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Scheduling Algorithm for Mission Planning and Logistics Evaluation (SAMPLE)

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SCHEDULING ALGORITHM FOR MISSION PLANNING AND LOGISTICS EVALUATION (SAMPLE)

VOLUME I

USERS' GUIDE

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FOREWORD

These reports document the eighth baseline version (SA8) of the Scheduling Algorithm for Mission Planning and Logistics Evaluation (SAMPLE). Volume I is the Users' Guide for SAMPLE, Volume II documents the Mission Payloads (MPLS) subsystem, the primary computational portion of SAMPLE, and Volume III discusses the GREEDY algorithm, the technique used to solve a set covering problem and determine a traffic model.

CONTENTS

1. INTRODUCTION

The Scheduling Algorithm for Mission Planning and Logistics Evaluation (SAMPLE) is an interactive computer program for automatically generating traffic models for the Space Transportation System (STS). The SAMPLE is composed of two major subsystems: the Mission Payloads (MPLS) program and the Set Covering Program (SCP). The MPLS program determines a set of payload combinations which satisfy various STS constraints, such as: the maximum weight-to-orbit capability, cargo bay capacity, Reaction Control System (RCS) and Orbital Maneuvering System (OMS) fuel capacities, etc. The SCP forms a subset (traffic model) of the feasible payload combinations from MPLS such that a minimum number of Shuttle flights will transport all the specified payloads without redundancies.

The SAMPLE was written in FORTRAN V and was designed to execute on the UNIVAC 1100 series computers using the EXEC 8 operating system. The program was written to be used primarily in a demand (interactive) mode, but it may also be run in the batch mode.

The purpose of this document is to describe how to use the SAMPLE. Information concerning run stream construction, input data, and output data is provided. The flow of the interactive data stream is described. Error messages are specified, along with suggestions for remedial action. In addition, formats and parameter definitions for the payload data set (payload model), feasible combination file, and traffic model are documented.

2. EXEC 8 CONTROL CARDS

The EXEC 8 control cards required to execute the SAMPLE program must be specified by the user as follows:

```
@RUN  JWLXI, 1230B........         The run card

@XQT  PL-NO6159*TOM.SAMPLE         Starts program execution

 .

 .

 .

INPUT

DATA

 .

 .

 .

@FIN                               Signs off of EXEC 8
```

3. INPUT DATA DESCRIPTION

3.1 GENERAL

The input to the SAMPLE is generally represented as data card images and in certain circumstances also requires nonformatted input. Large blocks of format-restricted input, specifically the payload model, are generally retained in a data element and added (@ADD) to the data stream at the appropriate place.

An optional input technique, used to suppress user tutorials, is available for the SAMPLE. This method is operational for Steps 2, 3, 4, 6, 7, and 10 identified in section 3.2. Note that integers requiring two or more digits must be surrounded by a slash. It is assumed that the input is ordered as the program expects the data; therefore, a user should become well acquainted with the input options before using this method.

The units of measure used for the SAMPLE may be English or metric.

3.2 INTERACTIVE DATA FLOW

The following steps identify the interactive data flow of the SAMPLE program. The steps identify required data input to be provided or options to be selected by the user. The steps are not necessarily contiguous as a certain option selected at one step may preclude data input and/or options available at other steps. Detailed discussion follows. At steps where various options are available, the user may optionally input a zero (0) to list all available options.

Step 1

The program internally assigns three temporary files at the beginning of execution to write the payload data, the feasible combinations and the traffic model. The file names are RS, LA and LX and are assigned to Units 13, 1 and 2 respectively. In the following examples, the file named 'FILE' should be replaced with a currently specified working file. The program execution runstream is:

```
@XQT  FILE.SAMPLE
```

At this point the program will print:

```
SELECT PERFORMANCE VEHICLE:
```

The user has the following options:

```
1:OV102
2:OV099
3:OV103
4:OTHER
```

Selection of option 1, 2 or 3 defines which vehicle (weight) is to be used. If the user desires to define another vehicle other than OV102, OV099 or OV103, he may choose option 4, in which case the program will print:

```
INPUT VEHICLE DRY WEIGHT:
```

The user must then input the weight to be used in this run. Control proceeds to Step 2.

Step 2

At this point the program will print:

```
INPUT UPPER STAGE CHARACTERISTICS AND MISSION MODEL DATA:
(FOR EXAMPLE:  @ADD SAMPLE.DATA99)
```

This user should add the payload model data. The upper stage logic in SAMPLE is currently not invoked. Consequently token upper stage data is included in the front of the payload model data. After reading the data, the control proceeds to Step 3.

Step 3

At this point the program will print:

SELECT AN OPTION: (5 to TERMINATE)

The user has the following six options for selection:

1: DISPLAY OPTIONS
2: SELECTION OF ANALYSIS TYPE
3: PAYLOAD VARIATION OPTIONS
4: OUTPUT DISPLAY OF FEASIBLE MISSIONS IN MKS
5: TERMINATE
6: SELECT ANOTHER YEAR

If the user selects option 1, control goes to Step 4. If he selects option 2, control goes to Step 5. If he selects option 3, control goes to Step 6. If he selects option 4, control goes to Step 7. If he selects option 5, the program terminates via Step 21. If he selects option 6, control goes to Step 8.

