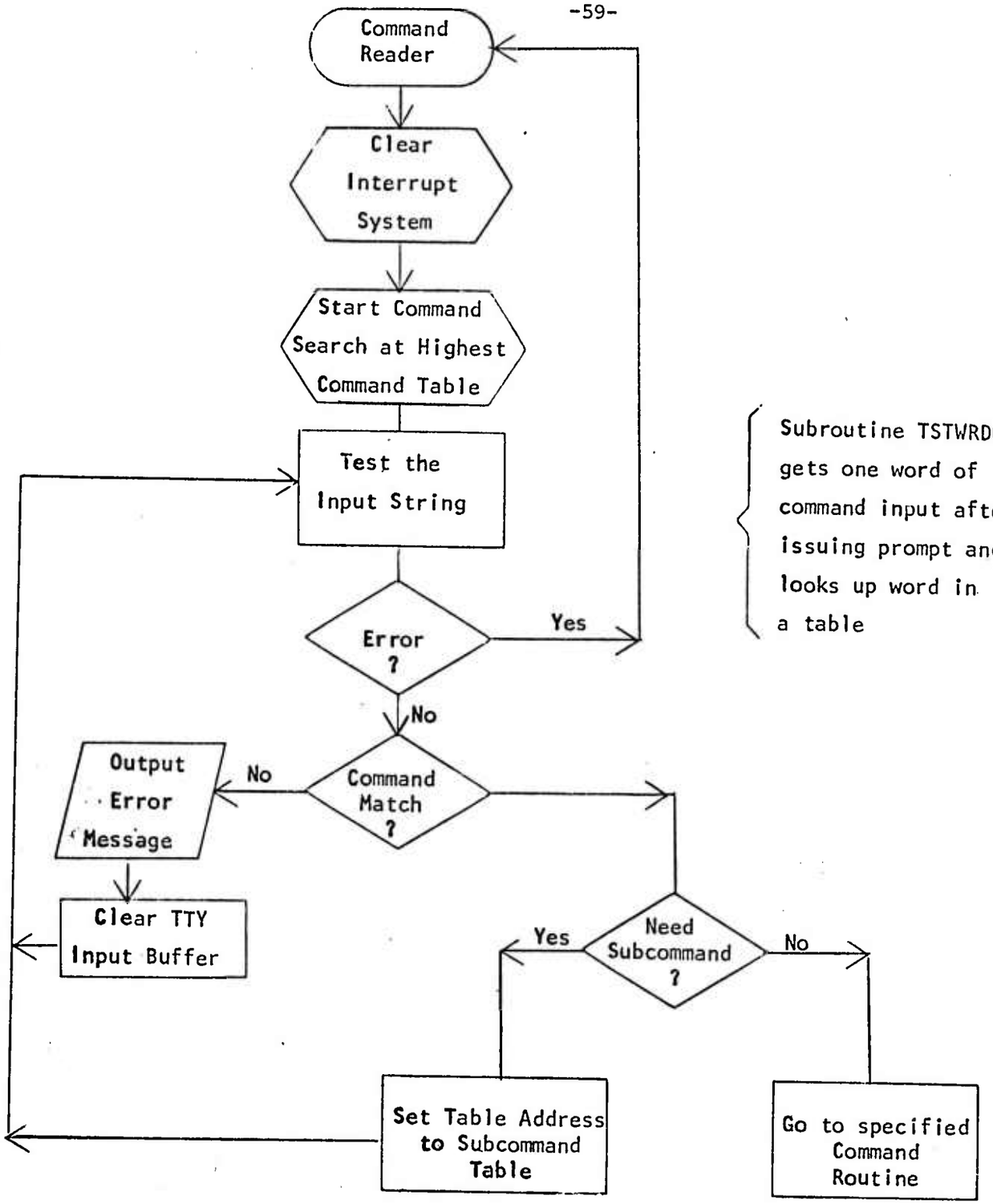

Command Reader
Clear Interrupt System
Start Command Search at Highest Command Table
Test the Input String
Error ?
Yes
No
Command Match ?
No
Output Error Message
Clear TTY Input Buffer
Need Subcommand ?
Yes
No
Set Table Address to Subcommand Table
Go to specified Command Routine
Subroutine TSTWRDC gets one word of command input after issuing prompt and looks up word in a table

FIGURE 18

The main command table (CMDTBL) contains the information needed for a given application of CMDRDR, the latter being designed for use in any package of programs and, therefore, needing to have specific commands and their corresponding routines loaded separately. CMDTBL contains three macros (TABLE, T, and TEND), which are used to set up the main command table and as many subcommand tables as it needs. The latter need not be declared internal. All routines referenced in the tables, however, must be declared here and internal in their own library files which are loaded separately.

The structure of a command table is as follows:

```
LABEL:    TABLE (PROMPTSTRING)
          T (COMMAND STRING 1, COMMAND TYPE, WHERE TO GO) (subroutine to call)
          T (COMMAND STRING 2, COMMAND TYPE, WHERE TO GO)
                    .
                    .
          T (COMMAND STRING N, COMMAND TYPE, WHERE TO GO)
          TEND
```

The dispatcher (DSPTCH) is a routine that calls program modules in sequence from the activity stack. The location of the activity stack is specified in the left halfword of the global variable "ACTSTK" (first word of respondent's entry in the primary directory of the Control File). The dispatcher routine uses the global variable "TOPDSG" to determine the topic number at which the activity stack is to be entered--say, topic number 1.1 It finds this location, and then checks to see if there are any activities associated with it. If there are activities, it checks whether it is permissible to proceed with the activities by examining the topic designator word in the Control File. If this word has been set to -1, the stack is "frozen" and the respondent must wait until it has been unfrozen. When the stack is unfrozen, the old topic control word in the Control File designator is replaced with the new topic designator control word. The dispatcher then calls each activity in sequence, using the continuation information contained in each activity entry. Exit from a set of activities at a given level is by a special activity entry (the last used, of course) which resets the global topic designator to a new value. Control is then resumed internally at the beginning of the dispatcher routing.

MASTER INDEX

MASTER INDEX (CONTINUED)

MASTER INDEX (CONCLUDED)

INDEX OF COMMANDS

I. COMMANDS AVAILABLE TO RESPONDENTS

Commands to Obtain Assistance

• HELP	Requests a shared writing space with the chairman.

Commands to Obtain Information

• INFORMATION ON INQUIRY	Describes the current inquiry
• INFORMATION ON PARTICIPANTS	Prints a list of participants
• INFORMATION ON INTERROGATION NETWORK	Describes the conferencing network
• INFORMATION ON TOPICS	Prints the agenda of the inquiry
• INFORMATION ON ITEM # an item #, or SAME LAST NEXT ALL	Prints the specified item
• QUESTION TEXT	Prints the question again
• STATUS OF PARTICIPANTS	Shows which participants are currently on line

Commands to Communicate with other Participants

• LINK to participant #	Requests a shared writing space
• ACCEPT link	Enables you to accept a link request
• MESSAGE to participant #	Allows you to send a message
• UNCLEAR	Informs the chairman you find a question unclear

Commands to Alter Your Progress

• JUMP to item # • SKIP to item # • GO to item # an item #, or SAME LAST NEXT	Enables you to restart at a specific item
• BACKUP to last item	Restarts you at the last item
• LAST item	"

• SAME item	Starts the current item over again
• CONTINUE	Continues where you left off
• NEXT item	Starts at the next item
• RESTART inquiry	Restarts you at the beginning of the inquiry
• LOGOUT	Ends your current participation
• QUIT	"
• EXIT	"

II. COMMANDS AVAILABLE TO THE CHAIRMAN TO CREATE, AMEND, AND PROCESS THE RESULTS OF AN INQUIRY

• SETUP INQUIRY	To create an inquiry
• SETUP PANEL	To create a panel of respondents
• SETUP ACTIVITY schedules	To assign agendas to respondents
• CALL conference at item	To call participants to a conference
• END conference at item	To end a conference
• DELETE item	To delete an item in an existing inquiry
• INSERT item	To insert an item in an existing agenda
• UNDELETE item	To recall a deleted item
• PRINT RESULTS	To print the aggregated responses to a question
• PRINT DETAILED results	To print the raw inputs to the terminal
• PRINT SAVE results	To print and save the aggregated responses
• SAVE RESULTS	To save the aggregated responses
• SAVE PRINT results	To print and save the aggregated responses

INDEX OF ERRORS

Message	Subsystem	Subroutine
CANNOT DISPLAY DATA; ALL < = 0	RSLTS	PRPDFS
CANNOT RECOGNIZE SYMBOLS USED	EXTINF	INPFPN
CANNOT IDENTIFY RESPONDENT #	PGMCTL	INPRDN
CANNOT IDENTIFY ITEM #	PGMCTL	INPTPN
COMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
EXPECTED A NUMBER WITHOUT WORDS	EXTINF	INPFPN
EXPECTED ONLY ONE DECIMAL POINT IN #	EXTINF	INPFPN
EXPECTED ONLY ONE SIGN FOR THE #	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE DECIMAL POINT	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE #	EXTINF	INPFPN
EXPECTED TOPIC # FORMAT TO BE: F.F.F.F.F 0 <= F <= 99	TERMIO	TNIN
EXPECTED Y OR N FOLLOWED BY (CR)	PGMCTL	GTCHAR
NO CONFERENCE AT THIS QUESTION #	PGMCTL	CLLCNF ENDCNF
NO # HAS BEEN ENTERED	EXTINF	INPFPN
NO SUCH TOPIC	INFMTN	DSPTOP
# MAY AT MOST HAVE 8 SIGNIFICANT DIGITS	EXTINF	INPFPN
# NOT RECOGNIZED	EXTINF	INPDCN
SORRY, WE CANNOT BACK UP. MAKE SURE...	PGMCTL	BCKUP
SUBCOMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
TELECONFERENCING NETWORK UNAVAILABLE	EXPERT	
TERMINAL TYPE NOT RECOGNIZED	TERMIO	TRMTYP
THERE IS NO ITEM WITH THAT #	RSLTS	PRTTXT
THIS ITEM # IS NOT ASSIGNED TO YOU	PGMCTL	DSPTCH
UNRECOGNIZED QUESTION TYPE...	SETUP	INPQSN
YOUR ESTIMATES ARE INCONSISTENT...	EXTINF	EXTPDF

INDEX OF SUBROUTINES

Subroutine	Subsystem
DSPDNT	INFMTN
DSPINQ	INFMTN
DSPRSP	INFMTN
DSPTCH	PGMCTL
DSPTOP	INFMTN
DUMMY	RSLTS
EDTCHR	TERMIO
ENDCNF	PGMCTL
EXPERT	
EXTANS	EXTINF
EXTCNF	EXTINF
EXTPDF	EXTINF
EXTSNV	EXTINF
FNDKF	FILREF
FNDLTF	PGMCTL
FNDNF	FILREF
FNDNTF	PGMCTL
GETGSK	PGMCTL
GTCHAR	PGMCTL
GTSTRØ	TERMIO
GTSTR1	TERMIO
HELP	CMNCTN
HERALD	TERMIO
INCGSK	PGMCTL
INDEXT	PGMCTL
INFAGN	INFMTN
INFDNT	INFMTN
INFINQ	INFMTN
INFQSN	INFMTN
INFRSP	INFMTN
INFTOP	INFMTN
INPBKG	SETUP
INPDCN	EXTINF

