

GUIDE TO GMU ISM SOFTWARE **(Appendix 2 of Handbook of Interactive Management)**

A2.1 GETTING STARTED.

The GMU ISM PC software is expected to run on an IBM-compatible machine, *provided* the machine also contains a math coprocessor. Attempts to run the programs without the coprocessor will cause an error message to occur that mentions floating point. For this software to run successfully, the IBM-compatible PC must have at least 640K of RAM. Old machines sometimes have only 512 K, and we know from experience that the software will "hang up" at the point where querying begins. It is also necessary that the machine have a graphics capability, because the querying may use more than one font, depending on the length of the query.

In this particular version of ISM software, three software commands are featured, one of which will be chosen in a specific structuring application. These commands are: DOMODEL, DOCLUS, and DOPRIOR.

DOMODEL. *DOMODEL is the most general command, and it can be used in any ISM structuring application.* As programmed in this software, it will not be as efficient as the other two commands for those applications where the other two are appropriate. The user should learn when to use DOCLUS and DOPRIOR and choose one of them when appropriate. For all other applications, the user should use DOMODEL.

DOCLUS. *The DOCLUS command is to be used when and only when the user knows at the beginning that the structure to be produced will consist only of one or more cycles.* (This knowledge allows the machine to use the following inference rule: If ARB, then BRA for all A&B. Conversely, if A is not related to B, then B is not related to A.)

DOPRIOR. *The DOPRIOR command is to be used when and only when the user knows at the beginning that the structure to be produced will consist of a priority structure (or a structure that meets all the requirements of a priority structure).* Such a structure will have a single path from one end of the structure to the other. It may have cycles on this path.¹

These notes have been prepared to help the user apply the software, once it has been installed in the C Drive. After the software has been installed, the ISM programs are held in the ISM Directory. This directory will also hold user-produced files, which will be explained in the next section. To see the program files in the ISM Directory, after installation of the software, you transfer to the ISM directory as shown later in these notes, and then you enter this command:

```
C:\ISM>>DIR /p
```

and press the ENTER or RETURN key. You should then see the following on your screen:

C:\ISM.dir

Volume in drive C is DISK1_VOL2

Directory of C:\ISM

PRIOREXE	301456	8-13-88	1:59 p	
MODLDK	EXE	299520	8-13-88	11:36a
MYFLAG	DAT	128	8-12-88	10:05a
OLDNEW	DAT	128	8-12-88	10:04a
OLDOLD	DAT	128	8-12-88	10:05a
CLUSDK	EXE	251344	8-13-88	10:18a
NEWNEW	DAT	128	8-12-88	10:04a
NEWOLD	DAT	128	8-12-88	10:05a
HALOIBMG	DEV	9862	4-02-88	6:50p
RUNISM	BAT	25	11-08-90	2:03p
DOCLUS	BAT	339	11-08-90	2:02p
DOMODEL	BAT	339	11-08-90	2:02p
DOPRIOR	BAT	339	11-08-90	2:03p

15 File(s) 8734720 bytes free

Each time you use the ISM software, you will create a matrix file ("mat") and a text file ("txt") . After you have created matrix and text files, they will also appear in the ISM directory listing. Instead of the listing shown above, the screen will then present a display like the following (showing just one illustrative matrix file and one illustrative text file):

Same contents as in the above files listing, followed by:

TEST1MAT	10741	11-13-90	11:34a	
TEST1TXT	57792	11-13-90	11:34a	

17 File(s) 8663040 bytes free

In the above, TEST1.MAT is a name that a user has arbitrarily assigned to a matrix file; while TEST1.TXT is a name that a user has arbitrarily assigned to a text file. Many other names could have been used, such as JOE, SALLY, PRINCETON or YALE.

This ISM software operates with two kinds of user-produced files. One is a file to hold a matrix that is developed in an ISM session. The other is a file to hold relevant textual information. ***It is suggested that you use your word processor to create an ISM Files Log.*** It is optional whether you do this, since this Log does not involve the ISM software, and is only for the convenience of

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the user in having a separate location for important information. The files held in this log might be retrieved by using a number, and should be assigned distinctive textual names to identify what they represent, as well as what ISM Project they relate to. The main purpose of this file is to enable past information to be retrieved for future use.

The suggested format is as follows:

ISM MATRIX FILE

Entry#1.

File Designation:	NAME1.mat
Pertains to ISM Project:	(describe the project)
Involves the Application Structural Type:	(describe the type)
Involves the following elements:	(describe the element set)
Involves the following generic question:	(type the generic question)
Information prepared by:	(type the name of the file creator)
Date of entry:	(type the current date when creating or amending the file)

Entry #2.

File Designation:	NAME2.mat
Fill in similarly as for NAME1, and so on.	

ISM TEXT FILE

Entry#1.

File Designation:	NAME1.txt
Pertains to ISM Project:	(describe the project)
Involves the Application Structural Type:	(describe the type)
Involves the following elements:	(describe the element set)
Involves the following generic question:	(type the generic question)
Information prepared by:	(type the name of the file creator)
Date of entry:	(Type the current date when creating or amending the file)

Entry #2.

File Designation:	NAME2.txt
Fill in similarly as for NAME1, and so on.	

Of course you may choose not to bother with this, preferring to use some other means to keep track of your files.

If the software has been loaded successfully into the C drive, the user may then go into the DOS system prepared to enter a command. The command that is recommended is:

chdir ISM

This command should put the user in touch with the C drive and the ISM directory, as the following material indicates.

Assumption 1	Assume that the GMU Software has been loaded into the C Drive. Then you will have a situation where you go to DOS to get into the ISM program.
Assumption 2	You are in the DOS program on C Drive
Assumption 3	You are looking at C:\>>

- TYPE IN MATERIAL SO THAT THE COMMAND READS AS FOLLOWS:

```
C:\>>chdir ism
```

- PRESS "ENTER" OR "RETURN". The DOS display should then read:

```
C:\ISM>>
```

You are now operating in the ISM directory.

- STARTING TO MODEL. Decide which of the three major commands you want to use; i.e., (A) DOMODEL, (B) DOCLUS, or (C) DOPRIOR. These commands are discussed, respectively, in Secs. A2.2, A2.3, and A2.4.

A2.2 THE DOMODEL COMMAND. The description of the DOMODEL Command begins with assumptions.

Assumption 1	You have decided to use the DOMODEL Command.
Assumption 2	Your ISM Files Log does <i>not</i> contain any old files that you wish to use. If this assumption is correct, (optional) choose a name for your matrix file and a name for your text file and enter these names in your ISM Files Log, then proceed with the instructions below. Otherwise, go to A2.2.2.

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS AS FOLLOWS:

```
C:\ISM>>DOMODEL XXX.MAT XXX.TXT
```

where instead of XXX you use the new file name that you have entered in your ISM Log.

Now hit the Enter or Return Key. As a result of this step, you should now see a screen display like this:

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```
C:\ISM>>echo off
1 File(s) copied
TEXT FILE EMPTY - PLEASE CREATE ONE!
BLANKING OUT NEW TEXT DATA FILE.
PLEASE WAIT.....