Step 4

When the user selects option 1 in Step 13 the program prints:

SELECT DISPLAY OPTIONS: (7 FOR ALL & 8 FOR NONE)

At this point, the following nine options are available to user:

1: PAYLOAD MODEL DISPLAY
2: STATISTICAL ANALYSIS OF MISSIONS
3: DISCIPLINE MIX DISPLAY
4: OCCURRENCE TABLE
5: FEASIBLE COMBINATIONS
6: INFEASIBLE COMBINATIONS
7: DISPLAY ALL (1 TO 6)
8: NONE OF THE ABOVE
9: MPLS DEBUG PRINT

Different options are available for printing the information about the mission payload data. If the user wishes to select options 1, 3 and 6, he should input 136. He may choose any order. To choose all the display options, the user can input 7. Option 9 is used for programmer checkout. After printing the results for the selected options, the control returns to Step 3. NOTE: The user will need much patience to see all the displays on the terminal; therefore, it is advisable to select these options under break point print (@BRKPT PRINT$) command only.

Step 5

When the user selects option 2 in Step 3, the program prints:

SELECT AN ANALYSIS TYPE: (5 FOR NONE)

The user has four options available to him:

```
1:  GENERATE FEASIBLE COMBINATIONS (MPLS ONLY)
2:  TRAFFIC MODEL (MPLS+SCA)
3:  ISOLATED MANIFESTING
4:  NONE OF THE ABOVE
```

Option 1 is selected if the user is interested only in generating feasible combinations. If the user desires the traffic model, option 2 is required. Option 4 can be selected if none of the above options are desired, in which case control will return to Step 3. If option 1 or 2 is selected, control goes to Step 7. Option 3 allows the user to do isolated manifesting, in which the user defines the payloads to be grouped. If option 4 is selected, control goes to Step 11.

Step 6

When the user selects option 3 in Step 3, the program prints:

```
INPUT THE PAYLOAD VARIATION OPTIONS
15 FOR NONE
```

This step permits parametric manipulation of the payload model. The original payload model is not modified. The user has 15 options available to him:

```
OPTION #    0 HAS BEEN SELECTED **

        IOP=1;   A 50% INCREASE IN NON-NASA AUTOMATED
        IOP=2;   A 50% REDUCTION IN NASA AUTOMATED
        IOP=3;   A 25% INCREASE IN NON-NASA AUTOMATED
        IOP=4;   A 25% REDUCTION IN NASA AUTOMATED
        IOP=5;   A 100% INCREASE IN NON-NASA SORTIES
        IOP=6;   A 50% INCREASE IN NASA SORTIES
        IOP=7;   A 100% INCREASE IN NON-NASA PAYLOADS
        IOP=8;   A 50% INCREASE IN NON-NASA PAYLOADS
        IOP=9;   DECREASE LENGTHS BY 20% & ADD 30% TO WEIGHT
        IOP=10;  DECREASE LENGTHS BY 15% & ADD 25% TO WEIGHT
        IOP=11;  INCREASE LENGTHS BY 15% & SUBTRACT 20% FROM WEIGHT
        IOP=12;  RANDOMIZE LENGTHS, MINIMUM OF 5 FT.
        IOP=13;  RANDOM DELETION OF PAYLOADS - SPECIFY A %
        IOP=14;  REGENERATE THE PAYLOAD MODEL
        IOP=15;  FINISHED OPTIONS OR NONE, WHICHEVER IS APPLICABLE
```

The user is required to select options until option 15 is chosen. In other words, the user may select any or all options at his discretion.

Options 1 to 8 cause the flight frequency of the payloads to be modified. In order to determine the actual change, a message is printed as

OPTION #8 HAS BEEN SELECTED **
THE PERCENT CHANGE IS nn.nnnn

where nn.nnnn is the percent change.

If the user selects options 9, 10, or 11, the payload lengths and weights are changed. The modified payload length cannot exceed 60 feet nor can the weight exceed 65,000 pounds.

Option 12 specifies that the payload lengths be computed as the payload length multiplied by a random number in the interval from zero to one. The minimum value of the length parameter is 5 feet.

Option 13 allows the user to specify a percentage of payloads to be deleted from the model. The user is prompted as:

INPUT THE PERCENTAGE OF THE PAYLOADS TO BE DELETED

The actual percentage is then printed as:

THE ACTUAL PERCENTAGE DELETED IS nn.nnnn.

Option 14 permits the user to save the modified payload model on mass storage. A message is then printed indicating the name of the file that contains the model, i.e.,

THE OUTPUT PAYLOAD MODEL IS CONTAINED ON FILE <MODEL>.

Selection of option 15 returns control to Step 3.

Step 7

If the user selects option 4 at Step 3, the printed output for feasible missions will be displayed in the mks system instead of the fps system. Control returns to Step 3.

Step 8

After selection of the analysis type, the program prints:

INPUT YEAR FOR ANALYSIS: (81 to 93)

The user should select the year for analysis in range of 81 to 93. If option 1 was selected at Step 5, the control goes to Step 11; otherwise, the control goes to Step 9.

Step 9

After obtaining the correct year for analysis, the message reads as:

SELECT INTERACTIVE OPTIONS: (3 FOR NONE)

The available options are:

1: USE PREVIOUSLY DEFINED FEASIBLE MISSIONS
2: USE INTERACTIVE FEATURE IN TRAFFIC MODELING
3: NONE OF THE ABOVE

If the user desires to use the previously defined feasible missions, he should select option 1. Option 2 should be selected if the interactive feature is desired in traffic modeling. The user may like to select both options 1 and 2; to do so, he should input 12. If the user desires not to select option 1 or 2, he can input 3. If option 1 is being selected, the control goes to Step 9; otherwise, control goes to Step 11.

Step 10

If the previously defined feasible mission option is selected, the program prints:

INPUT PREVIOUSLY DEFINED FEASIBLE MISSION DATA:
(FOR EXAMPLE: @ADD FILE.DATA81)

The user should use a previously defined feasible mission data element which has been saved from some previous run of the SAMPLE program. After reading the previously defined data, control goes to Step 16.