Subroutine	Subsystem
INPFPN	EXTINF
INPNME	SETUP
INPQSN	SETUP
INPRDN	PGMCTL
INPTPC	SETUP
INPTPN	PGMCTL
INPTXT	EXTINF
INSBKG	SETUP
INSQSN	SETUP
INSRSP	SETUP
INSTPC	SETUP
INTCFP	PGMCTL
INTLNK	CMNCTN
INTTOP	PGMCTL
INTXT1	TERMIO
INTXT2	TERMIO
LINK	CMNCTN
LSTITM	PGMCTL
MAPF	FILREF
MESSGE	CMNCTN
NEWPGE	TERMIO
NXTITM	PGMCTL
PCANSD	RSLTS
PCCNFD	RSLTS
PCPDFD	RSLTS
PCPDFS	RSLTS
PCRSLT	RSLTS
PCSNVD	RSLTS
PCSNVS	RSLTS
PGWAIT	TERMIO
PRBKGS	RSLTS
PRINT3	PGMCTL
PRPDFD	RSLTS

Subroutine	Subsystem
PRPDFS	RSLTS
PRSLT	RSLTS
PRSLTD	RSLTS
PRSNVD	RSLTS
PRSNVS	RSLTS
PRTBKG	RSLTS
PRTMSG	CMNCTN
PRTRDT	RSLTS
PRTRID	RSLTS
PRTRST	RSLTS
PRTTXT	RSLTS
PRTXTS	RSLTS
PSRSLT	RSLTS
QSNTYP	RSLTS
RESTRT	PGMCTL
RSLT1	RSLTS
RSLT2	RSLTS
SCAN	PGMCTL
SKIP	PGMCTL
SNDMSG	CMNCTN
SORT	RSLTS
SRSLT	RSLTS
STPACT	SETUP
STPINQ	SETUP
STPPNL	SETUP
STSRSP	INFMTN
SVRSLT	RSLTS
SVTXTF	FILREF
TNIN	TERMIO
TNOUT	TERMIO
TOPIC	PGMCTL
TOPSPN	PGMCTL
TRMTYP	TERMIO

Subroutine	Subsystem
TSTFLD	FILREF
TSTWRD	PGMCTL
UNCLR	CMNCTN
UNDTOP	SETUP
UPDATE	PGMCTL
WAIT	PGMCTL
WRTTMP	SETUP

ARPA POLICY-FORMULATION INTERROGATION NETWORK

CHAIRMAN'S GUIDE

INSTITUTE FOR THE FUTURE
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PREFACE

The ARPA policy-formulation interrogation network is a computer-based information gathering, storage, and processing tool designed primarily to aid decision-makers in utilizing knowledge inputs from geographically distributed expert respondents. The interrogation network as a whole consists of (a) an investigator or chairman, his assistants if any, and the remote respondents; (b) their terminals; (c) the ARPANET computer-communication network; (d) a computer, and (e) the controlling program written at the Institute for the Future. The current version (Release 3) of the Institute's network control program is merely a prototype of the more complete program currently being designed and implemented.

This document is a handbook for the chairman of an inquiry. It is intended to familiarize him with the workings of the interrogation network and the various capabilities of the chairman and the other inquiry participants. More specifically, it provides detailed instructions on the creation and running of inquiries. Special guidance for the novice chairman is offered by a sample session, glossary, and indexes.

Other documentation available on the interrogation network is as follows:

Respondent's Reference Cards
Chairman's Reference Cards
Respondent's Guide
Programmer's Guide
Program and File Specifications Notebook

ACKNOWLEDGEMENTS

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CONTENTS

I. INTRODUCTION: AN OVERVIEW OF THE INTERROGATION NETWORK

In order to use the interrogation network, the chairman must first understand the logical inquiry structure assumed in the design of the network control program. This section describes that structure, while introducing and defining the various terms and concepts used not only in the remainder of this document but also in the program with which the chairman will have to interact.

The ARPA policy-formulation interrogation network is a computer intermediary which assists in conducting on-line group inquiries. The computer, in conjunction with the ARPANET computer communications network, serves as a data collection, processing, and routing device which enables a geographically separated group of respondents to interact in a number of ways. The participants in such an inquiry comprise a control team and some number of respondents (say, between 5 and 30).

A. THE PARTICIPANTS

The control team is also referred to as the CUE team, since it will eventually consist of a Chairman, an Umpire, and an Editor; in the present version of the interrogation network computer program (Release 3), however, the control team is represented by the chairman alone.

The chairman is the initiator, leader, and overseer of an inquiry. It is the chairman who organizes the inquiry, prepares background information, has the final decision concerning the questions to be asked, and decides who is to be a respondent. The chairman is entitled to participate in the conference as a respondent, while his aides on the CUE team (the umpire and editor) will not be allowed to act as respondents.

The umpire will be the parliamentarian and second-in-command for the inquiry. It is the umpire who carries out participants' requests for

information or for help in some aspect of the conference. The umpire handles procedural matters as much as possible so as to free the chairman to concentrate on the substantive matters of the inquiry.

The editor will be in charge of correcting, collating, and filtering the various types of input from all participants. It is the editor who must aggregate various kinds of text so as to make the information usable to the chairman, the umpire, and the respondents.

The respondents in a full-fledged inquiry will normally be experts on a particular subject, although the interrogation network is intended to be usable by other types of groups as well. Further, the respondents will normally remain anonymous from one another during the course of the inquiry.

B. CREATING AN AGENDA

The first step in conducting an inquiry is for the chairman to prepare an agenda, using one of the network's component programs. In essence, the agenda consists of a series of activities which the computer is to undertake for the respondent--such as print background information, elicit numerical estimate, print a summary of group estimates, and call a conference to discuss results. In its physical representation in the computer, the agenda follows a tree structure, each node of which is referred to as an agenda item, or simply item. Two types of items are distinguished:

1. Topics, which are included for information value only and are not intended to be "answerable."
2. Questions, which are by definition answerable and hence require respondents to contribute estimates or whatever data is desired.

Every item is assigned an item number of the form N.N.N.N.N, where N is a number between 0 and 99. This number designates the node's position in the tree structure relative to other items. To give an example of an agenda, one might have an inquiry concerning an issue such as "Crimes of Violence in the United States." Suppose that in this inquiry one wishes to consider a series of topics such as "Crimes of Violence in San Francisco",

ITEM #	TITLE AND TYPE
1	"Crimes of Violence in the United States" - Topic Item
1.1	"Crimes of Violence in Los Angeles" - Topic Item
1.1.1	. . .
1.1.2	. . .
1.2	"Crimes of Violence in Sacramento" - Topic Item
1.2.1	. . .
1.3	"Crimes of Violence in San Francisco" - Topic Item
1.3.1	"Armed Robbery in San Francisco" - Topic Item
1.3.1.1	"What is your estimate of the number of armed robberies that will occur in San Francisco in 1980?" - Question Item
1.3.2	"Homocide in San Francisco" - Topic Item
.	
.	
.	
etc.	

TABLE 1. SEQUENCE OF AGENDA ITEMS

with subtopics such as "Armed Robbery in San Francisco." Under this last subtopic, the chairman might wish to pose to the respondents the question, "What is your estimate of the number of armed robberies that will occur in San Francisco in 1980?" Table 1 might then represent the sequence of agenda items as the respondent would see it.

Figure 1 shows this same set of agenda items in tree format, reflecting the agenda's inherent logical structure. In an inquiry, the computer program traces each branch of the tree structure to its conclusion (end node), and then turns to the next branch--resulting in precisely the same sequence of items as in Table 1.

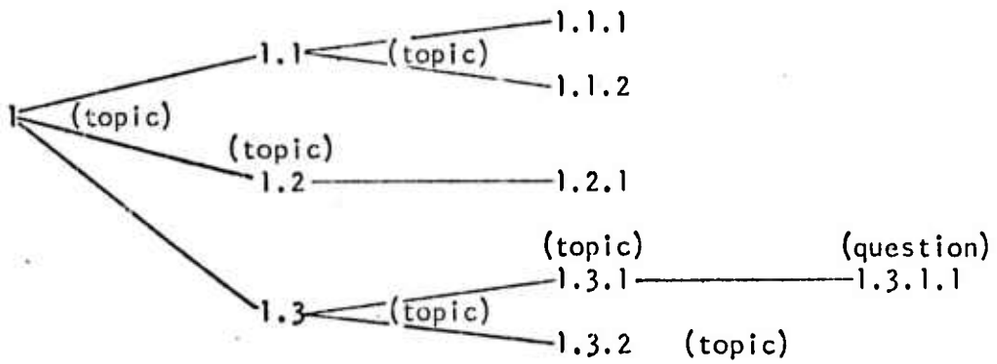

FIGURE 1

Each of the topic items in the agenda just described has two activities associated with it: (1) to print out the text of the topic so that the respondent knows the subject or issue to be addressed, and (2) to print any background information associated with that item. Question items such as Item 1.3.1.1 call for at least three activities, these being: (1) to print out the question, (2) to print any background information, and (3) to elicit (i.e., request, accept, and store in the computer) the respondent's reply.

As indicated earlier, a question is an agenda item which calls for an answer. Four types of questions are currently allowed in an inquiry, in keeping with the following types of input data which can be accepted and processed.

1. Text in response to a specific question
2. Text contributions to an open-ended debate
3. Single-number estimates (integer, decimal, or floating point)
4. Probability distributions (represented by three single-number estimates corresponding to 1%, 50%, and 99% probability levels)

C. ASSIGNING AN AGENDA TO RESPONDENTS

In the simplest inquiry, the chairman can assign the entire agenda to the entire panel of respondents. All respondents thus pass through the same sequence of activities (unless individuals elect to exercise their option to deviate deliberately from the order that is set in the agenda, a capability which we shall discuss presently). It is also possible, however, for the chairman to assign different responsibilities to various respondents. In the current release of the network controlling program, he does this by:

- setting up a master agenda containing all items in which he is interested
- assigning it to one group of respondents
- altering the master agenda by deleting and inserting items
- assigning the revised agenda to a different group of respondents

During the ensuing inquiry, the interrogation network simply follows the partial agenda assigned to each respondent, even if this means that no two respondents see any of the same topics or questions. In the sample inquiry described earlier, one respondent (perhaps a criminologist from Los Angeles) might be assigned Items 1.1 through 1.1.2 while another respondent or group of respondents (San Francisco criminologists) would be assigned Items 1.3 through 1.3.2.

Commands are available whereby the chairman can modify either the master agenda or the participants' individual agendas by deleting or inserting items after the initial creation process. So long as the chairman makes these alterations before starting the inquiry, no complications arise. But if he tries to alter the agendas of respondents who have already begun work, some confusion can result. Special provisions will be included in later releases to facilitate agenda changes at any time, but for now the chairman is encouraged to decide on his complete agenda assignments before starting the inquiry.

Once the chairman has set up an inquiry, he "opens" it for the respondents to begin their participation. Thereafter he may choose to declare himself a respondent and proceed to enter his own substantive contributions just as the other respondents do. Second, he may exercise a variety of commands to monitor the course of the inquiry, obtaining status reports on the participants, data summaries, and so forth. And finally, although this is not recommended, it is possible for him to alter the agenda for any or all respondents. He can do this by preparing a modified agenda, assigning it to the desired set of respondents, and then informing them that their agendas have been changed. They, in turn, execute a *CONTINUE* command (described later) and proceed with the revised agenda.