-----BEGINNING OPTIONS-----
1. CREATE RELATIONAL STATEMENTS
2. CREATE TEXT ELEMENTS
?
```

- Now set the caps lock so that any letter that you type in response to computer questioning will be a capital letter.

You have reached this point by starting to use the DOMODEL command, and because you are going to start with new file material. The screen display gives you two options:

1. Create relational statements
2. Create text elements

You must do both of these because you have begun with a blank text file.

Assumption 1 You have already constructed a generic question and are ready to fit it into the format that is required in this Case. The format is seen by pursuing option 1 above. If you have not constructed such a question, you will need to do so before continuing. Then select option 1. You will note that this option requires that you enter three distinct parts of your generic question in a prescribed format.

At this point, an example is introduced that takes the user through the entire process of using the DOMODEL command to develop a structure.

After you have worked through the example, you should be in a position to do a more complex example using your own information².

A2.2.1 Illustrating the Use of ISM Through an Example (The DOMODEL Command). This example illustrates the DOMODEL command.

1. Goal. I want to structure the following element set:

{1. feather, 2. Mack Truck, 3. beer can, 4. Volkswagen, 5. small boy, 6. professional wrestler, 7. universe}

using the following generic question:

*Is
Element A
heavier than
Element B
?*

2. *Flow of Activity Style.* I will write this example in the flow of activity style, i.e., I will present each step in the sequence that I do the step on the computer.

3. *Starting Conditions.* My ISM Files Log is empty. I have no prior matrix file and no prior text file. The ISM software is installed in my PC, which has the required math coprocessor, at least 640K of RAM, and graphics capability.

I have decided to use the DOMODEL program. (I could also use the DOPRIOR program because the structure I expect meets the conditions of a priority structure.

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However I will *not* use the DOCLUS program, which is only used when it is known that the structure to be developed consists entirely of cycles.)

4. Start the ISM Files Log (optional). I will use my word processor to start my ISM Files Log. The entry I will make is as follows:

ISM Files Log

ISM MATRIX FILE

Entry #1.

File Designation:	JEFF.MAT
Pertains to ISM Project:	creating an example to illustrate the use of the ISM PC Software
Involves the Application Structural Type:	None
Involves the Graphics Structural Type:	Linear hierarchy
Involves the following elements:	{feather, Mack Truck, beer can, Volkswagen, small boy, professional wrestler, universe}
Involves the generic question:	Is Element A heavier than Element B?
Information prepared by:	John N. Warfield
Date of Entry:	November 23, 1990

ISM TEXT FILE

Entry #1.

File Designation:	JEFF.TXT
Other entries are the same as for Matrix File	JEFF.MAT

5. Entering the ISM Directory. I turn on my computer and enter the ISM Directory.

6. Entering the DOMODEL Command. I create this screen display (entering the DOMODEL command)

```
C:\ISM>>DOMODEL JEFF.MAT JEFF.TXT
```

and then hit the Enter key.

7. Choosing an Option from a Menu. The machine asks me which of two options to choose, and I choose the option 1--"Create relational statements".

When it asks for R1, I enter IS
When it asks for R2, I enter HEAVIER THAN
When it asks for R3, I enter ?

NOTE : While entering this information, the screen asks me whether I want more lines, and whether I want to keep the displayed entry. The user should appreciate that the ISM program is written in such a way that when the user is asked to type in text information, the user should type only one line, and wait until the program asks you if you need more lines. Then you should type in the next line, and so on. If you don't fill up the line that's okay. The machine will later put all your lines together into an integrated text presentation. When the machine asks if you want to keep the entry you have just finished, it is giving you the opportunity to edit it further immediately before putting it in the text file.

Also note that unless you use only capital letters in response to queries, the machine will ignore your responses. So use the Caps Lock before continuing.

8. Limited Set Size. The screen then reveals that I am allowed up to 85 elements in the element file. (The program has automatically put me in the position of starting to carry out the second option (see 7 above)).

9. Responding to Queries. Several questions appear in sequence on the screen and I respond Y to each of them and hit the Enter or Return key.

10. Typing in the First Element. The machine now asks for element #1. I type :

FEATHER

11. More of Those Thrilling Queries. Once again the machine asks if I need more lines and I reply NO, then it asks if I want to keep the element I entered and I reply YES, and then it asks if I want to continue with another element, and I reply YES. [I reply by typing Y or N as prompted by the screen.]

12. Recycling. I then recycle steps 10 and 11, entering a new element each time, until I have entered the whole element set that I began with as given in Item 1 above. After I have entered element #7, and the machine asks if I want to enter another element, I type in NO.

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13. Entering File Reference Information. The screen now asks me to type in file information. I then enter the following:

ISM FILES LOG ENTRY #1 dated Nov. 23, 1990.

14. Main Editor Options. Next the screen shows me the Main Editor Options. The list is as follows:

```
----- MAIN EDITOR OPTIONSa -----  
0 - EXIT THE EDITOR  
3 - EDIT AN ELEMENT  
4 - EDIT A RELATIONAL STATEMENT  
5 - ADD AN ELEMENT  
6 - LIST TEXT ELEMENTS IN THE FILE  
7 - EDIT AN ELEMENT LABEL  
8 - DELETE THE CONTENT OF AN ELEMENT  
9 - MODIFY THE FILE INFORMATIONAL STATEMENT
```

15. Review or Exit the Editor ? If I have done everything correctly to this point, I do not need to do any editing, so I will press 0 to Exit the Editor. However if I did need to review, I would choose Option 6 followed by Sub Option 2 in order to change any element statements. If I needed to revise the generic question, I would choose Option 4 followed by the appropriate sub-option chosen from those shown on the screen following my choice of option 4.

16. Exit Editor. Next I would exit the Editor by pressing 0.

17. Entering an ISM Command. The screen then shows me the following:

```
>>>> TYPE AN I S M COMMAND (OR "HELP")
```

If you type "HELP", the screen will display the ISM Commands.

18. Border. I now choose the command BO to initiate the ISM structuring activity.

19. Responses the Machine Accepts. The machine tells me I must choose one of the four responses to each displayed question:

^a The word "label" normally refers to the number assigned to an element. The word "content" refers to the written statement of the element. A generic question typically is formed from three statements. The term "relational statement", as used here, is a misnomer, but that is what the programmer chose to use. The symbols chosen for the three statements are R1, R2, and R3 respectively.

- Y yes, the relationship is true
- N no, the relationship is false^b
- AB, abort
- ED, suspend comparisons to edit and then continue

20. Subordination Relation? After I hit the Return key, the machine asks if I am using a subordination relation (i.e., one that necessarily yields a hierarchical structure--a structure without any cycles). Since I am doing so in this particular example, I type Y and hit the Return or Enter key.

21. Problem - Options Structure. Next the screen asks if I am using a particular type of modeling plan--one in which I am connecting a set of proposed solution options to a structure comprised of interrelated problems (a "problematique"). Since I am not doing so, I type N. (This plan will be explained in A2.5.)

22. Element Numbers to Start Structuring. Now the screen asks for element numbers. First I type 1 and hit the Return key. Then I type 2 and hit the return key.

23. Question Sequence. The following is the sequence of steps that represents the questions, answers, and new element entries (I will now use the shorthand symbol "R" to represent the relationship "heavier than".) :

Is 1R2?	N	Return	5		7		
Is 2R1?	Y	Return	Is 4R5?	Y	Return		
3			Is 3R5?	N	Return		
Is 2R3?	Y	Return	Is 5R1?	Y	Return		
Is 1R3?	N	Return	Is 5R3?	Y	Return		
Is 3R1?	Y	Return	6		Is 7R2?	Y	Return
4			Is 4R6?	Y	Return		
Is 3R4?	N	Return	Is 3R6?	N	Return		
Is 4R3?	Y	Return	Is 6R3?	Y	Return		
Is 2R4?	Y	Return	Is 5R6?	N	Return		
			Is 6R5?	Y	Return		

24. Request for Next Command. The machine now asks for an ISM Command.

25. Display. I type DI and hit return to ask for a display of the structural information.

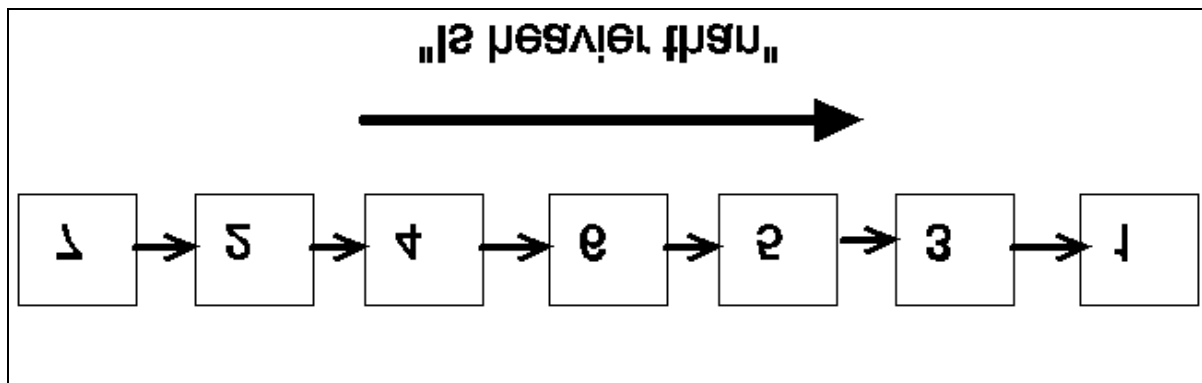
^b In the above the correct statement should read as follows:
No, the relationship is false OR I don't know enough to believe that the relationship is true.

26. Getting a Printout of the Structural Information. On my machine I hit the SHIFT - "Print Screen" keys repeatedly to get a printout of the structural information. The following is what the printout shows for this example:

```

LEVEL NO.  1
  1
LEVEL NO.  2
  3 ==>> 1 ,
LEVEL NO.  3
  5 ==>> 3 ,
<<RETURN>> TO CONTINUE
LEVEL NO.  4
  6 ==>> 5 ,
LEVEL NO.  5
  4 ==>> 6 ,
LEVEL NO.  6
  2 ==>> 4 ,
<<RETURN>> TO CONTINUE
LEVEL NO.  7
  7 ==>> 2 ,
TYPE AN I S M COMMAND (OR "HELP")
    
```

27. Interpretation. For example, LEVEL NO. 4 contains the element number 6, and the statement 6 ==>> 5 means that an arrow should be drawn from element 6 lying at Level 4 to element 5 lying at Level 3. The following figure shows the drawing that is constructed from the printout.



28. Terminating the Session. Having completed the development of the structure, I type the command TE to terminate the session. The machine then transfers back to the screen entry C:\ISM>>.

This example illustrates the use of the DOMODEL command.

A2.2.2 Using the DOMODEL Program With a Set of Old Files. There are many cases in which it is important to start using the DOMODEL option of the GMU ISM Software with a set of already existing files (as for example when an IM session has been interrupted because the end of the day, or maybe because for some reason it is important to create a new structure with the same set that has already been generated). For those cases, assuming that you are ready to start using the software, the assumption and steps are the following:

Assumption 1 Your ISM Files Log *contains old files* that you wish to use. If this assumption is correct, identify the names of the files and write them down to be used in carrying the steps below. Otherwise, go to A2.2

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS AS FOLLOWS:

```
C:\>>ISMDOMODEL www.MAT www.TXT
```

except that instead of www you enter the name of the old file that you will be using.

Now hit the Enter or Return Key to activate the command.

As a result of this step you may now see a screen display like this, beginning with the command entered above:

```
C:\ISM>>DOMODEL www.MAT www.TXT
C:\ISM>>echo off
1 File(s) copied
NEW STRUCTURE (Y/N)?
```

- Set the CapsLock key so that any letter you type in response to a screen query will be a capital letter.
- Answer the query NEW STRUCTURE (Y/N)?
 - a) If you plan to create a *new structure* using the elements contained in the text file given in the above command, type Y and press the Enter or Return key.
 - b) If you are *not* planning to create a new structure using the old file material, type N and press Enter or Return.

You will see the following screen display:

```
>>>> TYPE AN ISM COMMAND (OR "HELP")
?
```

- In this case you have two options :

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- a. If you are familiar with the ISM Commands, enter the appropriate one and continue. Otherwise go to Step b.
- b. Type HELP after the question mark, creating the following screen display:

?HELP

and press Return or Enter. You will then see the display of the ISM COMMANDS (which is shown on the following page).

Enter the appropriate command and continue. Use the examples given before to understand the most important ISM Commands.

```
----- I S M  C O M M A N D S  -----  
=== EMBEDDING ELEMENTSc  
BO - Transitive Bordering  
BOQ - Transitive Bordering with Selectable Queries  
=== DISPLAYING STRUCTURES  
DI - Display Minimum Edge Digraph in a Levels Format  
DIS - Display Minimum Edge Digraph in a Stages Format  
PRM - Print (portray on screen) the Reachability Matrix  
=== SUBSTANTIVE AMENDING  
ADD - Add Elements  
ELIM - Eliminate Elements  
AE - Add Edges (Relationships between elements of the  
minimum edge digraph)  
EE - Erase Edges (on the minimum edge digraph)  
=== FORMAT AMENDING  
PO - Pool Elements  
EC - Elementary Contraction  
=== TEXT EDITING  
ED - Edit an Element or Relationship  
=== END STRUCTURING  
TE - Terminate  
  
NOTE: ENTER <<RETURN>> TO CONTINUE
```

[NOTE ENTERED BY THE WRITER OF THIS CHAPTER: I have had better success using the "MAIN EDITOR OPTIONS" directly than I have had with the editing commands in the above

^c The ISM commands for "EMBEDDING ELEMENTS" will be different if you are using the DOPRIOR or DOCLUS commands.

list. If you choose the command ED from the above list, it takes you into the MAIN EDITOR OPTIONS menu, from which you can proceed.]

A2.2.3 Descriptions of ISM Commands for DOMODEL Program.^d Each of the ISM Commands described below is initiated by typing the symbol for the command (following a prompt) and then pressing the Enter or Return key.

A. EMBEDDING COMMANDS. "Embedding" means filling a matrix that contains all responses to questions that the DOMODEL program generates in its repetitive use of the generic question with different elements from your set of elements.

1. **BO**--The BO ISM Command instructs the computer to apply the "transitive bordering method" as the algorithm for matrix filling. This BO ISM Command is the one that is most frequently chosen for the purpose.
2. **BOQ**--The BOQ ISM Command instructs the computer to carry out the same kind of activity as described for the BO ISM Command just described. However this command allows you to use "selected queries".

B. DISPLAY COMMANDS. This set of commands allows you to call up various displays of results.

1. **DI**--This command will display information concerning the *vertical layout* of a digraph that corresponds to the filled matrix. Level 1 will contain the top-level elements, Level 2 will contain the second-level elements, and so on. Information is given showing which elements at a certain level connect to elements at higher levels. Also the contents of the various cycles (if any) are identified. [The graphical convention used in identifying Levels is to place an element as close to the top of the digraph as possible consistent with keeping the Levels distinct.]
2. **DIS**--This command will display information concerning the *horizontal layout* of a digraph that corresponds to the filled matrix. Stage 1 will contain the left-most elements, Stage 2 will contain those just to the right of Stage 1, and so on. The graphical convention used in identifying Stages is to place each element as far to the left in the digraph as possible, consistent with keeping the Stages distinct.
3. **PRM**--This command requests the computer to put the reachability matrix on the screen for viewing.

C. SUBSTANTIVE AMENDING COMMANDS. These ISM Commands provide for a variety of amendment or editing functions.

1. **ADD**-- TEXT TO BE ADDED
2. **ELIM**-- TEXT TO BE ADDED
3. **AE**-- TEXT TO BE ADDED
4. **EE**-- TEXT TO BE ADDED

^d Commands will be slightly different for DOPRIOR and DOCLUS programs.

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D. FORMAT AMENDING COMMANDS. These ISM Commands allows you to combine two elements from a digraph into a single element by the operations called "pooling" or "contracting".

1. **PO**--This ISM Command allows you to combine two elements that lie at the same level or in the same stage of a structure. The computer will ask you for a symbol to represent the pooled pair of elements.
2. **EC**--This ISM Command allows you to combine two related elements that lie on different levels or in different stages into a single element. The process is described as an "elementary contraction". The computer will ask you for a symbol to represent the two elements that have been combined in the elementary contraction.

E. TEXT EDITING COMMAND.

1. **ED**--This ISM Command allows you to edit an element or a relationship.

F. END STRUCTURING COMMAND.

1. **TE**--This ISM Command allows you to terminate a modeling session. It saves the structures and returns you to the command line. If you wish, you can then leave the ISM directory by typing C: followed by striking the Return or Enter key, which will return you to DOS.

A2.3 THE DOCLUS COMMAND. The description of the DOCLUS Command begins with assumptions.

Assumption 1	You have decided to use the DOCLUS Command.
Assumption 2	Your ISM Files Log does not contain any old files that you wish to use. If this assumption is correct, choose a name for your matrix file and a name for your text file and enter these names in your ISM Files Log, then proceed with the instructions below. Otherwise, go to A2.3.2.

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS :

```
C:\ISM>>DOCLUS JUDGE.MAT JUDGE.TXT
```

where I have chosen the highlighted name JUDGE for the file as shown in this command, but you would use the file name that you have chosen instead, as entered previously in your ISM Log.

Now hit the Enter or Return key.

As a result of this step, you should now see a screen display like this:

```
C:\ISM>>echo off
1 File(s) copied
TEXT FILE EMPTY - PLEASE CREATE ONE!
BLANKING OUT NEW TEXT DATA FILE.
PLEASE WAIT.....

-----BEGINNING OPTIONS-----
1. CREATE RELATIONAL STATEMENTS
2. CREATE TEXT ELEMENTS
?
```

- Now set the caps lock so that any letter that you type in response to computer questioning will be a capital letter.

You have reached this point by starting to use the DOCLUS command, and by indicating that you are going to create new files for use in this particular activity.

The screen display gives you two options:

1. Create relational statements
2. Create text elements

You must do both of these because you have begun with a blank text file.

Assumption 1 You have already constructed a generic question and are ready to fit it into the format that is required in this case. (The format is seen by pursuing option 1 above.)

If you have not constructed such a question, you will need to do so before continuing. Then select option 1. You will note that this option requires that you enter three distinct parts of your generic question in a required format.

At this point, an example is introduced that will take you through the DOCLUS Command in detail.

A2.3.1 Illustrating the use of ISM Through an Example (The DOCLUS command).

The following example illustrates the use of the DOCLUS command.

1. **Goal.** I want to structure the following element set:

{1. Gone With the Wind, 2. The Bijou, 3. Bus, 4. General Cinema, 5. Bicycle, 6. The Maltese Falcon, 7. Snow White and the Seven Dwarfs, 8. Loews, 9. Early Show, 10. Midnight Show, 11. Taxicab, 12. Matinee, 13. Casablanca}

using the following generic question:

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**Is
Element A
in the same category as
Element B
?**

2. Flow of Activity Style. I will write this example in the flow of activity style, i.e., I will present each step in the sequence that I do the step on the computer.

3. Starting Conditions. My ISM Files Log is empty. I have no prior matrix file and no prior text file. The ISM software is installed in my PC, which has the required math coprocessor.

Also I have decided to use the DOCLUS program because the nature of the generic question is such that all the elements in my set to be structured will end up being part of a symmetric relation, so that my outcome will be one or more cycles and no hierarchical component.

4. Start the ISM Files Log (optional). I will use my word processor to start my ISM Files Log. The entry I will make is as follows:

ISM Files Log

ISM MATRIX FILE

Entry #3.

File Designation:	HAROLD.MAT
Pertains to ISM Project:	creating an example to illustrate the use of the ISM PC Software
Involves the Application Structural Type:	None
Involves the Graphics Structural Type:	Cycle or set of Cycles

Involves the following elements: {Gone With the Wind, The Bijou, Bus, General Cinema, Bicycle, The Maltese Falcon, Snow White and the Seven Dwarfs, Loews, Early Show, Midnight Show, Taxicab, Matinee, Casablanca}
Involves the generic question: Is Element A in the same category as Element B?
Information prepared by: John N. Warfield
Date of Entry: February 16, 1991

ISM TEXT FILE

Entry #3.

File Designation: HAROLD.TXT

5. Entering the ISM Directory. I turn on my computer and enter the ISM Directory.

6. Entering the DOCLUS command. I create this screen display (entering the DOCLUS command)

```
C:\ISM>>DOCLUS HAROLD.MAT HAROLD.TXT
```

and then hit the Enter key.

7. Choosing an Option from a Menu. The machine asks me which of two options to choose, and I choose the option 1--"Create relational statements".

When it asks for R1, I enter IS
When it asks for R2, I enter IN THE SAME CATEGORY AS
When it asks for R3, I enter ?

NOTE : While entering this information, the screen asks me whether I want more lines, and whether I want to keep the displayed entry. The user should appreciate that the ISM program is written in such a way that when the user is asked to type in text information, the user should type only one line, and wait until the program asks you if you need more lines. Then you should type in the next line, and so on. If you don't fill up the line that's okay. The machine will later put all your lines together into an integrated text presentation. When the machine asks if you want to keep the entry you have just finished, it is giving you the opportunity to edit it further immediately before putting it in the text file.

Also note that unless you use only capital letters in response to queries, the machine will ignore your responses. So use the Caps Lock before continuing.

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8. Limited Set Size. As many as 150 elements can be used in the set to be structured with the DOCLUS Command. Note that other structuring modes do not allow this many elements. (The program has automatically put me in the position of starting to carry out the second option (see 7 above)).

9. Responding to Queries. Several questions appear in sequence on the screen and I respond Y to each of them and hit the Enter or Return key.

10. Typing in the First Element. The machine now asks for element #1. I type

GONE WITH THE WIND

11. More of those Thrilling Queries. Once again the machine asks if I need more lines and I reply NO, then it asks if I want to keep the element I entered and I reply YES, and then it asks if I want to continue with another element, and I reply YES. [I reply by typing Y or N as prompted by the screen.]

12. Recycling. I then recycle steps 10 and 11, entering a new element each time, until I have entered the whole element set that I began with as given in Item 1 above. After I have entered element #13, and the machine asks if I want to enter another element, I type in NO.

13. Entering file reference Information. The screen now asks me to type in file information. I then enter the following:

ISM FILES LOG ENTRY #3 DATED FEBRUARY 16, 1991

14. Main Editor Options. Next the screen shows me the Main Editor Options. The list is as follows:

```
----- MAIN EDITOR OPTIONSe -----  
0 - EXIT THE EDITOR  
3 - EDIT AN ELEMENT  
4 - EDIT A RELATIONAL STATEMENT  
5 - ADD AN ELEMENT  
6 - LIST TEXT ELEMENTS IN THE FILE  
7 - EDIT AN ELEMENT LABEL  
8 - DELETE THE CONTENT OF AN ELEMENT  
9 - MODIFY THE FILE INFORMATIONAL STATEMENT
```

^e The word "label" normally refers to the number assigned to an element. The word "content" refers to the written statement of the element. A generic question typically is formed from three statements. The term "relational statement" is a misnomer, but that is what the programmer chose to use. The symbols chosen for the three statements are R1 R2 and R3 respectively.

15. Review or Exit the Editor ? If I have done everything correctly to this point, I don't need to do any editing, so I will press 0 to Exit the Editor. However if I did need to review, I would choose Option 6 followed by Sub Option 2 in order to change any element statements. If I needed to revise the generic question, I would choose Option 4 followed by the appropriate sub-option chosen from those shown on the screen following my choice of option 4.

16. Exit Editor. Next I would exit the Editor by pressing 0.

17. Entering an ISM command. The screen then shows me the following:

```
>>>> TYPE AN I S M COMMAND (OR "HELP")
```

If you type "HELP", the screen will display the ISM Commands.

NOTE : The ISM Commands are not the same for the DOCLUS Command as for the DOMODEL or DOPRIOR Command. In this case, we have six possible commands. In this example, only the following three will be used:

```
CL -- for clustering  
DI -- for displaying clusters  
TE -- for terminating the program
```

18. Cluster. I now choose the command CL to initiate the ISM structuring activity.

19. Responses the Machine Accepts. The machine tells me I must choose one of the four responses to each displayed question:

```
Y  yes, the relationship is true  
N  no, the relationship is falsef  
AB, abort  
ED, suspend comparisons to edit and then continue
```

20. Element Numbers to Start Structuring. Now the screen asks for element numbers. First I type 1 and hit the Return key. Then I type 2 and hit the return key.

21. Question Sequence.^g The following is the sequence of steps that represent the questions, answers, and new element entries:

^f In the above the correct statement should read as follows:
No, the relationship is false OR I don't know enough to believe that the relationship is true.

^g I will now use the shorthand symbol "R" to represent the relationship "is in the same category as".

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IS 2R1? N	IS 7R1? Y	IS 10R9? Y
IS 3R1? N	IS 8R1? N	IS 11R1? N
IS 3R2? N	IS 8R2? Y	IS 11R2? N
IS 4R1? N	IS 9R1? N	IS 11R3? Y
IS 4R2? Y	IS 9R2? N	IS 12R1? N
IS 5R1? N	IS 9R3? N	IS 12R2? N
IS 5R2? N	IS 10R1? N	IS 12R3? N
IS 5R3? Y	IS 10R2? N	IS 12R9? Y
IS 6R1? Y	IS 10R3? N	IS 13R1? Y

22. Request for Next Command. The machine now asks for an ISM Command.

23. Display. I type DI and hit return to ask for a display of the structural information. This is what the display shows me:

```
Cluster No. 1    1,6,7,13
Cluster No. 2    2,4,8
Cluster No. 3    3,5,11
Cluster No. 4    9,10,12

TYPE AN ISM COMMAND (OR "HELP")
```

This is how the structure that is defined by the screen display just given would be presented:

MOVIE	THEATER	SHOW TIME	TRANSPORTATION
• Gone With the Wind	• The Bijou	• Early Show	• Bus
• The Maltese Falcon	• General Cinema	• Midnight Show	• Bicycle
• Snow White & the Seven Dwarfs	• Loews	• Matinee	• Taxicab
• Casablanca			

TIE LINE

24. Interpretation. The program has created the following cycles: {Gone With the Wind, The Maltese Falcon, Snow White and the Seven Dwarfs, Casablanca} [We can now name this cycle the "Movie Cycle"]³

{The Bijou, General Cinema, Loews} [We can now name this cycle the "Theater Cycle"]

{Bus, Bicycle, Taxicab} [We can now name this cycle the "Transportation Cycle"]

{Early Show, Midnight Show, Matinee} [We can now name this cycle the "Show-time Cycle"]

25. Terminating the Session. Having completed the development of the structure, I type the command TE to terminate the session. The machine then transfers back to the screen entry C:\ISM>>.

A2.3.2 Using the DOCLUS Program with a Set of Old Files. As with the DOMODEL Program, there are many cases in which it is important to start using the DOCLUS Program with a set of already existing files; for those cases, assuming that you are ready to start using the software, the associated assumptions and steps are the following:

Assumption 1 Your ISM Files Log contains old files that you wish to use. If this assumption is correct, identify the names of the files and write them down to be used in carrying out the steps below. Otherwise, go to A2.3

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS AS FOLLOWS:

```
C:\ISM>>DOCLUS WWW.MAT ZZZ.TXT
```

except that instead of WWW you enter the name of the old matrix file that you are going to be using and instead of ZZZ you enter the name of the old text file that you are going to be using.

Now hit the Enter or Return key to activate the command.

As a result of this step you may now see a screen display like this, beginning with the command entered above:

```
C:\ISM>>DOCLUS WWW.MAT ZZZ.TXT
C:\ISM>>echo off
1 File(s) copied
NEW STRUCTURE (Y/N)?
```

- Answer the query NEW STRUCTURE (Y/N)?

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- a) If you plan to create a new structure using the elements contained in the text file given in the above command, type Y and press the Enter or Return key.
- b) If you are not planning to create a new structure using the old file material, type N and press Enter or Return.

You will see the following screen display:

```
>>>>Type an ISM COMMAND (OR "HELP")  
?
```

- In this case, you have two options :
 - a. If you are familiar with the ISM commands, enter one and continue; otherwise go to Step b.
 - b. Type HELP after the question mark, creating the following screen display:

```
?HELP
```

and press Return or Enter. You will then see the following screen display of the commands for use with the DOCLUS comand.

```
-----LIST OF CLUSTERING COMMANDS -----  
CL - FOR CLUSTERING  
DI - FOR DISPLAYING CLUSTERS  
ER - FOR ERASING AN ELEMENT FROM THE STRUCTURE  
ED - FOR CREATING OR EDITING THE TEXT FILE  
TE - FOR TERMINATING THE PROGRAM  
HE - FOR REPRINTING THE ABOVE LIST
```

Enter the appropriate command and continue.

A2.4 THE DOPRIOR COMMAND

The description of the DOPRIOR Command begins with assumptions.

- | | |
|---------------------|---|
| Assumption 1 | You have decided to use the DOPRIOR Command. |
| Assumption 2 | Your ISM Files Log does not contain any old files that you wish to use. If this assumption is correct, choose a name for your matrix file and a name for your text file and enter these names in your ISM Files Log, then proceed with the instructions below. Otherwise, go to A2.4.2. |

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS :

```
C:\ISM>>DOPRIOR DAVID.MAT DAVID.TXT
```

where I have chosen the highlighted names for the files as shown in this command, but you would use the file names that you have chosen instead, these being entered previously in your ISM Log.

Now hit the Enter or Return key. As a result of this step, you should now see a screen display like this:

```
C:\ISM>>echo off
1 File(s) copied
TEXT FILE EMPTY - PLEASE CREATE ONE!
BLANKING OUT NEW TEXT DATA FILE.
PLEASE WAIT.....
-----BEGINNING OPTIONS-----
1. CREATE RELATIONAL STATEMENTS
2. CREATE TEXT ELEMENTS
?
```

- Now set the caps lock so that any letter that you type in response to computer questioning will be a capital letter.

You have reached this point by starting to use the DOPRIOR command, and by indicating that you are going to create new files for use in this particular activity.

The screen display gives you two options:

1. Create relational statements
2. Create text elements

You must do both of these because you have begun with a blank text file.

Assumption 1 You have already constructed a generic question and are ready to convert it into the format that is required in this case. The format is seen by pursuing option 1 above. If you have not constructed such a question, you will need to do so before continuing. Then select option 1. You will note that this option requires that you use two related generic questions, each of which involves three parts. The kind of relationship used for priority structuring is analogous to the "less than or equal" relationship in arithmetic. The program requires that you split this into two parts, one of which is analogous to exploring the "less than" and the other "equal to". You will learn more about the nature of the split when you work through the example provided now.

At this point, an example is introduced that will take you through the DOPRIOR command in detail.

A2.4.1 Illustrating the use of ISM Through an Example (The DOPRIOR command).

The following example illustrates the use of the DOPRIOR command.

1. Goal. Page 352 of Volume II of the 1990 edition of A SCIENCE OF GENERIC DESIGN contains a priority structure developed by the Creek Indian Nation (East of the Mississippi). I will take part of that structure and use it as an example of structuring the following element set. Note that I have altered the numbers shown on page 352, but have kept the element wordings unchanged, so that a comparison can be made with the structure shown in Figure 10.15. I want to structure the following element set:

{ 1. Lack of adequate and reliable community communication, 2. Motivation and consistency of employees, 3. Maintenance of self-worth of the members, 4. Revival of lost tribal culture and traditions, 5. Pride of tribal participation, 6. Fast growth of the tribe, 7. Work load increase without additional personnel, 8. Lack of dedication of our younger generation, 9. Survival for the tribe, 10. Lack of recreation facilities }

using the following generic question:

**Is
Element A
of equal or higher priority in organizing our discussion agenda than
Element B
?**

2. Flow of Activity Style. I will write this example in the flow of activity style, i.e., I will present each step in the sequence that I do the step on the computer.

3. Starting Conditions. My ISM Files Log is empty. I have no prior matrix file and no prior text file. The ISM software is installed in my PC, which has the required math coprocessor. Also I have decided to use the DOPRIOR program because I am looking for a priority structure to govern the topical flow for discussion of the items to be structured. We will end up discussing the highest priority items first, and the lowest last, and this assures that if we run out of time we will have discussed those that are of highest priority in our thinking.

4. Start the ISM Files Log. I will use my word processor to start my ISM Files Log. The entry I will make is as follows:

ISM Files Log

ISM MATRIX FILE

Entry #2.

File Designation:

INDIAN.MAT

Pertains to ISM Project:

creating an example to illustrate the use of
the ISM PC Software

Involves the Application Structural Type: Priority Structure

Involves the Graphics Structural Type:	Hybrid Structure
Involves the following elements:	{Lack of adequate and reliable community communications, Motivation and consistency of employees, Maintenance of self-worth of the members, Revival of our tribal culture and traditions, Pride of tribal participation, Fast growth of the tribe, Work load increase without additional personnel, Lack of dedication of our younger generation, Survival for the tribe, Lack of recreation facilities}
Information prepared by:	John N. Warfield
Date of Entry:	February 16, 1991

ISM TEXT FILE

Entry #2.

File Designation: INDIAN.TXT

Other entries are the same as for Matrix File INDIAN.MAT

5. *Entering the ISM Directory.* I turn on my computer and enter the ISM Directory.

6. *Entering the DOPRIOR Command.* I create this screen display (entering the DOPRIOR command).

```
C:\ISM>>DOPRIOR INDIAN.MAT INDIAN.TXT
```

and then hit the Enter key.

7. *Choosing an Option from a Menu.* The machine asks me which of two options to choose, and I choose the option 1--"Create relational statements". In this instance, the machine tells me in effect that I have to create two generic questions. One of them will be looking for a distinct difference in priority, while the other will be looking for roughly equal priority. Accordingly, in developing the first generic question:

When it asks for R1, I enter IS

When it asks for R2, I enter OF DISTINCTLY HIGHER PRIORITY THAN

When it asks for R3, I enter ?

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NOTE : While entering this information, the screen asks me whether I want more lines, and whether I want to keep the displayed entry. The user should appreciate that the ISM program is written in such a way that when the user is asked to type in text information, the user should type only one line, and wait until the program asks you if you need more lines. Then you should type in the next line, and so on. If you don't fill up the line that's okay. The machine will later put all your lines together into an integrated text presentation. When the machine asks if you want to keep the entry you have just finished, it is giving you the opportunity to edit it further immediately before putting it in the text file.

Also note that unless you use only capital letters in response to queries, the machine will ignore your responses. So use the Caps Lock before continuing.

When the machine asks me for information on the second generic question, it asks if the first and third entries will be the same as for the question that I just formulated, and I answer Y. It is only in the R2 part that I make a change, and I enter:

OF ROUGHLY EQUAL PRIORITY WITH

Then I answer the remaining routine questions in order to proceed.

8. *Limited Set Size.* The screen then reveals that I am allowed up to 85 elements in the element file. (The program has automatically put me in the position of starting to carry out the second option (see 7 above).

9. *Responding to Queries.* Several questions appear in sequence on the screen and I respond Y to each of them and hit the Enter or Return key.

10. *Typing in the First Element.* The machine now asks for element #1. I type

LACK OF ADEQUATE AND RELIABLE COMMUNITY COMMUNICATION

11. *More of those Thrilling Queries.* Once again the machine asks if I need more lines and I reply NO, then it asks if I want to keep the element I entered and I reply YES, and then it asks if I want to continue with another element, and I reply YES. [I reply by typing Y or N as prompted by the screen.]

12. *Recycling.* I then recycle steps 10 and 11, entering a new element each time, until I have entered the whole element set that I began with as given in Item 1 above. After I have entered element #10, and the machine asks if I want to enter another element, I type in NO.

13. *Entering File Reference Information.* The screen now asks me to type in file information. I then enter the following:

ISM FILES LOG ENTRY #2 dated Feb. 16, 1991.

14. Main Editor Options. Next the screen shows me the Main Editor Options. The list is as follows:

```
----- MAIN EDITOR OPTIONSh -----  
0 - EXIT THE EDITOR  
3 - EDIT AN ELEMENT  
4 - EDIT A RELATIONAL STATEMENT  
5 - ADD AN ELEMENT  
6 - LIST TEXT ELEMENTS IN THE FILE  
7 - EDIT AN ELEMENT LABEL  
8 - DELETE THE CONTENT OF AN ELEMENT  
9 - MODIFY THE FILE INFORMATIONAL STATEMENT
```

15. Review or Exit Editor ? If I have done everything correctly to this point, I don't need to do any editing, so I will press 0 to Exit the Editor. However if I did need to review, I would choose Option 6 followed by Sub Option 2 in order to change any element statements. If I needed to revise the generic question, I would choose Option 4 followed by the appropriate sub-option chosen from those shown on the screen following my choice of option 4.

16. Exit Editor. Next I would exit the Editor by pressing 0.

17. Entering an ISM Command. The screen then shows me the following:

```
>>>> TYPE AN I S M COMMAND (OR "HELP")
```

If you type "HELP", the screen will display the ISM Commands.

Note that the ISM Command list is different for the DOPRIOR command than for the DOMODEL Command. We will only use commands from the following subset:

```
PR - Prioritize  
DIS - Display results in stages  
PRM - Print the reachability matrix, and  
TE - Terminate the ISM activity
```

18. Prioritize. I now choose the command PR to initiate the ISM structuring activity.

^h The word "label" normally refers to the number assigned to an element. The word "content" refers to the written statement of the element. A generic question typically is formed from three statements. The term "relational statement" is a misnomer, but that is what the programmer chose to use. The symbols chosen for the three statements are R1 R2 and R3 respectively.

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19. Responses the Machine Accepts. The machine tells me I must choose one of the four responses to each displayed question:

- Y yes, the relationship is true
- N no, the relationship is falseⁱ
- AB, abort
- ED, suspend comparisons to edit and then continue

20. Element Numbers to Start Structuring. Now the screen asks for element numbers. First I type 1 and hit the Return key. Then I type 2 and hit the return key.

21. Question Sequence^j. The following is the sequence of steps that represent the questions, answers, and new element entries:

Is 1>>2?	N	Is 6>>3?	N	Is 3>>9?	Y
Is 1=2?	Y	Is 6=3?	N	Is 6>>9?	Y
Is 1>>3?	Y	Is 5>>6?	Y	Is 8>>9?	N
Is 4>>1?	N	Is 3>>7?	Y	Is 8=9?	Y
Is 4=1?	N	Is 6>>7?	Y	Is 3>>10?	Y
Is 3>>4?	N	Is 3>>8?	Y	Is 7>>10?	Y
Is 3=4?	Y	Is 6>>8?	Y	Is 8>>10?	Y
Is 3>>5?	Y	Is 7>>8?	Y		

22. Request for Next Command. The machine now asks for an ISM Command.

23. Display. I type DIS and hit return to ask for a display of the structural information. This command will display the structure in a staged format, which is useful for showing priority.

24. Output. The screen display gives the information in tabular form that is needed to draw the structure. The structure is drawn from this tabular information:

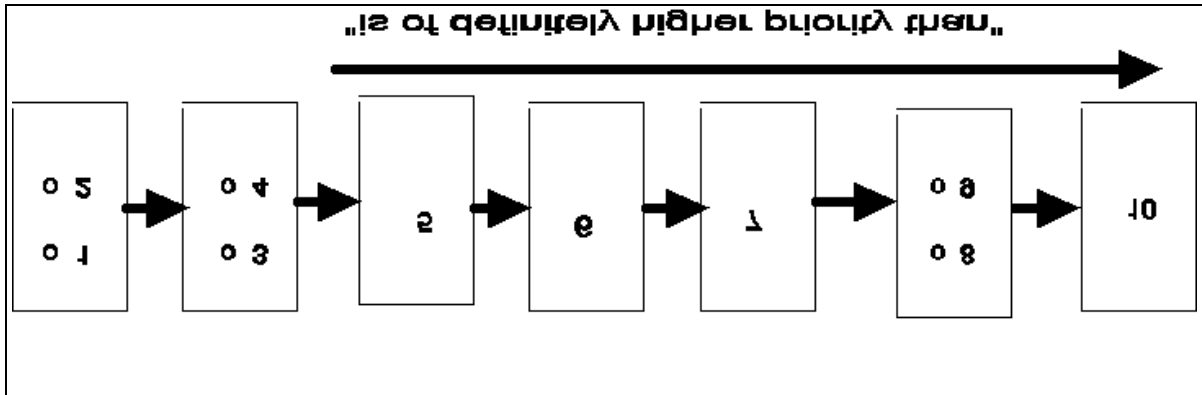
Cycle on 1,2	
Cycle on 3,4	
Cycle on 8,9	
Stage 1	1 ==>> 3
Stage 2	3 ==>> 5
Stage 3	5 ==>> 6
Stage 4	6 ==>> 7
Stage 5	7 ==>> 8

ⁱ In the above the correct statement should read as follows:
No, the relationship is false OR I don't know enough to believe that the relationship is true.

^j I will now use the shorthand symbol >> to represent "of definitely higher priority than" and the shorthand notation = to represent "of roughly equal priority".

Stage 6	8 ==>>10
Stage 7	10

When we draw the structure that is indicated by the above information, we can use at first only the stage information, and then we can add on the known cycle components to complete the drawing, as shown in the following figure:



25. Terminating the Session. Having completed the development of the structure, I type the command TE to terminate the session. The machine then transfers back to the screen entry C:\ISM>>.

This example illustrates the use of the DOPRIOR command.

After you have worked through the example, you should be in a position to do a more complex example using your own information. Alternatively, if you have available the book A SCIENCE OF GENERIC DESIGN: MANAGING COMPLEXITY THROUGH SYSTEMS DESIGN, you might choose one of the structures in Chapter 10 and reconstruct it using the DOPRIOR command to get practice in using this command.

A2.4.2 Using the DOPRIOR Program With a Set of Old Files. As with the other programs, this last section of the DOPRIOR deals with the case in which the program is going to be used with a set of already existing files; for those cases, assuming that you are ready to start using the software, the associate assumption and steps are the following:

Assumption 1 Your ISM Files Log contains old files that you wish to use. If this assumption is correct, identify the names of the files and write them down to be used in carrying out the steps below. Otherwise, go to A2.4

- NOW TYPE IN MATERIAL SO THAT THE COMMAND READS AS FOLLOWS:

C:\ISM>>DOPRIOR FFF.MAT GGG.TXT

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except that instead of FFF you enter the name of the old matrix file that you are going to be using and instead of GGG you enter the name of the old text file that you will use.

Now hit the Enter or Return key to activate the command.

As a result of this step you may now see a screen display like this, beginning with the command entered above:

```
C:\ISM>>DOPRIOR FFF.MAT GGG.TXT
C:\ISM>>echo off
1 File(s) copied
NEW STRUCTURE (Y/N)?
```

- Answer the query NEW STRUCTURE (Y/N)?
 - a) If you plan to create a new structure using the elements contained in the text file given in the above command, type Y and press the Enter or Return key.
 - b) If you are not planning to create a new structure using the old file material, type N and press Enter or Return.

You will see the following screen display:

```
>>>>Type an ISM COMMAND (OR "HELP")
?
```

- In this case you have two options:
 - a. If you are familiar with the ISM commands, enter one and continue; otherwise go to Step b.
 - b. Type HELP after the question mark, creating the following screen display:
?HELP
and press Return or Enter. You will then see the following screen display of the commands for use with the DOPRIOR commands:

----- PRIORITY STRUCTURING COMMANDS -----

==== EMBEDDING ELEMENTS
PR - PRIORITY STRUCTURING
PRQ - PRIORITY STRUCTURING WITH SELECTABLE QUERIES
==== DISPLAYING STRUCTURES
DI - DISPLAY MINIMUM EDGE DIGRAPH IN A LEVELS FORMAT
DIS - DISPLAY MINIMUM EDGE DIGRAPH IN A STAGE FORMAT
PRM - PRINT THE REACHABILITY MATRIX
==== SUBSTANTIVE AMENDING
ADD - ADD ELEMENTS
ELIM - ELIMINATE ELEMENTS
AE - ADD EDGES (RELATIONSHIPS BETWEEN ELEMENTS ON THE
MINIMUM EDGE DIGRAPH)
EE - ERASE EDGES (ON THE MINIMUM EDGE DIGRAPH)
==== FORMAT AMENDING
PO - POOL ELEMENTS
EC - ELEMENTARY CONTRACTION
==== TEXT EDITING
ED - EDIT AN ELEMENT OR A RELATIONSHIP
==== END STRUCTURING
TE - TERMINATE

N O T E: ENTER <<RETURN>> TO CONTINUE

Enter the appropriate command and continue.

A2.5 PROBLEM/SOLUTION (RESOLUTION STRUCTURE) ISM SOFTWARE.

The GMU PC Software described above offers the possibility of developing a problematique using a given element set and a relation such as "aggravates"--to be followed by continued structuring. This possibility was mentioned earlier in Sec. A2.2, Item 21, "Problem-Options Structure". (The GMU PC Software uses the language "problem/solution" structure. Chapter 6 uses the language "Resolution Structure", which is the preferred name for such a structure. The Resolution Structure is described in Sec. 6.11. The reader who wishes to develop a Resolution Structure should read Sec. 6.11, before proceeding to the outline of the description of how to use the GMU PC software for this purpose, which begins in the next paragraph.) The continued structuring allows for a second element set comprised of potential conditions that could alleviate one or more problems contained in the problematique. In this section, an explanation is given of how this feature can be used. An artificial example will be used to illustrate the feature.

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A2.5.1 Example. Enter the ISM directory with the command ChDir ISM. Now enter the command DOMODEL Horse.Mat Horse.Txt. Then hit the carriage return. This command prepares the two empty files needed for this example. We will start developing a Resolution Structure, by first developing a problematique. It will be created using the element set: { 1. poverty, 2. homelessness, 3. hunger, 4. illness, 5. a headache }, and using the relationship "aggravates".

1. Entering the Generic Question and the Element Set. Choose option 1 from the menu, i.e., "create relational statements". When the machine asks for R1, enter "Does". When it asks for R2, enter "Aggravate". When it asks for R3, enter a question mark. After each of these entries, a carriage return is needed. Use only capital letters to respond to queries. Answer "N" to the question that asks if you want more lines. When you are finished with the relational statements, go to menu option 2, and enter the element set given above. After you have finished supplying the five elements, you may enter any file reference information you wish to enter. If you are satisfied with your results, type 0 (zero) to Exit the Editor.

2. Preparing to Develop the Resolution Structure. Now the machine asks for an ISM Command. Type BO and hit return. Hit return a second time. Now the computer asks if you are using a subordination relation. Enter N and hit the return key. The machine then asks if you are constructing a problem/solution structural model, and you answer Y. The machine then asks you to tell how many problem statements will be used and you respond with number 5 (the number of elements given in the element set above).

3. Developing the Problematique. Next the machine asks you for an element number. Type in 1 and return. Type in 2 and return. Now the querying begins automatically, and you can respond to the queries until you have exhausted the possible questions. At this point, you have completed the problematique.

If you follow the sequence shown below, you can develop the problematique step by step.

1A2? Y, 2A1? Y, 1A3? Y, 3A1? Y, 1A4? Y, 4A1? Y, 1A5? N, 5A1? N.
You can now use PRM to see the matrix on the screen. It will appear as follows:

11110
11110
11110
11110
00001

You can use the DI command to see the structural information, which is:

```
Cycle on 1,2,3,4
```

```
Level #1
```

```
1
```

```
5
```

4. *Modifying the Relationship.* Now use the ISM Command ED to return to the Main Editor. In preparation for completion of the Resolution Structure, use Command 4 from the Main Editor, to edit the relationship. In the menu that appears, enter C to prepare to enter a new relationship. The new relationship can be formed from a generic question like: "Will X help resolve Y"?

5. *Entering the Remedial Elements.* After you have completed the creation of the new generic question, return to the Main Editor. Now select Command 5, to add elements to the list beginning with number 6 and extending through number 8. The remedial elements to be added in our example will be: {6. wealth, 7. friends in high places, 8. analgesic}. When you have added these elements, then choose Command 0 to exit the editor.

6. *Completing the Resolution Structure.* Next you present again the command BO, and the machine will now ask you questions about how members of the second set relate to members of the problematique. When the question set is exhausted, you can use the command PRM to see the binary matrix on the screen, or you can use the command DI to display the structure containing all 8 elements. Note that in this instance, the arrows from the remedial set to the problem set represent the relationship "helps resolve", while the arrows within the problem set represent the relationship "aggravates".

If you answer the queries according to the following, you can check results with our results:

6R1? Y, 6R5? N, 7R1? Y, 7R5? N, 8R1? N, 8R5? Y.

The information presented in response to the DI command is:

```
Cycle on 1,2,3,4
```

```
Level 1
```

```
1
```

```
5
```

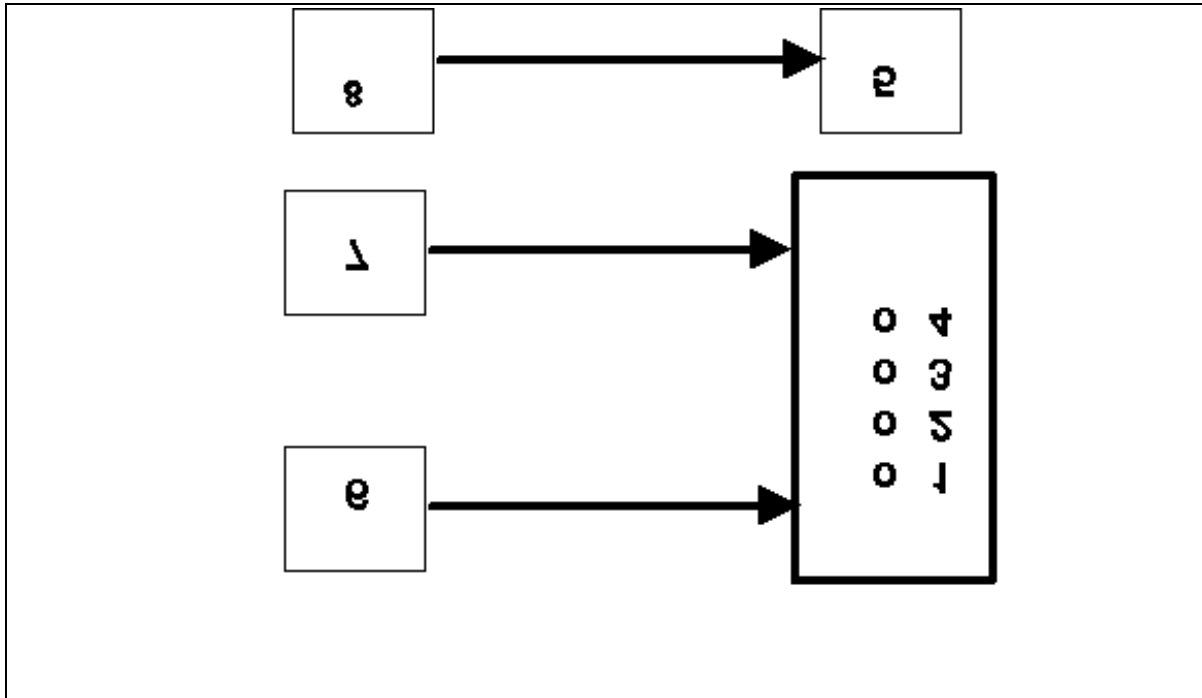
```
Level 2
```

```
6 ==>> 1
```

```
7 ==>> 1
```

```
8 ==>> 5
```

The completed structure now shows how the remedial elements act to alleviate the problems shown in the problematique.



A2.5.2 Another Possibility. While the foregoing description has emphasized the problematique development, it is equally possible to develop an enhancement structure instead of a problematique. The procedural changes would only involve using an element set and a relationship that are characteristic of the enhancement structure (Sec. 6.3).

NOTES

STUDY QUESTIONS

APPENDIX 2. GMU ISM SOFTWARE

1. What are the three principal software commands in the GMU ISM Software?
2. When is DOMODEL to be used?
3. When is DOCLUS to be used?
4. When is DOPRIOR to be used?
5. What example can be followed to learn to use the DOMODEL command?
6. What example can be followed to learn to use the DOCLUS command?
7. What example can be followed to learn to use the DOPRIOR command?

8. What example can be followed to learn to use the software to construct a Resolution Structure?

1. *The following reference defines "priority structure" in great detail: John N. Warfield, "Priority Structures", IEEE Transactions on Systems, Man, and Cybernetics, SMC-10, October, 1980, 642-645.*

2. *Alternatively, if you have available the book A SCIENCE OF GENERIC DESIGN: MANAGING COMPLEXITY THROUGH SYSTEMS DESIGN, you might choose one of the structures given in Chapter 10 and reconstruct it using the DOMODEL command to get practice in using this command.*

3. *Note that this example is discussed (with more elements) in the book A SCIENCE OF GENERIC DESIGN, starting on page 245..*