Step 11

At this point the program will print:

SELECT PERSONAL DATA BASE TO GENERATE FEASIBLE MISSION:
(10 FOR NONE)

The following ten options are available:

1: UPPER STAGE PERFORMANCE DATA
2: PAYLOAD MODEL DATA
3: YEARS AVAILABILITY OF UPPER STAGE
4: AVAILABILITY YEAR FOR WTR
5: MAXIMUM NUMBER OF PAYLOADS
6: MISSION TYPES
7: DISCIPLINE MIX
8: CG CONSTRAINT ON
9: MAXIMUM NUMBER OF OMS KITS ALLOWED
10: NONE OF THE ABOVE

Any number of options can be selected to change the data base. To select options 2, 6, 7, and 4, the input should be 2674. In other words, the user is required to specify a minimum of one option and may specify a maximum of seven.

Option 1 causes the third stage vehicle (TSV) performance data to be input again. This allows for a data override (reference Step 1). The user is prompted for input as:

INPUT UPPER STAGE PERFORMANCE DATA:

Option 2 causes the payload model data to be input again. The user is prompted for input as:

INPUT PAYLOAD MODEL DATA:

Option 3 causes the years of availability of the TSV to be input. The user is prompted for input as:

INPUT YEARS AVAILABILITY OF UPPER STAGES:

The user is required to input in free field form 10 two-digit years specifying when the TSV's input at option 1 are available. The range of usable TSV's are from 1979 to 1991, therefore 1999 indicates the particular TSV is unavailable. A sample input might be

84, 99, 99, 99, 99, 79, 81, 99, 99, 99

for ten distinct third stage vehicles.

Option 4 causes the availability of the western test range (WTR) to be specified. The user is prompted for input as:

INPUT AVAILABILITY YEAR FOR WTR:

A typical user response might be

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Option 5 causes the maximum number of payloads which can be grouped on a flight to be reset. It should be pointed out that a maximum of six payloads may be flown regardless of the user input. The user is prompted as:

INPUT MAXIMUM NUMBER OF PAYLOADS ALLOWED IN ONE COMBINATION

A typical user response might be

4

If option 6 was chosen, the program prints

```
SELECT MISSION TYPE:
         1:  FOR INPUT CHANGES TO LIST
         0:  NO CONSTRAINTS APPLIED
        -1:  APPLY CONSTRAINTS USING LIST
```

A user response of 1 indicates that the mission type constraint list is to be changed; 0 indicates that the constraint does not apply; and -1 indicates that the default mission type constraint list (see below) is to apply. No system response is given to a user input of 0 or -1. If the user inputs a 1, the program responds with

```
INPUT 1 TO PRINT MISSION CLASS CODE LIST; OTHERWISE SKIP A LINE
```

An input of 1 provides the message

```
                    MISSION CLASS CODE LIST

1=A      2=S      3=D      4=R
A                 S              D                  R                S A
D A               D S            D D                R D              D S A
D D A             D D S          D D D              R D D            D D S A
D D D A           D D D S

*MISSION CLASS CODE REVISION*
   THE DEFAULT LIST IS PRINTED ABOVE.
  DELETE CODE BY ENTERING NEGATIVE CODE.
  ENTER CODE BY ENTERING POSITIVE CODE.
  STOP WITH BLANK.
```

Option 7 provides the program response

```
SELECT DISCIPLINE MIX:
          1:  FOR INPUT CHANGES TO LIST
          0:  NO CONSTRAINTS APPLIED
         -1:  APPLY CONSTRAINTS USING LIST
```

A user response of 1 indicates that the discipline mix constraint list is to be changed; 0 indicates that the constraint does not apply; and -1 indicates that the default discipline mix constraint list is to apply. No system response is given to a user input of 0 or -1. If the user inputs a 1 the program responds with

```
INPUT 1 TO PRINT MISSION CLASS CODE LIST; OTHERWISE SKIP A LINE
```

An input of 1 provides the response

```
                PAYLOAD DISCIPLINE MIX LIST

 1=AS    2=OP    3=CN    4=ST    5=LS    6=EO    7=PL    8=SS    9=SP

10=PH   11=LU   12=OA   13=AP   14=SO   15=HE   16=EP   17=NN   18=AW

19=AY   20=AV   21=AU

*PAYLOAD DISCIPLINE MIX REVISION*
   THE DEFAULT LIST IS PRINTED ABOVE.
  DELETE CODE BY ENTERING NEGATIVE CODE.
  ENTER CODE BY ENTERING POSITIVE CODE.
  STOP WITH BLANK.
```

The user can modify the discipline mix codes as instructed above.

Option 9 causes the maximum number of OMS kits allowed to be reset. The user is prompted for input as:

INPUT MAXIMUM NUMBER OF OMS KITS ALLOWED

The choice of option 8 or 10 transfers control to Step 14. If in Step 5 option 4 was selected (isolated manifesting), control goes to Step 12.

Step 12

When the user selects option 4 in Step 5, the program prints:

ISOLATED MANIFESTING
INPUT THE PAYLOADS FOR THIS FLIGHT:

The user may then input, in any order, the payloads to be grouped for a flight. The sequence number (order it appears in the payload model) for each payload is given - separated by a blank. The user should input a zero or a carriage return to transfer control to Step 16. Otherwise, the payload numbers are read and control goes to Step 13.

Step 13

At this stage, the program performs constraint testing on the group of payloads specified by the user. Information as to whether the combination is feasible or infeasible is printed. If the combination is infeasible, c- trol returns to Step 12. If the combination is feasible, the following message is printed:

IS THIS FLIGHT TO BE SAVED FOR THE TRAFFIC MODEL?

0: NO
1: YES

The user should input a 1 to save this flight in the traffic model. Control returns to Step 12.