D. THE RESPONDENT'S PARTICIPATION

Having surveyed the interrogation network's operation from the chairman's viewpoint, one should also consider the respondent and his participation after the chairman initiates an inquiry. After logging into the network inquiry at the appointed time, the respondent is asked to identify himself, is assigned a respondent number, and begins his assigned activities. The program, meanwhile, begins storing not only the information which he deliberately inputs in response to the questions of the inquiry, but also some information about him. For instance, a status word is created for him, containing (a) a set of flags which indicate whether he is presently engaged in some activity within the network, has a message waiting for him, etc.,

and (b) a skill rating, which records his evident familiarity with the network programs as indicated by the frequency with which he makes errors (i.e., makes inputs which deviate from the controlling program's expectations). The purpose of this rating is to determine the amount of detail to be included in the instructions and error messages which the respondent receives.

Four modes of operation are possible for the respondent. The first and simplest is the question and answer mode (Q & A mode), in which the respondent simply follows the instructions which the controlling program gives him, reads whatever is presented to him, and answers whatever is asked. An inquiry in which this inquisitorial mode is used exclusively is actually an "on-line questionnaire." Use of the other modes of operation imply interaction between respondents.

The second mode is the synchronous discussion mode. Unlike Q & A mode, in which it is entirely possible for no two respondents to be working on the same agenda item at the same time, discussion mode provides for simultaneous consideration of and conversation about a single item by two or more respondents. A conference consisting entirely of the discussion mode would be nearly equivalent to a face-to-face group conversation and, hence, would require all participants to be on-line at the same time and to proceed no faster than their slowest colleague. To avoid these restrictions as much as possible, inquiries can have both synchronous and asynchronous portions, respondents being allowed to proceed at their own pace most of the time and being called together for synchronous discussion only when necessary. To facilitate such "mixed-mode" inquiries, the interrogation network contains a mechanism for interrupting a respondent who is working asynchronously and summoning him into the required synchronous discussion. This mechanism minimizes disruption of the respondent's train of thought by (a) waiting to interrupt him until he reaches a "good stopping place", i.e., the end of the agenda item on which he is currently working, and (b) sending him back to the appropriate point in his asynchronous activities as soon as the discussion is over.

Third is command mode. Any participant may escape from his prearranged sequence of activities and enter command mode by pressing the ESC or ESCAPE (or ALT) key on his terminal at any time. From command mode, he can call

for a variety of special actions by typing commands such as *HELP* or *RESTART*. For additional detail on the respondent's available commands, refer to the program descriptions in the Index of Respondent's Commands.

Finally, the respondent can be in link mode, communicating directly with one other inquiry participant via a hardware "link" between their terminals. All characters which are printed out on the one respondent's terminal--including those which he himself types--are simultaneously printed out on all linked terminals. Because of the confusion which could result from an undesired link, each participant is ordinarily protected against link attempts by a "refuse links" flag in the system. Someone seeking to link to him issues a link-request command to the system, which in turn rings a bell on our respondent's terminal. He then may accept the link by halting whatever he is currently doing, going into command mode, and issuing an accept-links command; or, if he prefers not to be bothered, he may refuse the link request by simply ignoring the bell. If the link is established, conversation continues until one or the other party returns to command mode, thus breaking the link; both parties then resume their activities by issuing appropriate commands.

II. BASIC INSTRUCTIONS FOR USE OF THE NETWORK

A. TERMINALS AND HOW TO USE THEM

Release 3 of the network control program is designed to work with terminals of various kinds. These include hardcopy (i.e., terminals which display by typing or printing on paper) and display screen terminals (which use cathode ray tubes--CRT's--or storage tubes). When logging into the interrogation network, one of the first messages you will receive is:

"PLEASE INDICATE YOUR TYPE OF TERMINAL BY TYPING THE APPROPRIATE NUMBER." plus a short list of terminal types. If you are using a hardcopy terminal, type the number corresponding to "TYPING ON PAPER". If your type of terminal is not on the list, type the number labeled "OTHER".

Your terminal can be used exactly as if it were a conventional electric typewriter, with only two exceptions to this rule. First, the character @ ("at" sign) has special meaning to the network hardware. Although you may, and indeed must use it during the log-in procedure (see Section II. B., "Logging into the Interrogation Network"), you ought to avoid using it thereafter. If you should wish to use @ after log-in has been completed, you must type two of them (@@); when you type @@, the computer will receive @.

Second, there are some occasions on which you will need to type so-called control characters (represented in these instructions by combinations such as CTRL-A and CTRL-R). Control characters are obtained by depressing the CTRL key on your terminal and striking the letter required; thus, CTRL-A means hold-down-CTRL-and-hit-A.

A word on notation; two other keys that have importance to you are the linefeed or LF key and the carriage return or CR key. Whenever you are required to strike one, we will enclose the two-letter designation in parentheses, e.g., (CR) or (LF).

B. LOGGING INTO THE INTERROGATION NETWORK

For a detailed description of log-in procedures, see the card entitled "Entering the Interrogation Network." Note that different versions of this card exist according to the terminal type which you intend to use. Currently the types of terminals provided for include the Teletype 33, Texas Instruments 700, G.E. TermiNet 300, Hazeltine 2000, Tektronix 4010, Datapoint 3300, Computek 400, and Beehive (all models).

The basic instructions for entering the network are as follows. First, prepare your terminal and acoustic coupler for use by setting them for full-duplex operation at 30 characters per second (30 cps is equivalent to 300 Baud). The terminal/coupler unit should be set for on-line use. Second, after having turned on the terminal equipment, dial the telephone number given on the log-in cards and, upon receiving the high-pitched "carrier" tone, place the handset in the coupler, being sure that the telephone cord is at the correct end.

The precise log-in protocols differ for different terminals and different locations. The point to remember is that you can do no damage to the computer or the terminal by making typing errors. This is stressed to inform the users that the network has been designed with a great deal of thought given to protection and security of all participants and all network components.

Recovery procedures are given on the back of the logging-in card. Should these procedures be insufficient to resolve a problem encountered, the Institute staff will be glad to help if you telephone 415-854-6322.

To leave the inquiry or the network at any time, you need only remove the telephone handset from the coupler and hang up the phone (i.e., break the telephone connection). The network control program will keep track of your progress; no information or input will be lost; if you log in again later the control program will automatically pick up where it left off.

Please read through the appropriate card for entering the network at least once before attempting to log in. Remember that when you are instructed to type something such as:

@L 86

you must type each character, e.g., an "at" sign (@), an "L", a space, and the number "86".

Before entering the network, it is also especially important that you read Section II. F., on special characters.

C. INPUT TO THE COMPUTER

The network, after asking you a question or requesting some input, prompts for input with one of several different symbols:

- # to ask for a number
- > to ask for text input
- * to ask for a command
- ; to ask for special input that is communicated directly to another participant.

To terminate a line of input, type a carriage return (CR).

If the system expects more than one line of input, it will give you another prompting symbol.

To terminate multi-line input, type two consecutive carriage returns (CR) at the end of a line.

D. EDITING COMMANDS

Whenever you are asked to type information into the network via your terminal keyboard, editing facilities are available which allow you to correct typographical errors before your input is recorded in the inquiry. This capability depends on the fact that each such input is held in temporary storage until the appropriate input-terminating character is received (one carriage return for one-line inputs, two consecutive carriage returns for multi-line inputs).

The available editing commands (each represented by a single control character) are listed below.

CTRL-A	Deletes preceding character
CTRL-W	Deletes last word typed

CTRL-Q	Deletes current line of input
CTRL-X	Deletes whole input (same as CTRL-Q if input is only one line)
CTRL-R	Types out current line
CTRL-Y	Types out whole input (same as CTRL-R if input is only one line)

E. NUMERICAL INPUTS

Whenever you are asked to provide a numerical estimate or other quantitative input, your response should be typed in as an ordinary integer or decimal number. Use decimal points, plus or minus signs, commas, percent signs, and dollar signs as needed. Do not use other symbols, nor such words as "million", "billion", etc. Thus, the following are admissable entries:

6,000,000
45%
0
-1
-123.45
$12.35

The following, however, are not admissable:

6 million
zero
2/3
66¢

If you use any of the inadmissable forms, you will receive an error message and should retype your input correctly.

F. SPECIAL CHARACTERS

When you are using the network, the following characters have special usage. (Control characters are obtained by depressing the CTRL key on

your terminal and striking the letter required; thus, CTRL-A means hold-down-CTRL-and-hit-A.)

Carriage return or (CR)

Indicates that a line of input has been completed. Two consecutive carriage returns indicate the end of multi-line input. The key is marked CR or RET.

Linefeed or (LF)

Indicates that a command given during the logging-in procedure has been completed. See Section II. A., "Terminals and How to Use Them."

"At" sign or @

If at any time after log-in has been completed you wish to type an "at" sign, type 2 "at" signs (@@) for correct response.

Escape or Altmode (or ESC or ALT)

Indicates that the user wishes to stop whatever is happening currently and go into command mode. This key will stop all activity and cause a command prompt to be sent to your terminal.

Control-A or CTRL-A (hold-down-CTRL-and-type-A)

An editing command which deletes the preceding character.

Control-W or CTRL-W (hold-down-CTRL-and-type-W)

An editing command which deletes the last word typed on the current line.

Control-Q or CTRL-Q (hold-down-CTRL-and-type-Q)

An editing command which deletes the current line of input.

Control-X or CTRL-X (hold-down-CTRL-and-type-X)

An editing command which deletes the whole input. (Same as CTRL-Q if the input is only one line.)

Control-R or CTRL-R (hold-down-CTRL-and-type-R)

An editing command which types out the current line.

Control-Y or CTRL-Y (hold-down-CTRL-and-type-Y)

Types out the whole input. (Same as CTRL-R if input is only one line.)

III. HOW TO CONDUCT AN INQUIRY

As a rule, the chairman's activities in an inquiry are performed by means of explicit commands which he initiates by pressing the ESCAPE (ESC) key to reach command mode and then typing the appropriate command word or phrase.

The chairman's command repertoire may be divided into five types of commands. These are:

- Creating an inquiry
- Amending an inquiry
- Monitoring an inquiry
- Communication
- Program control

Logically, the first commands to be used by a chairman are those which originally set up an inquiry. The rest of the commands are not in any logical order since they may be called from the command reader at any time.

A. CREATING AN INQUIRY

The creation of an inquiry is controlled by one major instruction called "SETUP". The set-up process requires the use of three *SETUP* subcommands:

- *SETUP INQUIRY*
- *SETUP PANEL*
- *SETUP ACTIVITY SCHEDULES FOR PARTICIPANT*

1. *SETUP INQUIRY*

This command creates a master list or model of the acitivites to be given to the respondents in an inquiry. This master schedule is divided into numbered items. There are two types of numbered items:

- Topic Items
- Question Items

Topic items are short titles describing a particular section of the inquiry. These topics may be divided into subtopics so that the inquiry takes on the numbering and structure of an outline. Each of these topic items may have background information attached to it but a topic item demands no input on the part of a respondent. Thus, the topic items provide the organizational framework for an inquiry and may provide background information to the respondent.