Step 14

At this stage, the program is ready to go through the MPLS part of the program to generate all the feasible missions for the selected data base. After generating the feasible missions, the statistical analysis for the year under consideration is printed along with the analysis of time elapsed.

If in Step 5 option 1 was selected (i.e., only MPLS analysis was desired), the control goes to Step 21; otherwise, control goes to Step 15.

Step 15

This step allows the user to specify the value index of flights to be used in the traffic model selection. The following message is printed:

SPECIFY VALUE INDEX OF FLIGHT TO BE USED IN TRAFFIC MODEL SELECTION

Available options are:

SET VALUE OF EACH FLIGHT EQUAL TO:
1: UNITY
2: MAXIMUM OF WEIGHT LOAD FACTOR UP OR DOWN
3: ON-ORBIT OMS PROPELLANT REQUIRED
4: MINIMUM OF UNUSED WEIGHT CAPABILITY UP OR DOWN
5: MAXIMUM OF LENGTH LOAD FACTOR UP OR DOWN
6: CARGO WEIGHT UP
7: CARGO LENGTH UP
8: MAXIMUM OF WEIGHT LOAD FACTOR UP OR DOWN, OR LENGTH LOAD FACTOR UP OR DOWN
9: PRODUCT OF PRIORITY OF CONSTITUENT PAYLOADS
10: SUM OF SHARABILITY OF CONSTITUENT PAYLOADS
11: CHARGE FACTOR (UNAVAILABLE)
12: UNALLOCATED

Upon option selection, control proceeds to Step 16.

Step 16

This step allows the user to specify the solution strategy to be used in determining a traffic model. The following message is printed:

SPECIFY SOLUTION STRATEGY FOR TRAFFIC MODEL SELECTION

Available options are:

SOLUTION FOR TRAFFIC MODEL PROCEEDS ACCORDING TO:
1: CHOOSE AVAILABLE FLIGHTS WITH HIGHEST VALUE
2: RANDOMLY CHOOSE AVAILABLE FLIGHTS
3: RANDOMLY CHOOSE FROM AVAILABLE FLIGHTS WITH N PAYLOADS, N = 6, 5, . . . , 1

The available flights (feasible combinations) are first reordered in terms of increasing value where value is as defined in step 15. Option 1 specifies that the flights shall be chosen from highest valued to lowest valued flights. Generally, the selection of one flight (e.g., a flight with payloads A, B and C) precludes other flights (i.e., flights which contain payloads A, B or C) for which the same payloads (i.e., A, B and C) are "covered" or flown. Option 2 dictates that the flights are randomly chosen, regardless of the value specified in step 15. Option 3 requires that the traffic model be chosen randomly from flights with N payloads where N = 6, 5, . . . , 1. Upon option selection, control proceeds to step 17.

Step 17

At this stage, a traffic model is completed and the program prints out the results. Then the message is printed:

DO YOU WISH TO SEE INFORMATION ON THESE MISSIONS?

0: NONE
-1: PRINT ALL
-2: PRINT ALL AND SAVE ON SCRATCH FILE
-3: SAVE ON SCRATCH FILE ONLY
N: ENTER MISSION "N"

If the user is not interested in seeing the information about the flights, he should input the zero. In this case, control goes to Step 18. If the user wishes to see the information about the missions selected for the traffic model, he should input -1.

If he wishes flight information and wishes to save the traffic model on a scratch file, he should enter -2. If he wishes to save it on scratch file only, the user should enter -3. The saved traffic model is written on logical unit 2 (LX).

If the user desires to have the information about specific flights, he should input the flight number he desires. The information for that flight will be printed. Then the user can enter another flight number. The control proceeds to Step 18 when he enters zero.

Step 18

If in Step 5 option 3 was selected (isolated manifesting) control goes to Step 3.

In Step 9, if the user had not selected option 2, which means the user is not interested in the interactive feature in traffic modeling, the statistics for the current traffic model will be printed; then control returns to Step 3. Otherwise, a message is printed:

ALTERNATE TRAFFIC MODEL OPTION

DO YOU WANT ANOTHER SCHEDULE?

1: YES
0: NO

If the user desires to have another traffic model, he should input 1 and the control goes to Step 19. Otherwise, when 0 is input, the control goes to Step 3.

Step 19

WHICH MISSIONS DO YOU WANT OMITTED?

(ENTER 0 TO END)

At this time, the user should enter the missions to be omitted one at a time. The last entry should be zero in order to transfer control to Step 20.

Step 20

WHICH MISSION DO YOU WANT TO ENTER?

(ENTER 0 TO END)

The user should enter the mission to be specified in the traffic model one at a time. The last entry should be zero in order to transfer control to Step 17.

Step 21

In case of normal termination, the temporary files assigned by the program can be saved for future use. For example, the temporary file LA will have feasible mission data for the year under consideration (the final selection in case another year was selected for analysis). To save this data for future use, it should be copied to a secured file. Assuming that SECURE is a cataloged file and COMB81 is the user-defined element name, the runstream would be:

```
@ED  LA., SECURE.COMB81
@
```

This saved data can be used in the future as previously defined feasible mission data and can be added in Step 10. By saving the data for future use, the user does not have to go through the generation of feasible mission data (i.e., MPLS program) repeatedly for the same set of payload data.

4. OUTPUT DESCRIPTION

4.1 NORMAL OUTPUT

The output from the SAMPLE program can be classified into the following four basic types.

4.1.1 Payload Model

This output is written on an unformatted mass storage file, logical unit 13, and is optional. It has the same information and format as the input mission model. The reader is referred to section 3.3 for a detailed description.

4.1.2 Feasible Combination File

Two mass storage files (logical units 1 and 2) are assigned to retain the information of feasible combinations. The complete set of feasible combinations from the MPLS is stored on logical unit 1. Logical unit 2 is used to keep the input information for the SCP. The information on logical unit 1 is always transferred to logical unit 2, either totally or partially. The reasons are:

a. Since the SCP is designed to handle a maximum of 2000 combinations, whenever the combinations in logical unit 1 exceed that limit, logical unit 2 can store a randomly chosen subset of those combinations of which the total number will be within 2000.

b. By transferring the information to logical unit 2, logical unit 1 can be reused to retain the traffic model.

Both logical unit 1 and logical unit 2 contain fixed length records. The user is referred to Appendix A for description of the feasible combination file.

4.1.3 Traffic Model File

The traffic model output is written on a formatted file which is logical unit 1. It is initiated by the first card image "n*CASE* m" where n is the number of missions in the traffic model and m is the number of the traffic model. The rest of the cards are identified in sets of six. The format of the traffic model file is described in Appendix B.

4.1.4 Display

The display output of the SAMPLE can be differentiated into the following six types, any of which are optional.

a. Payload model display

This is the initial output of the SAMPLE and it consists of approximately three pages of information pertaining to the payload model. This information is displayed in four different sets. The first set prints the following parameters for each payload.

- Payload discipline
- Payload ID
- Payload name

The second set prints out the following parameters for each payload.

- Payload diameter
- Weight of the H_2 for electrical power system (EPS)
- Weight of the O_2 for EPS
- Height of apogee
- Payload duration
- Operation time
- C3 energy

The third set of information consists of the following parameters for each payload.

- Inclination
- RCS fuel supply
- Center of gravity
- Launch length
- Launch weight including adapter
- Landing weight
- Payload mission type

The fourth set of information provides the flight frequencies for each payload in every year from 1979 through 1991.

b. Mission class and discipline mix display

This display contains two lists of payload parameters. The first one is called 'MISSION CLASS CODE LIST,' and prints out the payload number and the mission type associated with that payload. The second one is called 'PAYLOAD DISCIPLINE MIX LIST,' and includes the payload number and its discipline mix.

c. Occurrence table

This optional print is a list of each payload and all feasible combinations which include that payload. The title of the table is displayed as "n OCCURRENCE TABLE," where n is the year in which the particular case is executed. This is immediately followed by "PAYLOAD" and "FEASIBLE COMBINATIONS." Under the column of "PAYLOAD" are printed out the payload ID's. Under the column of "FEASIBLE COMBINATIONS" are combination numbers which carry that payload.

d. Feasible combinations

This display prints the following parameters for the feasible combinations.

- Flight number
- Launch site
- Payload identification number/name
- Orbiter sequence
- Inclination
- Total weight up/down
- Up/down length
- TSV name
- TSV sequence
- Altitude
- Payload type
- Orbiter and TSV ΔV
- Number of orbital maneuvering system (OMS) kits
- Load factor
- Payload margin
- Percentage used of the first kit

e. Infeasible combinations

This option will give a list of infeasible combinations. For each combination, the following information will be printed out.

- Payload ID's and their disciplines
- One of the following messages will be displayed to indicate the reason that the combination fails.

(1) DOWN WEIGHT CONSTRAINT VIOLATED

(2) MISSION TYPE NOT ALLOWED

(3) NO FEASIBLE SEQUENCE FOUND

(4) NO TUGS SATISFY LENGTH AND WEIGHT CONSTRAINTS

(5) NUMBER OF PAYLOADS ON A TUG GREATER THAN 3

(6) PAYLOAD iii CAN ONLY BE DEDICATED TUG

(7) PAYLOAD DISCIPLINE MIX NOT ALLOWED

(8) THE RCS WEIGHT IS GREATER THAN THE CAPACITY IN THIS CASE

(9) TOTAL LENGTH GREATER THAN BAY LENGTH, DOWN TOTAL LENGTH = rrrr.r

(10) UPWEIGHT CONSTRAINT VIOLATED

(11) INCLINATION RANGE GREATER THAN 0.5

f. Traffic model data

These data give the total number of missions in the traffic model, the mission identifications, and the total cost of this traffic model.

4.2 ABNORMAL OUTPUT

Diagnostic messages from subroutines of SAMPLE are listed below.

Diagnostic message	Subroutine	Description
STORING ERROR	LOAD5	The program writes more data on a file than it can hold. The user can either reassign a larger file or contact the responsible programmer for help.
TABLE ERROR***INPUT TO GREEDY IS CLOBBERED**	TABLE	This message implies that more than one payload in a combination have the same ID; a responsible programmer should be contacted.
GREEDY ERROR	GREEDY	This display indicates either a certain payload is not covered or is overlapped in the traffic model. A responsible programmer should be contacted.
THE NUMBER ENTERED IS TOO LARGE, PLEASE ENTER A NUMBER LESS THAN XX	RESCH	In the mission omit option, the user inputs the mission ID, which is larger than any existing mission ID.
MISSION XX CANNOT BE OMITTED, BECAUSE PAYLOAD YY WOULD BE UNCOVERED	RESCH	The user wants to omit some missions that will cause some payloads not to be contained in the traffic model. He should refer to the occurrence table and be sure all payloads can be included.
MISSION XX IS UNACCEPTABLE	RESCH	In the mission addition option, the user entered more than one mission which contains the same payload.

5. SAMPLE INPUT AND OUTPUT

This section contains two run streams and a typical printed output from SAMPLE.