SETUP INQUIRY leads the chairman through the creation of this schedule by starting with the uppermost "levels' of the inquiry and working down to the lowest subdivisions. The steps are as follows:

1. Asks for a statement of purpose for the inquiry (one line).
2. Asks if you wish to create agenda; i.e., do you wish to break the inquiry into topic items (logical subdivisions which contain subtopics, questions, etc.). If "no" is the reply, the system assumes that you want to include only a list of question items, with no major subdivisions (if this is the case, continue at Step 6).
3. Asks you to enter one line statements of the topic items that constitute the highest divisions in the inquiry. When you enter a carriage return instead of a title, the system assumes that there are no more topics at the highest level.
4. Asks if any of the topics inserted in Step 3 are to be broken down further into subtopics. The chairman must specify which topic or subtopic is to be subdivided by typing in the item number when the prompt:

   "TOPIC ITEM #"

   is given.
5. Asks if you wish to provide background information on a specific item. You may enter as much text as you like. To finish the input, hit two consecutive carriage returns (i.e., type a blank line).

6. Takes the first topic item and asks for the questions to be asked under this item number. If you do not wish to ask more questions under this topic, type a carriage return rather than the text of a question.
7. Having given the text of a question, the program must know what kind of data will be input by a respondent. Thus, it asks for the type of question and will prompt:

"TYPE:"

You have five options as to the type of input the question should require, and may select one or more of these types:

- Answer — Text input with no restrictions as to length
- Number — Single numerical value, integer or decimal
- Probability — Probability density estimate on a variable, elicited by a CAI-type dialogue concerning "Sam the Bookmaker"
- Conference — See *CALL CONFERENCE* in Section II. E.
- Results — Will give feedback to the respondent. Notice that when a question type is requested, the program takes that specification and then asks for type again. In this spot, one may ask the program to give immediate feedback on the results of the question just asked by giving Results as the question type. This type demands no input from the respondent.

2. *SETUP PANEL*

This command asks the chairman for the names of the control team (i.e., the chairman, the umpire, the editor) and the names of all the respondents. The instruction will print a title or a respondent number and ask for a name to be associated with that designation. To end the panel creation process, type a carriage return instead of a name.

3. *SETUP ACTIVITY SCHEDULES FOR PARTICIPANT*

This command gives a copy of the master agenda to the specified respondents, and to the members of the control team if they are specified. One may list the respondent numbers to whom the copy should go, or give numbers in a range (e.g., *SETUP ACTIVITY SCHEDULES FOR PARTICIPANTs 100-109*), or one may say "all", in which case all members of the control team, and all respondents will get a duplicate copy of activity schedules.

If, however, you wish to alter the activity schedules for some respondents, you may set up a master agenda and give it specifically to some respondents, and then amend the master copy and setup activity schedules for the respondents to whom you wish to give an altered schedule.

B. AMENDING AN INQUIRY

The following commands are used after a master agenda of activities has been prepared using the SETUP commands:

- *DELETE ITEM*
- *UNDELETE ITEM*
- *INSERT BACKGROUND*
- *INSERT TOPIC*
- *INSERT QUESTION*

1. *DELETE ITEM (#) FOR PARTICIPANT (#)*

This command will delete a specific item number, either a topic or a question for the respondent specified. The options are a single number, a list of respondent numbers, a range of respondent numbers, and the word "all". Given any of these responses, the system will delete that topic from the activity schedule of the designated participant, but will not change the master list. That is, should you setup activity schedules again, the item number would still exist.

Another response to a prompt for participant numbers is a carriage return. This will delete the item from the activity schedules of all participants and will delete the item from the master list.

2. *UNDELETE ITEM*

This command will reinstate the previously deleted item to the activity schedules of a single respondent, a list of respondents, a range of respondents' numbers, and "all".

3. *INSERT BACKGROUND*

This command allows the chairman to add or change the background information for a specified topic without calling setup and retyping the entire schedule. The chairman must explicitly set up an activity schedule for the participant.

4. *INSERT QUESTION and INSERT TOPIC*

Both of these commands enable the chairman to insert a numbered item into the master list without going through the entire setup inquiry procedure. The individual copies of the activity list are not changed until the chairman does a *SETUP ACTIVITY SCHEDULE*.

C. MONITORING AN INQUIRY

The following commands are used to get information on the inquiry, the status of the participants, or the use of the interrogation network itself.

- *INFORMATION ON INQUIRY*
- *INFORMATION ON ITEM*
- *INFORMATION ON PARTICIPANTS*
- *INFORMATION ON RENOTE INTERROGATION NETWORK*
- *INFORMATION ON TOPICS*
- *PRINT DETAILED RESULTS FOR QUESTION*
- *PRINT RESULTS FOR QUESTION*
- *PRINT (and) SAVE RESULTS FOR QUESTION*
- *SAVE (and) PRINT RESULTS FOR QUESTION*
- *SAVE RESULTS FOR QUESTION*

- *STATUS OF RESPONDENTS*
- *QUESTION TEXT*

1. *INFORMATION ON INQUIRY*

This command prints out the title and general background for the inquiry.

2. *INFORMATION ON ITEM*

This command gives the text and background information for the items specified either by a single item number, a list, a range statement or the word "all".

3. *INFORMATION ON PARTICIPANTS*

This command lists the titles or respondent numbers and the participants' names for the entire panel. This enables the chairman to associate the names with the respondent numbers.

4. *INFORMATION ON REMOTE INTERROGATION NETWORK*

This command gives you the option of seeing the background information items that consist of the user's guide instructions for using the interrogation programs.

5. *INFORMATION ON TOPICS*

This command gives you the basic outline of the current master agenda.

6. *PRINT DETAILED RESULTS FOR QUESTION*

This command lists all the responses made for the question designated. These are simply printed on your terminal.

7. *PRINT RESULTS FOR QUESTION*

This command prints the processed or summarized results of the question designated.

8. *PRINT (and) SAVE RESULTS FOR QUESTION*

This command will print the processed results of a question to your terminal and will save the same display as background information under the item number you specify.

9. *SAVE (and) PRINT RESULTS FOR QUESTION*

This instruction is the same as *PRINT (and) SAVE. . .* (See number 8 above.)

10. *SAVE RESULTS FOR QUESTION*

This command saves the processed results as background under the item designated. This does not print the display to the terminal.

11. *STATUS OF PARTICIPANTS*

This command prints the titles or respondent numbers of the participants and their names, and tells whether or not the individuals are currently logged into the system.

12. *QUESTION TEXT*

This command gives the text of a question and the background of the last question in the inquiry you have seen.

D. COMMUNICATION

Other than in the on-line conference, there are two forms of communication (direct link and message forwarding) that the chairman may use to communicate with a single individual or with a number of respondents. The commands which apply to these forms of communication are:

- *LINK TO PARTICIPANT*
- *ACCEPT LINK*
- *MESSAGE TO PARTICIPANT*

1. *LINK TO PARTICIPANT*

This command attempts to link your terminal keyboard to that of the designated participant. If the recipient of this link attempt accepts the link, you may type and the message will be immediately transferred, letter by letter, to the recipient's terminal.

2. *ACCEPT LINK*

When you hear several consecutive "bells" or buzzes from your terminal, you know that someone is attempting to link directly to your terminal. You do not have to accept, but if you do wish to accept hit the ESCAPE or ALTMODE key and type *ACCEPT LINK* and a carriage return. To break the link simply hit the ESCAPE or ALTMODE key and you will be returned to command mode.

3. *MESSAGE TO PARTICIPANT*

This command allows you to leave a message for a single respondent or a number of respondents. They may or may not be currently logged into the system. Each respondent will receive the message the next time he enters command mode or when he finishes his current item.

E. PROGRAM CONTROL

With the exceptions of *CALL CONFERENCE* and *END CONFERENCE*, the commands for program refer to a respondent going through the inquiry. It should be noted that the chairman must have a copy of the inquiry that is current if he is to call or end a conference. It should also be noted that all of these commands must be given while in command mode.

- *CALL CONFERENCE*
- *END CONFERENCE*
- *BACKUP TO LAST ITEM*
- *CONTINUE*
- *GO TO ITEM*
- *EXIT*

- *LAST ITEM*
- *SAME ITEM*
- *NEXT ITEM*
- *RESTART INQUIRY*

1. *CALL CONFERENCE*

CALL CONFERENCE AT QUESTION (#)
STARTING AT ITEM (#)
ENDING AT ITEM (#)

This command allows the chairman to call an on-line conference that was scheduled at a particular item number when the chairman used setup inquiry. The two subcommands, *STARTING AT* and *ENDING AT*, allow the chairman to start all those who have the conference in their activity schedules at an item number somewhat before the conference and end their conference at some item following the conference. When the chairman gives this command, all respondents with this conference in their schedules, are pulled away from whatever item they were on, and are started at the *START AT ITEM* address. When they complete the *ENDING AT ITEM* topic, they are returned to the item from which they were pulled.

2. *END CONFERENCE*

This command allows all the respondents to leave the conference situation and continue on to those items designated by the chairman when he called the conference. Until the chairman gives this command, all respondents will remain in the conference.

NOTE: The following commands refer to movement within the activity schedule and are the same commands available to the respondents.

3. *BACKUP TO LAST ITEM*

This command takes the current item number and restarts you at the item immediately preceding it.

4. *CONTINUE*

This command restarts you at the next consecutive event within the same item number. This may be used to suppress the printing of background information you may have already seen.

5. *GO TO*

This command restarts you in the inquiry at the designated item number, or you may use the subcommands *"LAST"* (previous topic), *"SAME"* (restart at the same topic), or *"NEXT"* (discontinue the current item and go on to the next one).

6. *EXIT*

This command discontinues the inquiry and logs you out of the interrogation computer program.

7. *LAST ITEM*

This command restarts you at the preceding item in the inquiry.

8. *SAME ITEM*

This command restarts you at the current item in the inquiry.

9. *NEXT ITEM*

This command restarts you at the next consecutive item in the inquiry.

10. *RESTART INQUIRY*

This command restarts you at the beginning of the inquiry (i.e., at item 0).

IV. SAMPLE SESSION

Chairman

```
   ?
@RUN CHAIRMAN

CHAIRMAN      REMOTE CONFERENCING NETWORK      6-APR-73        PAGE # 1

PLEASE INDICATE YOUR TYPE OF TERMINAL BY TYPING THE APPROPRIATE #.

  0: TYPING ON PAPER    1: HAZELTINE 2000    2: TEKTRONIX 4010
  3: DATAPOINT 3300     4: COMPUTEK  400     5: BEEHIVE
  6: OTHER

#: 0

COMMAND:
*SETUP INQUIRY

ENTER STATEMENT OF PURPOSE OF INQUIRY.(1 LINE)
>AN INQUIRY CONCERNING CRIME IN THE U.S.

WISH TO PROVIDE BACKGROUND INFORMATION ON INQUIRY?
>YES

PLEASE ENTER BACKGROUND INFORMATION.
>THIS IS A DEMONSTRATION INQUIRY DESIGNEDTO ACQUAINT THE USERS
>OF THE ARPA POLICY-FORMULATION INTERROGATION NETWORK WITHTHE
>SETTING UP AND RUNNING OF AN INQUIRY.
>

WISH TO CREATE AGENDA?
>Y

ENTER STATEMENTS OF TOPIC ITEMS (1 LINE).

TOPIC # 1
>CRIMES OF VIOLENCE IN THE UNITED STATES

TOPIC # 2
>NON-VIOLENT CRIME IN THE UNITED STATES

TOPIC # 3
>

WISH TO BREAK DOWN TOPIC ITEMS FURTHER?
>Y

TOPIC ITEM # 1

ENTER STATEMENTS OF TOPIC ITEMS (1 LINE).

TOPIC # 1.1
>CRIMES OF VIOLENCE IN LOS ANGELES

TOPIC # 1.2
>CRIMES OF VIOLENCE IN SACRAMENTS\SO

TOPIC # 1.3
>CRIMES OF VIOLENCE IN SAN FRANCISCO

TOPIC # 1.4
>
```

TOPIC ITEM # 1.3

ENTER STATEMENTS OF TOPIC ITEMS (1 LINE).

TOPIC # 1.3.1
>ARMED ROBBERY IN SAN FRANCISCO

TOPIC # 1.3.2
>HOMOCIDE IN SAN FRANCISCO

TOPIC # 1.3.3
>

TOPIC ITEM #

WISH TO PROVIDE BACKGROUND INFORMATION ON SPECIFIC TOPIC ITEMS?
>NO

PLEASE ENTER THE QUESTIONS FOR THE INQUIRY.

AN INQUIRY CONCERNING CRIME IN THE U.S.

1 CRIMES OF VIOLENCE IN THE UNITED STATES

1.1 CRIMES OF VIOLENCE IN LOS ANGELES

QUESTION # 1.1.1
>WHAT, IN YOUR OPINION, IS THE GREATEST SOCIAL FACTOR
>CONTRIBUTING TO CRIME IN LOS ANGELES?
>
TYPE : ANSWER
TYPE :

QUESTION # 1.1.2
>WHAT PERCENTAGE OF CRIMES IN LOS ANGELES ARE CONDUCTED
>USING ILLEGALLY OBTAINED WEAPONS?
>
TYPE : NUMBER
TYPE :

QUESTION # 1.1.3
>
1.2 CRIMES OF VIOLENCE IN SACRAMENTO

QUESTION # 1.2.1
>APPROXIMATELY HOW MANY HOMOCIDES WERE COMMITED IN
>SACRAMENTO DURING THE YEAR 1965?
>
TYPE : NUMBER
TYPE :

QUESTION # 1.2.2
>
1.3 CRIMES OF VIOLENCE IN SAN FRANCISCO

1.3.1 ARMED ROBBERY IN SAN FRANCISCO

QUESTION # 1.3.1.1
>WHAT IS YOUR ESTIMATE OF THE NUMBER OF ARMED ROBBERIES THAT
>WILL OCCUR IN SAN FRANCISCO IN THE YEAR 1980?
>
TYPE : PROBABILITY
TYPE :

QUESTION # 1.3.1.2
>
1.3.2 HOMOCIDE IN SAN FRANCISCO

QUESTION # 1.3.2.1
>WHAT IS THE GREATEST SOCIAL FACTOR CONTRIBUTING TO THE
>INCREASE IN HOMOCIDES IN SAN FRANCISCO?
>
TYPE : ANSWER
TYPE :

QUESTION # 1.3.2.2
>
2 NON-VIOLENT CRIME IN THE UNITED STATES

QUESTION # 2.1
>WE WILL NOW HOLD AN ON-LINE DISCUSSION. THE TOPIC WILL BE:
> IS THERE SUCH A THING AS NON-VIOLENT CRIME ?
>
TYPE : CONFERENCE
TYPE :

QUESTION # 2.2
>

WISH TO PROVIDE BACKGROUND INFORMATION ON SPECIFIC QUESTIONS?
>NO

COMMAND:
*SETUP PANEL

PLEASE ENTER NAMES OF CONTROL TEAM.

CHAIRMAN : SMITH
UMPIRE : JONES
EDITOR: : WHITE

PLEASE ENTER NAMES OF RESPONDENTS
RESP # 100 : WILSON
RESP # 101 : MORGAN
RESP # 102 :

CHAIRMAN REMOTE CONFERENCING NETWORK 6-APR-73 PAGE # 4

COMMAND:
*

```
 SETUP ACTIVITY SCHEDULES FOR PARTICIPANT # ALL

COMMAND:
*QUIT

THE INQUIRY IS NOW ENDING. PLEASE REMOVE THE TELEPHONE RECEIVER
FROM THE COUPLER AND TURN OFF ALL EQUIPMENT. YOU MAY GET A MESSAGE
STARTING WITH "KILLED JOB ..." WHICH SIGNIFIES THE END OF YOUR
PROGRAM.

THANK YOU.

KILLED JOB 26, USER RECON, ACCT 1, TTY 44, AT  4/06/73 1119
  USED 0:0:11 IN 0:40:20
```

IV. SAMPLE SESSION

Respondent

```
RUN EXPERT
                REMOTE CONFERENCING NETWORK      6-APR-73        PAGE # 1

PLEASE LOG IN BY TYPING YOUR LAST NAME FOLLOWED BY A CARRIAGE RETURN.
>MORGAN

LOG IN CONFIRMED.  YOUR RESPONDENT # IS 101

PLEASE INDICATE YOUR TYPE OF TERMINAL BY TYPING THE APPROPRIATE #.

  0: TYPING ON PAPER    1: HAZELTINE 2000    2: TEKTRONIX 4010
  3: DATAPOINT 3300     4: COMPUTEK  400     5: BEEHIVE
  6: OTHER

#: 0

INFORMATION IS AVAILABLE ON THE FOLLOWING SUBJECTS :

        1       GENERAL INSTRUCTIONS FOR USER
        2       HOW TO USE YOUR TERMINAL
        3       HOW TO LOG INTO THE TELECONFERENCING NETWORK
        4       YOUR COMMAND REPERTOIRE
        5       USER AIDS
        6       COMMUNICATION WITHIN THE REMOTE CONFERENCING NETWORK
        7       PROGRAM CONTROL
        8       HOW TO CORRECT TYPOGRAPHICAL ERRORS: TEXT EDITOR
        9       HOW TO MAKE NUMERICAL INPUT

DO YOU WISH TO SEE ANY OF THIS INFORMATION?  TYPE Y OR N FOLLOWED BY
A CARRIAGE RETURN(CR).
>NO

PURPOSE OF INQUIRY :
AN INQUIRY CONCERNING CRIME IN THE U.S.

BACKGROUND DATA :
THIS IS A DEMONSTRATION INQUIRY DESIGNEDTO ACQUAINT THE USERS
OF THE ARPA POLICY-FORMULATION INTERROGATION NETWORK WITHTHE
SETTING UP AND RUNNING OF AN INQUIRY.

TOPICS FOR INQUIRY ARE :

1  CRIMES OF VIOLENCE IN THE UNITED STATES
1.1  CRIMES OF VIOLENCE IN LOS ANGELES
1.2  CRIMES OF VIOLENCE IN SACRAMENTO
1.3  CRIMES OF VIOLENCE IN SAN FRANCISCO
1.3.1  ARMED ROBBERY IN SAN FRANCISCO
1.3.2  HOMOCIDE IN SAN FRANCISCO
2  NON-VIOLENT CRIME IN THE UNITED STATES

PARTICIPANTS IN REMOTE CONFERENCING NETWORK ARE :

CHAIRMAN :  SMITH
UMPIRE :  JONES
EDITOR :  WHITE
```

WILSON
MORGAN

TOPIC # 1 :
CRIMES OF VIOLENCE IN THE UNITED STATES

TOPIC # 1.1 :
CRIMES OF VIOLENCE IN LOS ANGELES

QUESTION # 1.1.1 :
WHAT, IN YOUR OPINION, IS THE GREATEST SOCIAL FACTOR CONTRIBUTING TO CRIME IN LOS ANGELES?

>NO COMMENT
>

QUESTION # 1.1.2 :
WHAT PERCENTAGE OF CRIMES IN LOS ANGELES ARE CONDUCTED USING ILLEGALLY OBTAINED WEAPONS?

#: 67

TOPIC # 1.2 :
CRIMES OF VIOLENCE IN SACRAMENTO

QUESTION # 1.2.1 :
APPROXIMATELY HOW MANY HOMOCIDES WERE COMMITED IN SACRAMENTO DURING THE YEAR 1965?

#: ?

*** CANNOT RECOGNIZE THE SYMBOLS USED. PLEASE RETYPE.

#: 97

TOPIC # 1.3 :
CRIMES OF VIOLENCE IN SAN FRANCISCO

TOPIC # 1.3.1 :
ARMED ROBBERY IN SAN FRANCISCO

QUESTION # 1.3.1.1 :
WHAT IS YOUR ESTIMATE OF THE NUMBER OF ARMED ROBBERIES THAT
WILL OCCUR IN SAN FRANCISCO IN THE YEAR 1980?

WHAT IS THE MINIMUM VALUE THIS NUMBER MAY HAVE?
#: 300

WHAT IS THE MAXIMUM VALUE IT MAY HAVE?
#: 450

NOW SAM THE BOOKMAKER IS CONDUCTING A BETTING POOL ON THE VALUE OF THIS
NUMBER. HE'S HAD A GREAT SEASON AT SANTA ANITA AND WANTS TO CELEBRATE.
HE IS GIVING AWAY 100 FREE LOTTERY TICKETS ON A $1000 PRIZE.

HE SPREADS THE TICKETS EVENLY SO THAT THERE ARE 50 TICKETS BETWEEN
300 AND 375 , AND 50 BETWEEN 375 AND 450
IF YOU COULD CHOOSE EITHER THE 50 TICKETS ABOVE OR BELOW 375
WHICH WOULD YOU CHOOSE? TYPE -1 FOR BELOW, 0 FOR CAN'T DECIDE,
OR 1 FOR ABOVE.

#: 1

SAM HAS CHANGED HIS MIND; HE DOESN'T WANT THE TICKETS EVENLY SPREAD.

HE NOW PUTS 50 BETWEEN 300 AND 390 , AND 50 BETWEEN
390 AND 450
IF YOU COULD CHOOSE EITHER THE 50 TICKETS ABOVE OR BELOW 390
WHICH WOULD YOU CHOOSE? TYPE -1 FOR BELOW, 0 FOR CAN'T DECIDE,
OR 1 FOR ABOVE.

#: 0

RESP # 101 REMOTE CONFERENCING NETWORK 6-APR-73 PAGE # 4

TOPIC # 1.3.2 :
HOMOCIDE IN SAN FRANCISCO

QUESTION # 1.3.2.1 :
WHAT IS THE GREATEST SOCIAL FACTOR CONTRIBUTING TO THE
INCREASE IN HOMOCIDES IN SAN FRANCISCO?

>NO COMMENT, BUT I WOULD LIKE TO SAY THAT ONE CANNOT PIN-POINT
>A SINGLE CAUSE AND DECIDE THAT IT IS THE MAJOR ONE.
>

TOPIC # 2 :
NON-VIOLENT CRIME IN THE UNITED STATES

QUESTION # 2.1 :
WE WILL NOW HOLD AN ON-LINE DISCUSSION. THE TOPIC WILL BE:
    IS THERE SUCH A THING AS NON-VIOLENT CRIME ?

THERE IS TO BE A CONFERENCE ON THIS SUBJECT BUT ALL PEOPLE ARE NOT
YET PRESENT. PLEASE CONTINUE WITH YOUR ACTIVITIES. WHEN THE CON-
FERENCE IS CALLED, YOU WILL BE NOTIFIED.

ALL YOUR SCHEDULED ACTIVITIES ARE NOW COMPLETED. DO YOU WISH TO REVIEW
ANY OF YOUR ACTIVITIES? TYPE Y OR N AND (CR).
>N

THE INQUIRY IS NOW ENDING. PLEASE REMOVE THE TELEPHONE RECEIVER
FROM THE COUPLER AND TURN OFF ALL EQUIPMENT. YOU MAY GET A MESSAGE
STARTING WITH "KILLED JOB ..." WHICH SIGNIFIES THE END OF YOUR
PROGRAM.