5.1 COMPACT RUN STREAM FOR SAMPLE

@RUN	Run card
@USE S.,FD3-L78486*SAMPLE	Specifies an internal file name for an external file name
@XQT S.SAMPLE	Starts execution
2	Selects OV099 performance vehicle
@ADD S.DATA	Adds the mission model to the run
1722/80/38	This string of input specifies the following options in the order given: (1) The "1" specifies the display option (2) The "7" specifies all displays (3) The "2" specifies that an analysis type is to be chosen (4) The second "2" specifies GREEDY and MPLS are to be executed (5) The "/80/" denotes that a two-digit number 80 was input to specify the year under analysis (6) The "3" specifies no interactive options are to be chosen (7) The "8" specifies that c.g. constraint tests are applied
0	Does not store feasible combination data
1	The value index to be used by the GREEDY program.
3	The solution strategy for the GREEDY program
5	Terminate analysis

5.2 COMPACT RUN STREAM FOR GREEDY ONLY

@RUN JWLXIA	Run card
@USE S.,FD3-L78486*SAMPLE	Specifies an internal file name for an external file name
@XQT S.SAMPLE	Starts execution
2	Selects OV099 performance vehicle
@ADD S.DATA	Adds the mission model to the run
22/80/1	This string of input specifies the following options in the order given: (1) The first "2" specifies that an analysis type is to be chosen (2) The second "2" specifies that the MPLS and GREEDY programs are to be executed (3) The "/80/" specifies that the year of analysis is 1980 (4) The "1" indicates that a previously defined feasible mission file is to be used
DATA.	This input specifies that the feasible mission file is named DATA
0	Does not store feasible combination data
1	The value index for the GREEDY program
3	The solution strategy for the GREEDY program
5	Terminate analysis

XXXXXXXXXXXXXXXXXXXXXXX MISSION MODEL DISPLAY XXXXXXXXXXXXXXXXXXXXXX

NO.	PAYLOAD DISCIPLINE	PAYLOAD ID	NAME
1	AG	ADV RELATVTY	ADVANCED RELATIVITY
2	AE	SMM	SOLAR MAXIMUM MISSION
3	AE	SMM RETRIEVE	SOLAR MAXIMUM MISSION RETRIEVE
4	AA	AMPTE	ACTIVE MAGNETOSPHERIC PART TRCR EX
5	AB	SPACE TELE	SPACE TELESCOPE
6	AB	ST RETRIEVE	SPACE TELESCOPE RETRIEVE
7	AB	ST REVISIT	SPACE TELESCOPE REVISIT
8	AC	GAMMA RAY OB	GAMMA RAY OBSERVATORY
9	AC	GRO RETRIEVE	GAMMA RAY OBSERVATORY RETRIEVE
10	AC	GRO REVISIT	GAMMA RAY REVISIT
11	AB	X-RAY OB	X-RAY OBSERVATORY
12	AB	XRO RETRIEVE	X-RAY OBSERVATORY RETRIEVE
13	AB	XRO REVISIT	X-RAY OBSERVATORY REVISIT
14	AA	EUVE	EXTREME ULTRAVIOLET EXPLORER
15	AC	CRO	COSMIC RAY OBSERVATORY
16	AC	CRO RETRIEVE	COSMIC RAY OBSERVATORY RETRIEVE
17	AC	CRO REVISIT	COSMIC RAY OBSERVATORY REVISIT
18	AB	LSO	LARGE SOLAR OBSERVATORY
19	AG	OPEN	ORIGIN OF PLASMAS IN EARTHS NEIGHBD
20	AF	VLBI-A	VERY LONG BASELINE INTERFEROMETER-A
21	AF	VLBI-B	VERY LONG BASELINE INTERFEROMETER-B
22	AH	GALILEO	GALILEO
23	AJ	SOLAR POLAR	SOLAR POLAR
24	AK	VOIR	VENUS ORBITING IMAGING RADAR
25	AK	HALLEY-C FLY	HALLEY COMET FLYBY

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26	AJ	SOLAR PROBE	SOLAR PROBE
27	AH	ASTEROID RDZ	ASTEROID RENDEZVOUS
28	AK	MARS RET 1	MARS SAMPLE RETURN 1
29	AK	MARS RET 2	MARS SAMPLE RETURN 2
30	AK	MARS RET 3	MARS SAMPLE RETURN 3
31	AP	ERBSS	EARTH RADIATION BUDGET SATELLITE SYS
32	AP	ERBSS RET	EARTH RADIATION BUDGET SAT. SYS RETR
33	AQ	LTNG MAPPER	LIGHTNING MAPPER
34	AG	REG H2O QM	REGIONAL WATER QUALITY MONITOR
35	AQ	STORMS OBS	SEVERE STORMS OBSERVATION SYSTEM
36	AP	SEOS	SYNCHRONOUS ENVIRONMENT OBS SATELLIT
37	AR	HALOGEN OCC	HALLOGEN OCCULTATION
38	AP	COASTAL ZONE	COASTAL ZONE MONITOR
39	AV	WIDE BAND	WIDE BAND
40	AV	ADV MBEAM AR	ADVANCED MULTIBEAM ARRAY
41	AW	RURAL COMM	RURAL COMMUNICATIONS
42	AV	MOBIL COMM	MOBIL COMMUNICATIONS
43	AW	SERCH & RESC	SEARCH AND RESCUE
44	AL	LDEF	LONG DURATION EXPOSURE FACICLTY
45	AL	LDEF RETR	LONG DURATION EXPOSURE FACILITY RETR
46	AM	SLERV	SHUTTLE LAUNCHED ENTRY RESEARCH VEHI
47	AM	SSST	SPACE STRUCTURE SYSTEM TECHNOLOGY EX
48	AN	25KW PWR MOD	25 KW POWER MODULE
49	AM	SCI &APPL MO	SCIENCE AND APPLICATIONS MODULES
50	AM	MAR EXP CARR	MATERIALS EXPERIMENT CARRIER
51	AM	MAT MODULES	MATERIALS MODULES
52	AN	LG SPACE STR	LARGE SPACE STRUCTURES