THANK YOU.

KILLED JOB 40, USER RECON, ACCT 1, TTY 44, AT 4/06/73 1159
  USED 0:0:14 IN 0:19:0
-

MASTER INDEX

MASTER INDEX (CONCLUDED)

INDEX OF COMMANDS

I. COMMANDS AVAILABLE TO RESPONDENTS

Commands to Obtain Assistance

• HELP	Requests a shared writing space with the chairman.

Commands to Obtain Information

• INFORMATION ON INQUIRY	Describes the current inquiry
• INFORMATION ON PARTICIPANTS	Prints a list of participants
• INFORMATION ON INTERROGATION NETWORK	Describes the conferencing network
• INFORMATION ON TOPICS	Prints the agenda of the inquiry
• INFORMATION ON ITEM # an item #, or SAME LAST NEXT ALL	Prints the specified item
• QUESTION TEXT	Prints the question again
• STATUS OF PARTICIPANTS	Shows which participants are currently on line

Commands to Communicate with other Participants

• LINK to participant #	Requests a shared writing space
• ACCEPT link	Enables you to accept a link request
• MESSAGE to participant #	Allows you to send a message
• UNCLEAR	Informs the chairman you find a question unclear

Commands to Alter Your Progress

• JUMP to item # • SKIP to item # • GO to Item # } { an item #, or SAME LAST NEXT	Enables you to restart at a specific item
• BACKUP to last item	Restarts you at the last item
• LAST item	"

o SAME item	Starts the current item over again
o CONTINUE	Continues where you left off
o NEXT item	Starts at the next item
o RESTART inquiry	Restarts you at the beginning of the inquiry
o LOGOUT	Ends your current participation
o QUIT	"
o EXIT	"

II. COMMANDS AVAILABLE TO THE CHAIRMAN TO CREATE, AMEND, AND PROCESS THE RESULTS OF AN INQUIRY

o SETUP INQUIRY	To create an inquiry
o SETUP PANEL	To create a panel of respondents
o SETUP ACTIVITY schedules	To assign agendas to respondents
o CALL conference at item	To call participants to a conference
o END conference at item	To end a conference
o DELETE item	To delete an item in an existing inquiry
o INSERT item	To insert an item in an existing agenda
o UNDELETE item	To recall a deleted item
o PRINT RESULTS	To print the aggregated responses to a question
o PRINT DETAILED results	To print the raw inputs to the terminal
o PRINT SAVE results	To print and save the aggregated responses
o SAVE RESULTS	To save the aggregated responses
o SAVE PRINT results	To print and save the aggregated responses

INDEX OF ERRORS

Message	Subsystem	Subroutine
CANNOT DISPLAY DATA; ALL < = 0	RSLTS	PRPDFS
CANNOT RECOGNIZE SYMBOLS USED	EXTINF	INPFPN
CANNOT IDENTIFY RESPONDENT #	PGMCTL	INPRDN
CANNOT IDENTIFY ITEM #	PGMCTL	INPTPN
COMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
EXPECTED A NUMBER WITHOUT WORDS	EXTINF	INPFPN
EXPECTED ONLY ONE DECIMAL POINT IN #	EXTINF	INPFPN
EXPECTED ONLY ONE SIGN FOR THE #	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE DECIMAL POINT	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE #	EXTINF	INPFPN
EXPECTED TOPIC # FORMAT TO BE: F.F.F.F.F 0 <= F <= 99	TERMIO	TNIN
EXPECTED Y OR N FOLLOWED BY (CR)	PGMCTL	GTCHAR
NO CONFERENCE AT THIS QUESTION #	PGMCTL	CLLCNF SNDCNF
NO # HAS BEEN ENTERED	EXTINF	INPFPN
NO SUCH TOPIC	INFMTN	DSPTOP
# MAY AT MOST HAVE 8 SIGNIFICANT DIGITS	EXTINF	INPFPN
# NOT RECOGNIZED	EXTINF	INPDCN
SORRY, WE CANNOT BACK UP. MAKE SURE...	PGMCTL	BCKUP
SUBCOMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
TELECONFERENCING NETWORK UNAVAILABLE	EXPERT	
TERMINAL TYPE NOT RECOGNIZED	TERMIO	TRMTYP
THERE IS NO ITEM WITH THAT #	RSLTS	PRTTXT
THIS ITEM # IS NOT ASSIGNED TO YOU	PGMCTL	DSPTCH
UNRECOGNIZED QUESTION TYPE...	SETUP	INPQSN
YOUR ESTIMATES ARE INCONSISTENT...	EXTINF	EXTPDF

ARPA POLICY-FORMULATION INTERROGATION NETWORK

RESPONDENT'S GUIDE

INSTITUTE FOR THE FUTURE
2725 Sand Hill Road
Menlo Park, California

April 1973

PREFACE

The ARPA policy-formulation interrogation network is a computer-based information gathering, storage, and processing tool designed primarily to aid decision-makers in utilizing knowledge inputs from geographically distributed expert respondents. The interrogation network as a whole consists of (a) an investigator or chairman, his assistants if any, and the remote respondents; (b) their terminals; (c) the ARPANET computer-communication network; (d) a computer, and (e) the controlling program written at the Institute for the Future. The current version (Release 3) of the Institute's network control program is merely a prototype of the more complete program currently being designed and implemented.

This document is a handbook for the respondent in an inquiry. It briefly describes the structure of an inquiry and the roles of the various participants. Most important, it provides detailed instructions for the respondent's participation.

Other documentation available on the interrogation network is as follows:

Respondent's Reference Cards
Chairman's Reference Cards
Chairman's Guide
Programmer's Guide
Program and File Specifications Notebook

ACKNOWLEDGEMENTS

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CONTENTS

I. INTRODUCTION: THE INTERROGATION NETWORK

Basically, the ARPA policy-formulation interrogation network is intended to achieve three operational objectives. These are:

- The structured elicitation of expert opinion, with computer-aided aggregation and processing of the results.
- Real-time communication among inquiry participants as an aid to opinion exchange, with "mail-drop" storage and forwarding of messages also available.
- Real-time and post-facto access to a full record of inquiry interactions and information.

An inquiry is structured around an agenda which can be visualized in the form of an outline with one overall topic (the subject of the inquiry), some number of subtopics perhaps hierarchically arranged, and finally a set of detailed questions requiring answers. Throughout the inquiry you, the respondent, will have topics and questions presented to you with instructions as to what tasks you are asked to perform. Although the sequence and content of these tasks are preset, you have the option of deviating from the prescribed agenda in various ways, by means of commands which you can issue to the network control program (see Section III. C.).

A. THE CHAIRMAN AND THE CONTROL TEAM

The chairman is the leader and overseer of an inquiry. It is the chairman who organizes the inquiry, prepares any background information, has the final decision as to the questions to be asked, and decides who is to participate. To help the chairman in his duties while the inquiry is going, he has two aides, known as the umpire and the editor.

The umpire is the parliamentarian and the second-in-command for the inquiry. It is the umpire who responds to participants' requests for information

or help and in general handles procedural matters as much as possible so as to free the chairman to concentrate on the substantive content of the inquiry.

The editor is in charge of correcting, collating, and filtering the various types of input from all participants. It is the editor who must aggregate various kinds of text so as to make the information usable to the chairman, the umpire and the respondents.

The chairman, umpire and editor are known and referred to in this guide as the CUE team or control team. The following are summaries of the control team's duties:

- Chairman
  - The chairman is the initiator and terminator of the inquiry. He is the person with a decision or problem to be addressed by the inquiry and has control over what will be asked and who may attend.
  - The chairman is a participant in the inquiry and is entitled to make substantive contributions as if he were a respondent.
  - The chairman has extended commands which allow him more complete access to participants' input than anyone else has.
- Umpire
  - The umpire is the "parliamentarian". He handles procedural matters for the inquiry.
  - The umpire is a resource person to whom all requests for help or information are directed.
- Editor
  - The editor monitors all input and checks text for bad grammar or lack of clarity. He is the one in charge of aggregating information to be distributed as feedback to the participants of the inquiry.

B. THE EXPERT RESPONDENT

When the chairman sets up an inquiry, he designates by name those who will be allowed to participate. Associated with each participant (including

the members of the CUE team) is a participant number. Each respondent has a participant number greater than one hundred. The chairman is usually assigned participant number 97, the umpire number 98, and the editor number 99.

Anonymity is preserved in the inquiry, but input information is identified by the contributor's participant number. Thus, one participant may "address" another by number without knowing his identity. Only the chairman knows the true identities of participants.

Each respondent is given a set of questions or tasks which are not necessarily identical to those of other respondents. Each respondent is allowed to view his assigned items, answer them, and observe what others have answered to these particular questions. He is not allowed to view other questions which he has not been assigned.

The respondent may communicate with one other participant in a mode which is private. That is, no record is kept of the conversation and only the two participants involved are allowed "on the line". Otherwise, all inputs are recorded and are accessible to, at least, the chairman.

The respondent has at his disposal a set of commands referred to as a command language. At any time during an inquiry, the respondent may interrupt whatever he is currently doing (e.g., reading output, answering a question, etc.) and jump into command mode, simply by pressing the ESCAPE (ESC) or ALTMODE (ALT) key on his terminal. Once the respondent is in command mode, the command language allows him the following abilities:

a. The respondent may deviate from the "flow" of tasks and "move" to a different set of tasks.
b. He may communicate with other participants by sending "messages" which are stored and forwarded to the recipient at appropriate times.
c. He may communicate directly and privately by "linking" with another terminal device.
d. He may get information from the network control program or from the umpire on almost any aspect of the current inquiry or on the use of the network.

e. He may view the answers which other participants have given to various questions.

One should note that it is not always necessary that all participants be using the interrogation network at the same time. The tasks given to respondents by the chairman can for the most part be done at the pace and at the convenience of the individual respondent. There do exist, however, situations and provisions for synchronous activities.

II. BASIC INSTRUCTIONS FOR USE OF THE NETWORK

A. TERMINALS AND HOW TO USE THEM

Release 3 of the network control program is designed to work with terminals of various kinds. These include hardcopy (i.e., terminals which display by typing or printing on paper) and display screen terminals (which use cathode ray tubes--CRT's--or storage tubes). When logging into the interrogation network, one of the first messages you will receive is:

"PLEASE INDICATE YOUR TYPE OF TERMINAL BY TYPING THE APPROPRIATE NUMBER." plus a short list of terminal types. If you are using a hardcopy terminal, type the number corresponding to "TYPING ON PAPER". If your type of terminal is not on the list, type the number labeled "OTHER".

Your terminal can be used exactly as if it were a conventional electric typewriter, with only two exceptions to this rule. First, the character @ ("at" sign) has special meaning to the network hardware. Although you may, and indeed must use it during the log-in procedure (see Section II. B., "Logging into the Interrogation Network"), you ought to avoid using it thereafter. If you should wish to use @ after log-in has been completed, you must type two of them (@@); when you type @@, the computer will receive @.

Second, there are some occasions on which you will need to type so-called control characters (represented in these instructions by combinations such as CTRL-A and CTRL-R). Control characters are obtained by depressing the CTRL key on your terminal and striking the letter required; thus, CTRL-A means hold-down-CTRL-and-hit-A.