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NO.	DIAM	HEPS	OXEPS	HA	PLDUR	OPTIME	C3
1	7.	0.	0.	281.	1.	0.	.0000
2	15.	0.	0.	160.	1.	0.	.0000
3	15.	0.	0.	320.	1.	0.	.0000
4	5.	0.	0.	160.	1.	0.	.0000
5	14.	0.	0.	270.	1.	0.	.0000
6	14.	0.	0.	270.	1.	0.	.0000
7	15.	0.	0.	270.	1.	0.	.0000
8	14.	0.	0.	160.	1.	0.	.0000
9	14.	0.	0.	160.	1.	0.	.0000
10	15.	0.	0.	250.	1.	0.	.0000
11	15.	0.	0.	160.	1.	0.	.0000
12	15.	0.	0.	160.	1.	0.	.0000
13	15.	0.	0.	280.	1.	0.	.0000
14	3.	0.	0.	186.	1.	0.	.0000
15	15.	0.	0.	160.	1.	0.	.0000
16	15.	0.	0.	160.	1.	0.	.0000
17	15.	0.	0.	250.	1.	0.	.0000
18	15.	0.	0.	160.	1.	0.	.0000
19	5.	0.	0.	160.	1.	0.	.0000
20	8.	0.	0.	160.	1.	0.	.0000
21	8.	0.	0.	160.	1.	0.	.0000
22	12.	0.	0.	160.	1.	0.	.0000
23	8.	0.	0.	160.	1.	0.	.0000
24	10.	0.	0.	160.	1.	0.	.0000
25	15.	0.	0.	160.	1.	0.	.0000
26	15.	0.	0.	[illegible]	1.	0.	.0000
27	15.	0.	0.	160.	1.	0.	.0000
28	15.	0.	0.	160.	1.	0.	.0000
29	15.	0.	0.	160.	1.	0.	.0000
30	15.	0.	0.	160.	1.	0.	.0000
31	10.	0.	0.	160.	1.	0.	.0000
32	10.	0.	0.	160.	1.	0.	.0000
33	5.	0.	0.	160.	1.	0.	.0000
34	5.	0.	0.	160.	1.	0.	.0000
35	5.	0.	0.	160.	1.	0.	.0000
36	10.	0.	0.	160.	1.	0.	.0000
37	3.	0.	0.	160.	1.	0.	.0000
38	15.	0.	0.	160.	1.	0.	.0000
39	10.	0.	0.	160.	1.	0.	.0000
40	10.	0.	0.	160.	1.	0.	.0000
41	4.	0.	0.	160.	1.	0.	.0000
42	8.	0.	0.	180.	1.	0.	.0000
43	4.	0.	0.	160.	1.	0.	.0000
44	15.	0.	0.	225.	1.	0.	.0000
45	15.	0.	0.	225.	1.	0.	.0000
46	8.	0.	0.	160.	1.	0.	.0000
47	15.	0.	0.	160.	1.	0.	.0000
48	15.	0.	0.	250.	1.	0.	.0000
49	15.	0.	0.	250.	1.	0.	.0000
50	15.	0.	0.	250.	1.	0.	.0000
51	15.	0.	0.	250.	1.	0.	.0000
52	15.	0.	0.	250.	1.	0.	.0000
53	15.	0.	0.	250.	1.	0.	.0000

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NO.	INCL	RCS	CG	LAUNCH LENGTH, FT.	LAUNCH WT. INCL. ADAPTER	ADAPTER WT., LB.	PMT
1	90.0	.0	6.3	11.8	1633.6	1433.0	D
2	28.5	.0	10.8	21.7	11700.0	4500.0	D
3	28.5	.0	10.8	21.7	4500.0	11700.0	R
4	28.5	.0	5.6	11.3	6578.0	2250.0	D
5	28.5	.0	21.5	43.0	23531.3	20944.0	D
6	28.5	.0	21.5	43.0	.0	20944.0	R
7	28.5	.0	5.0	10.0	5000.0	5000.0	S
8	28.5	.0	16.8	33.6	25700.0	4000.0	D
9	28.5	.0	16.8	33.6	4000.0	19400.0	R
10	28.5	.0	5.0	10.0	5000.0	5000.0	S
11	28.5	.0	25.3	50.6	31700.0	4000.0	R
12	28.5	.0	25.3	50.6	4000.0	25400.0	R
13	28.5	.0	5.0	10.0	5000.0	5000.0	S
14	28.5	.0	1.5	3.0	604.2	530.0	D
15	28.5	.0	17.3	34.6	25700.0	4000.0	D
16	28.5	.0	17.3	34.6	4000.0	19400.0	R
17	28.5	.0	5.0	10.0	5000.0	5000.0	S
18	28.5	.0	29.8	59.6	32700.0	4000.0	D
19	28.5	.0	5.6	11.3	7618.0	2250.0	D
20	28.5	.0	13.8	27.6	54728.0	6924.0	D
21	28.5	.0	13.8	27.6	54728.0	6924.0	D
22	28.5	.0	22.3	44.7	65000.0	6591.0	D
23	28.5	.0	18.5	37.0	62607.0	6591.0	D
24	28.5	.0	20.5	41.0	61033.0	6924.0	D
25	28.5	.0	24.0	48.0	65000.0	6591.0	D
26	28.5	.0	24.0	48.0	62657.0	6591.0	D
27	28.5	.0	24.0	48.0	65000.0	6591.0	D
28	28.5	.0	24.0	48.0	65000.0	6591.0	D
29	28.5	.0	24.0	48.0	65000.0	6591.0	D
30	28.5	.0	24.0	48.0	65000.0	6591.0	D
31	56.0	.0	9.8	19.7	10000.0	4500.0	D
32	56.0	.0	9.8	19.7	4500.0	9833.0	R
33	28.5	.0	5.6	11.3	7318.0	2250.0	D
34	28.5	.0	5.6	11.3	7318.0	2250.0	D
35	28.5	.0	5.6	11.3	7318.0	2250.0	D
36	28.5	.0	11.4	22.8	15275.0	3500.0	D
37	56.0	.0	3.7	7.5	627.0	550.0	D
38	28.5	.0	11.2	22.5	16160.0	3800.0	D
39	28.5	.0	13.7	27.5	16360.0	3800.0	D
40	28.5	.0	13.7	27.5	16360.0	3800.0	D
41	28.5	.0	5.4	10.8	7473.0	2250.0	D
42	28.5	.0	13.7	27.5	16396.0	3800.0	D
43	28.5	.0	5.4	10.8	7468.0	2250.0	D
44	28.5	.0	15.0	30.0	22500.0	20000.0	D
45	28.5	.0	15.0	30.0	.0	20000.0	R
46	28.5	.0	5.0	10.0	5700.0	5000.0	D
47	28.5	.0	5.0	10.0	9120.0	8000.0	D
48	28.5	.0	30.0	60.0	30147.5	27000.0	D
49	28.5	.0	5.0	10.0	16950.0	15000.0	D
50	28.5	.0	5.0	10.0	11400.0	10000.0	D
51	28.5	.0	5.0	10.0	13620.0	12000.0	D