A word on notation; two other keys that have importance to you are the linefeed or LF key and the carriage return or CR key. Whenever you are required to strike one, we will enclose the two-letter designation in parentheses, e.g., (CR) or (LF).

B. LOGGING INTO THE INTERROGATION NETWORK

For a detailed description of log-in procedures, see the card entitled "Entering the Interrogation Network." Note that different versions of this card exist according to the terminal type which you intend to use. Currently the types of terminals provided for include the Teletype 33, Texas Instruments 700, G.E. TermiNet 300, Hazeltine 2000, Tektronix 4010, Datapoint 3300, Computek 400, and Beehive (all models).

The basic instructions for entering the network are as follows. First, prepare your terminal and acoustic coupler for use by setting them for full-duplex operation at 30 characters per second (30 cps is equivalent to 300 Baud). The terminal/coupler unit should be set for on-line use. Second, after having turned on the terminal equipment, dial the telephone number given on the log-in cards and, upon receiving the high-pitched "carrier" tone, place the handset in the coupler, being sure that the telephone cord is at the correct end.

The precise log-in protocols differ for different terminals and different locations. The point to remember is that you can do no damage to the computer or the terminal by making typing errors. This is stressed to inform the users that the network has been designed with a great deal of thought given to protection and security of all participants and all network components.

Recovery procedures are given on the back of the logging-in card. Should these procedures be insufficient to resolve a problem encountered, the Institute staff will be glad to help if you telephone 415-854-6322.

To leave the inquiry or the network at any time, you need only remove the telephone handset from the coupler and hang up the phone (i.e., break the telephone connection). The network control program will keep track of your progress; no information or input will be lost; if you log in again later the control program will automatically pick up where it left off.

Please read through the appropriate card for entering the network at least once before attempting to log in. Remember that when you are instructed to type something such as:

you must type each character, e.g., an "at" sign (@), an "L", a space, and the number "86".

Before entering the network, it is also especially important that you read Section II. F., on special characters.

C. INPUT TO THE COMPUTER

The network, after asking you a question or requesting some input, prompts for input with one of several different symbols:

- # to ask for a number
- > to ask for text input
- * to ask for a command
- ; to ask for special input that is communicated directly to another participant.

To terminate a line of input, type a carriage return (CR).

If the system expects more than one line of input, it will give you another prompting symbol.

To terminate multi-line input, type two consecutive carriage returns (CR) at the end of a line.

D. EDITING COMMANDS

Whenever you are asked to type information into the network via your terminal keyboard, editing facilities are available which allow you to correct typographical errors before your input is recorded in the inquiry. This capability depends on the fact that each such input is held in temporary storage until the appropriate input-terminating character is received (one carriage return for one-line inputs, two consecutive carriage returns for multi-line inputs).

The available editing commands (each represented by a single control character) are listed below.

CTRL-A	Deletes preceding character
CTRL-W	Deletes last word typed

CTRL-Q	Deletes current line of input
CTRL-X	Deletes whole input (same as CTRL-Q if input is only one line)
CTRL-R	Types out current line
CTRL-Y	Types out whole input (same as CTRL-R if input is only one line)

E. NUMERICAL INPUTS

Whenever you are asked to provide a numerical estimate or other quantitative input, your response should be typed in as an ordinary integer or decimal number. Use decimal points, plus or minus signs, commas, percent signs, and dollar signs as needed. Do not use other symbols, nor such words as "million", "billion", etc. Thus, the following are admissable entries:

6,000,000
45%
0
-1
-123.45
$12.35

The following, however, are not admissable:

6 million
zero
2/3
66¢

If you use any of the inadmissable forms, you will receive an error message and should retype your input correctly.

F. SPECIAL CHARACTERS

When you are using the network, the following characters have special usage. (Control characters are obtained by depressing the CTRL key on

your terminal and striking the letter required; thus, CTRL-A means hold-down-CTRL-and-hit-A.)

Carriage return or (CR)

Indicates that a line of input has been completed. Two consecutive carriage returns indicate the end of multi-line input. The key is marked CR or RET.

Linefeed or (LF)

Indicates that a command given during the logging-in procedure has been completed. See Section II. A., "Terminals and How to Use Them."

"At" sign or @

If at any time after log-in has been completed you wish to type an "at" sign, type 2 "at" signs (@@) for correct response.

Escape or Altmode (or ESC or ALT)

Indicates that the user wishes to stop whatever is happening currently and go into command mode. This key will stop all activity and cause a command prompt to be sent to your terminal.

Control-A or CTRL-A (hold-down-CTRL-and-type-A)

An editing command which deletes the preceding character.

Control-W or CTRL-W (hold-down-CTRL-and-type-W)

An editing command which deletes the last word typed on the current line.

Control-Q or CTRL-Q (hold-down-CTRL-and-type-Q)

An editing command which deletes the current line of input.

Control-X or CTRL-X (hold-down-CTRL-and-type-X)

An editing command which deletes the whole input. (Same as CTRL-Q if the input is only one line.)

Control-R or CTRL-R (hold-down-CTRL-and-type-R)

An editing command which types out the current line.

Control-Y or CTRL-Y (hold-down-CTRL-and-type-Y)

Types out the whole input. (Same as CTRL-R if input is only one line.)

III. HOW TO PARTICIPATE IN AN INQUIRY

Once you have logged into the interrogation network, the network control program will guide your entire participation, giving you instructions at every step. Most of the time you will be in question and answer mode, in which questions will be posed to you on your terminal and you should simply type in your responses. If the inquiry agenda contains "conference" items (which is up to the chairman), you may be automatically put into conference mode, but here too you will be given complete instructions. It is therefore possible for you to participate fully without taking any special initiatives of your own.

If, however, you wish to deviate from your prescribed sequence of tasks in order to ask for help, communicate with another participant, review a task you performed previously, or jump to a later task on the agenda, you may do so via command mode. From command mode you may go into link mode for direct communication with another inquiry participant.

A. QUESTION AND ANSWER MODE

The first and most straightforward mode is the question and answer mode (Q & A mode), in which you simply follow the instructions which the controlling program gives you, read whatever is presented, and answer whatever is asked. An inquiry in which this inquisitorial mode is used exclusively is actually an on-line questionnaire. Use of the other modes of operation implies interaction between respondents.

B. CONFERENCE MODE

The second mode is the synchronous conference or discussion mode. Unlike Q & A mode, in which it is entirely possible that no two respondents

would be working on the same agenda item at the same time, discussion mode provides for simultaneous consideration of and conversation about a single item by two or more respondents. A conference consisting entirely of the discussion mode would be nearly equivalent to a face-to-face group conversation and, thus, would require all participants to be on-line at the same time. In this situation, you can proceed no faster than your slowest colleague. To avoid these restrictions as much as possible, inquiries can have both synchronous and asynchronous portions, respondents being allowed to proceed at their own pace most of the time and being called together for synchronous discussion only when necessary. To facilitate such "mixed-mode" inquiries, the interrogation network contains a mechanism for interrupting you while you are working asynchronously and summoning you into the required synchronous discussion. This mechanism minimizes disruption of the respondent's train of thought by (a) waiting to interrupt you until you reach a "good stopping point", i.e., the end of the agenda item on which you are currently working, and (b) sending you back to the appropriate point in your asynchronous activities as soon as the discussion is over.

C. COMMAND MODE

A general command language has been developed in order to give you flexibility in controlling your participation in the inquiry. Although the inquiry is basically self-propelling, adjusting to the user's expertise in using the system and to his desires as to the speed with which he proceeds, the user is allowed to "move around" in the schedule of activities, thus altering the sequence of events by his control.

To be released from the previously set-up schedule, you must hit the escape key which is labeled on your terminal as either ESC or ALT (which stands for altmode). The system will print the character "$" and a command prompt. The system now waits for a command. To save time, type three or four letters of the command and hit the space bar. If the system recognizes the letters as an unambiguous command, the remainder of the command text will be printed out.

Should the information you type into the command-reader be ambiguous, the system will prompt you with a bell and wait until sufficient information is given or a carriage return is typed, which requests that the command letters typed on the current line be ignored.

Thus, to suspend the inquiry and utilize your command language:

1. Hit the escape or altmode key ($ will be printed out).
2. Wait for the command prompt.
3. Type your command (either complete text or using the space bar to fill out the text).
4. When the command is in the correct form, with all the necessary information, hit a carriage return (CR).
5. If you are not sure of the wording of a command or of a sub-command, type a ? (question mark) and a space. A list of all the valid commands will be printed.

The command language can be divided into three main categories of commands. These are:

- User aids - the set of commands to get information, obtain personalized help, or complain about unclear or badly worded tasks.
- Communication - the set of commands used by the respondent to leave messages for or link directly to other participants.
- Program control - the set of commands allowing the respondent to start or stop the sequence of tasks at any time and resume the tasks at a different spot in the agenda.

1. User Aids

All of these commands must be followed by a carriage return.

HELP

This command links you directly to the umpire or chairman, who can deal with your problems or supply needed information in real time.

UNCLEAR

This command is used when you are unsatisfied with the phrasing of a question or agenda item and wish to obtain further information to clarify the item. This command leaves the text of your complaint or suggestion as a message for the umpire or chairman.

STATUS

This command will print out the respondent numbers or titles of those participants who are currently logged in to the inquiry.

INFORMATION ON PARTICIPANTS

This command lists the names of all participants who are taking part in the inquiry.

INFORMATION ON INTERROGATION NETWORK

This command allows you to see any of the background user information concerning the program.

INFORMATION ON INQUIRY

This command will give you general information as to the nature of the inquiry in which you are participating.

INFORMATION ON TOPICS

This command gives you the outlined version of the complete agenda for this inquiry, printing out topic numbers and descriptive titles for the various items.

INFORMATION ON ITEM #

This command will print out all the background and introductory material associated with the designated item number. You must designate which information you want by typing:

1. a specific item number,
2. a list of item numbers separated by commas (e.g., 1, 3, 4, 6),
3. a range of item numbers (e.g., 4-9), or
4. a carriage return only, which signifies the item in which you are currently working.

2. Communication

As a respondent, you can create an environment of real-time communication between terminals, since you have the option of linking directly to a specific individual or leaving a message for him.

LINK

This command requests the respondent number of the individual to whom you wish to link. The program will ring the bells on his terminal and wait for him to accept the link or, if he is not currently on-line, the program will ask you if you wish to leave a message.

ACCEPT LINK

This command enables another individual who has been given the link command to complete a connection to your terminal. This command is analogous to "answering the phone" by accepting the call. To give this command (and all of the other commands) you must be in command mode; that is, if you are in the inquiry you must first hit the escape key and then give the *ACCEPT LINK* command.

MESSAGE

This command allows you to send a message to a user. You will be asked for the respondent number to whom the message is to be sent and you will be asked to identify yourself (either by name or by respondent number). You will then be asked for the text of the message. The designated respondent will receive the message when he finishes a higher priority task or, if he is not currently on-line, when he logs into the system.

3. Program Control

Should you wish at any time to interrupt your current activity in the inquiry, all that is necessary is to strike the escape or altmode key, which will put you in command mode. When you are ready to rejoin the inquiry, you may control your re-entry into the scheduled activities by means of the following commands.

BACKUP

This command will restart you at the previous item number in your schedule of activities.

CONTINUE

This command will restart you at the next task within an item number. This can be used to skip over background information which you have already seen.

GO TO ITEM #

This command restarts you at the item number you specify or will respond correctly to the arguments: *NEXT*
LAST
SAME

LAST

This command restarts you at the previous topic number and continues with your scheduled activities from that point.

NEXT

This command restarts you at the next consecutive topic number, thus skipping the remaining tasks in the current topic.

SAME

This command restarts you at the current topic, enabling you to erase the responses you have given under the current topic. Thus, this instruction is used when you wish to change a response or read through the entire topic again.

QUIT

This instruction takes you out of the inquiry and gives you instructions for logging out of the computer system and the network. The system will keep track of what you have completed and will start your scheduled activities at the first uncompleted topic in your schedule when you return to the inquiry at a later date.

IV. SAMPLE SESSION

REMOTE CONFERENCING NETWORK 6-APR-73 PAGE # 1

PLEASE LOG IN BY TYPING YOUR LAST NAME FOLLOWED BY A CARRIAGE RETURN.
>MORGAN

LOG IN CONFIRMED. YOUR RESPONDENT # IS 101

PLEASE INDICATE YOUR TYPE OF TERMINAL BY TYPING THE APPROPRIATE #.

0: TYPING ON PAPER	1: HAZELTINE 2000	2: TEKTRONIX 4010
3: DATAPOINT 3300	4: COMPUTEK 400	5: BEEHIVE
6: OTHER		

#: 0

INFORMATION IS AVAILABLE ON THE FOLLOWING SUBJECTS :

1 GENERAL INSTRUCTIONS FOR USER
2 HOW TO USE YOUR TERMINAL
3 HOW TO LOG INTO THE TELECONFERENCING NETWORK
4 YOUR COMMAND REPERTOIRE
5 USER AIDS
6 COMMUNICATION WITHIN THE REMOTE CONFERENCING NETWORK
7 PROGRAM CONTROL
8 HOW TO CORRECT TYPOGRAPHICAL ERRORS: TEXT EDITOR
9 HOW TO MAKE NUMERICAL INPUT

DO YOU WISH TO SEE ANY OF THIS INFORMATION? TYPE Y OR N FOLLOWED BY A CARRIAGE RETURN(CR).
>NO

PURPOSE OF INQUIRY :
AN INQUIRY CONCERNING CRIME IN THE U.S.

BACKGROUND DATA :
THIS IS A DEMONSTRATION INQUIRY DESIGNEDTO ACQUAINT THE USERS OF THE ARPA POLICY-FORMULATION INTERROGATION NETWORK WITHTHE SETTING UP AND RUNNING OF AN INQUIRY.

TOPICS FOR INQUIRY ARE :

1 CRIMES OF VIOLENCE IN THE UNITED STATES
1.1 CRIMES OF VIOLENCE IN LOS ANGELES
1.2 CRIMES OF VIOLENCE IN SACRAMENTO
1.3 CRIMES OF VIOLENCE IN SAN FRANCISCO
1.3.1 ARMED ROBBERY IN SAN FRANCISCO
1.3.2 HOMOCIDE IN SAN FRANCISCO
2 NON-VIOLENT CRIME IN THE UNITED STATES

PARTICIPANTS IN REMOTE CONFERENCING NETWORK ARE :

CHAIRMAN : SMITH
UMPIRE : JONES
EDITOR : WHITE

WILSON
MORGAN

TOPIC # 1 :
CRIMES OF VIOLENCE IN THE UNITED STATES

TOPIC # 1.1 :
CRIMES OF VIOLENCE IN LOS ANGELES

QUESTION # 1.1.1 :
WHAT, IN YOUR OPINION, IS THE GREATEST SOCIAL FACTOR CONTRIBUTING TO CRIME IN LOS ANGELES?

>NO COMMENT
>

QUESTION # 1.1.2 :
WHAT PERCENTAGE OF CRIMES IN LOS ANGELES ARE CONDUCTED USING ILLEGALLY OBTAINED WEAPONS?

#: 67

TOPIC # 1.2 :
CRIMES OF VIOLENCE IN SACRAMENTO

QUESTION # 1.2.1 :
APPROXIMATELY HOW MANY HOMOCIDES WERE COMMITED IN SACRAMENTO DURING THE YEAR 1965?

#: ?

*** CANNOT RECOGNIZE THE SYMBOLS USED. PLEASE RETYPE.

#: 97

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TOPIC # 1.3 :
CRIMES OF VIOLENCE IN SAN FRANCISCO

TOPIC # 1.3.1 :
ARMED ROBBERY IN SAN FRANCISCO

QUESTION # 1.3.1.1 :
WHAT IS YOUR ESTIMATE OF THE NUMBER OF ARMED ROBBERIES THAT
WILL OCCUR IN SAN FRANCISCO IN THE YEAR 1980?

WHAT IS THE MINIMUM VALUE THIS NUMBER MAY HAVE?
#: 300

WHAT IS THE MAXIMUM VALUE IT MAY HAVE?
#: 450

NOW SAM THE BOOKMAKER IS CONDUCTING A BETTING POOL ON THE VALUE OF THIS NUMBER. HE'S HAD A GREAT SEASON AT SANTA ANITA AND WANTS TO CELEBRATE. HE IS GIVING AWAY 100 FREE LOTTERY TICKETS ON A $1000 PRIZE.

HE SPREADS THE TICKETS EVENLY SO THAT THERE ARE 50 TICKETS BETWEEN
300 AND 375 , AND 50 BETWEEN 375 AND 450
IF YOU COULD CHOOSE EITHER THE 50 TICKETS ABOVE OR BELOW 375
WHICH WOULD YOU CHOOSE? TYPE -1 FOR BELOW, 0 FOR CAN'T DECIDE,
OR 1 FOR ABOVE.

#: 1

SAM HAS CHANGED HIS MIND; HE DOESN'T WANT THE TICKETS EVENLY SPREAD.

HE NOW PUTS 50 BETWEEN 300 AND 390 , AND 50 BETWEEN
390 AND 450
IF YOU COULD CHOOSE EITHER THE 50 TICKETS ABOVE OR BELOW 390
WHICH WOULD YOU CHOOSE? TYPE -1 FOR BELOW, 0 FOR CAN'T DECIDE,
OR 1 FOR ABOVE.

#: 0

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TOPIC # 1.3.2 :
HOMOCIDE IN SAN FRANCISCO

QUESTION # 1.3.2.1 :
WHAT IS THE GREATEST SOCIAL FACTOR CONTRIBUTING TO THE
INCREASE IN HOMOCIDES IN SAN FRANCISCO?

>NO COMMENT, BUT I WOULD LIKE TO SAY THAT ONE CANNOT PIN-POINT
>A SINGLE CAUSE AND DECIDE THAT IT IS THE MAJOR ONE.
>

TOPIC # 2 :
NON-VIOLENT CRIME IN THE UNITED STATES

QUESTION # 2.1 :
WE WILL NOW HOLD AN ON-LINE DISCUSSION. THE TOPIC WILL BE:
    IS THERE SUCH A THING AS NON-VIOLENT CRIME ?

THERE IS TO BE A CONFERENCE ON THIS SUBJECT BUT ALL PEOPLE ARE NOT
YET PRESENT. PLEASE CONTINUE WITH YOUR ACTIVITIES. WHEN THE CON-
FERENCE IS CALLED, YOU WILL BE NOTIFIED.

ALL YOUR SCHEDULED ACTIVITIES ARE NOW COMPLETED. DO YOU WISH TO REVIEW
ANY OF YOUR ACTIVITIES? TYPE Y OR N AND (CR).
>N

THE INQUIRY IS NOW ENDING. PLEASE REMOVE THE TELEPHONE RECEIVER
FROM THE COUPLER AND TURN OFF ALL EQUIPMENT. YOU MAY GET A MESSAGE
STARTING WITH "KILLED JOB ..." WHICH SIGNIFIES THE END OF YOUR
PROGRAM.

THANK YOU.

KILLED JOB 40, USER RECON, ACCT 1, TTY 44, AT 4/06/73 1159
  USED 0:0:14 IN 0:19:0

MASTER INDEX

MASTER INDEX (CONCLUDED)

INDEX OF COMMANDS

Commands to Obtain Assistance

• HELP	Requests a shared writing space with the chairman.

Commands to Obtain Information

• INFORMATION ON INQUIRY	Describes the current inquiry
• INFORMATION ON PARTICIPANTS	Prints a list of participants
• INFORMATION ON INTERROGATION NETWORK	Describes the conferencing network
• INFORMATION ON TOPICS	Prints the agenda of the inquiry
• INFORMATION ON ITEM # an item #, or SAME LAST NEXT ALL	Prints the specified item
• QUESTION TEXT	Prints the question again
• STATUS OF PARTICIPANTS	Shows which participants are currently on line

Commands to Communicate with other Participants

• LINK to participant #	Requests a shared writing space
• ACCEPT link	Enables you to accept a link request
• MESSAGE to participant #	Allows you to send a message
• UNCLEAR	Informs the chairman you find a question unclear

Commands to Alter Your Progress

• JUMP to item # • SKIP to item # • GO to item # } { an item #, or SAME LAST NEXT	Enables you to restart at a specific item
• BACKUP to last item	Restarts you at the last item
• LAST item	"
• SAME item	Starts the current item over again
• CONTINUE	Continues where you left off

• NEXT item	Starts at the next item
• RESTART inquiry	Restarts you at the beginning of the inquiry
• LOGOUT	Ends your current participation
• QUIT	"
• EXIT	"

INDEX OF ERRORS

Message	Subsystem	Subroutine
CANNOT DISPLAY DATA; ALL < = 0	RSLTS	PRPDFS
CANNOT RECOGNIZE SYMBOLS USED	EXTINF	INPFPN
CANNOT IDENTIFY RESPONDENT #	PGMCTL	INPRDN
CANNOT IDENTIFY ITEM #	PGMCTL	INPTPN
COMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
EXPECTED A NUMBER WITHOUT WORDS	EXTINF	INPFPN
EXPECTED ONLY ONE DECIMAL POINT IN #	EXTINF	INPFPN
EXPECTED ONLY ONE SIGN FOR THE #	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE DECIMAL POINT	EXTINF	INPFPN
EXPECTED THE SIGN TO PRECEDE THE #	EXTINF	INPFPN
EXPECTED TOPIC # FORMAT TO BE: F.F.F.F.F 0 <= F <= 99	TERMIO	TNIN
EXPECTED Y OR N FOLLOWED BY (CR)	PGMCTL	GTCHAR
NO CONFERENCE AT THIS QUESTION #	PGMCTL	CLLCNF ENDCNF
NO # HAS BEEN ENTERED	EXTINF	INPFPN
NO SUCH TOPIC	INFMTN	DSPTOP
# MAY AT MOST HAVE 8 SIGNIFICANT DIGITS	EXTINF	INPFPN
# NOT RECOGNIZED	EXTINF	INPDCN
SORRY, WE CANNOT BACK UP. MAKE SURE...	PGMCTL	BCKUP
SUBCOMMAND NOT RECOGNIZED	PGMCTL	CMDRDR
TELECONFERENCING NETWORK UNAVAILABLE	EXPERT	
TERMINAL TYPE NOT RECOGNIZED	TERMIO	TRMTYP
THERE IS NO ITEM WITH THAT #	RSLTS	PRTTXT
THIS ITEM # IS NOT ASSIGNED TO YOU	PGMCTL	DSPTCH
UNRECOGNIZED QUESTION TYPE...	SETUP	INPQSN
YOUR ESTIMATES ARE INCONSISTENT...	EXTINF	EXTPDF