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FLIGHTS PER YEAR

NO.	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	0	0	0	0	0	0	0	0	0	2	0	0
2	0	0	0	1	0	0	1	0	1	0	1	1	0
3	0	1	0	0	0	1	0	1	0	1	0	0	0
4	0	1	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	1	0	0	0	0	0	1	0	0	0
6	0	0	0	0	0	0	0	0	1	0	0	0	0
7	0	0	0	0	1	1	1	0	0	0	1	0	0
8	0	0	0	0	1	0	0	1	0	0	1	0	0
9	0	0	0	0	0	0	1	0	0	1	0	0	0
10	0	0	0	0	0	0	0	0	1	0	0	1	0
11	0	0	0	0	0	0	1	0	0	0	0	1	0
12	0	0	0	0	0	0	9	0	0	0	1	0	0
13	0	0	0	0	0	0	0	0	1	1	0	0	0
14	0	0	0	0	1	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1	0	0	1	1	0	0
16	0	0	0	0	0	0	0	0	0	1	0	0	0
17	0	0	0	0	0	0	0	1	1	0	0	1	0
18	0	0	0	0	0	0	0	0	0	1	0	0	0
19	0	0	0	0	1	1	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	1	0	0	0	0	0
21	0	0	0	0	0	0	0	0	1	0	0	0	0
22	0	1	0	0	0	0	0	0	0	0	0	0	0
23	0	0	1	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0
25	0	0	0	0	1	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	1	0	0	0	0	0	0
27	0	0	0	0	0	0	0	1	0	0	0	0	0
28	0	0	0	0	0	0	0	1	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	1	0	0	0
30	0	0	0	0	0	0	0	0	0	1	0	0	0
31	0	1	0	0	0	1	0	0	0	1	0	0	0
32	0	0	0	0	1	1	0	0	1	0	0	0	0
33	0	0	0	0	1	0	0	0	0	0	0	0	0
34	0	0	0	0	0	1	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	1	0	0	0	0	0
36	0	0	0	0	0	0	0	0	1	0	0	1	0
37	0	3	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	1	0	0	0	1	0	0	0
39	0	0	0	1	0	0	0	1	0	0	0	1	0
40	0	1	0	0	0	1	0	0	0	1	0	0	0
41	0	0	0	0	0	0	0	0	0	0	1	0	0
42	0	0	0	0	0	0	0	0	0	1	0	0	0
43	0	1	1	1	0	0	0	0	0	0	0	0	0
44	0	1	1	0	1	1	0	1	1	0	1	0	0
45	0	0	1	1	1	0	1	1	0	1	0	1	0
46	0	0	0	0	1	1	1	0	0	0	0	0	0
47	0	0	0	0	0	1	1	0	0	0	0	0	0
48	0	0	0	1	0	0	0	0	0	0	0	0	0
49	0	0	0	1	1	1	1	1	1	1	1	1	0
50	0	0	0	1	1	0	[illegible]	1	0	0	1	0	0
51	0	0	0	0	0	1	2	1	2	2	1	2	0

732:>

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SEQUENCE NO.,PAYLOAD ID,PMT
  1  57 3     2  59 3     3  61 3     4  62 3     5  63 3     6  64 3
  7  80 3     8  82 3     9  92 1

DUPLICATED PAYLOADS
 PAYLOAD ID,TIMES DUPLICATED
  61  2      63  2      80  2
 SEQ,PAYLOAD NO,TUG
      1 57  0       2 59  0       3 61  0       4 62  0       5 63  0
      6 64  0       7 80  0       8 82  0       9 92  0

FLT. NO.     1      LAUNCH SITE: ETR

 PAYLOADS:    GOES
                  57
 SHUTTLE SEQUENCE      57-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:   22.      TOTAL WEIGHT UP: 13994.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:   .21529
 SHUTTLE DELTAV:    581.

FLT. NO.     2      LAUNCH SITE: ETR

 PAYLOADS:    INTELSAT V
                  59
 SHUTTLE SEQUENCE      59-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:   32.      TOTAL WEIGHT UP: 16343.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:   .25143
 SHUTTLE DELTAV:    581.

FLT. NO.     3      LAUNCH SITE: ETR

 PAYLOADS:    TDRSS/WESTAR
               61001
 SHUTTLE SEQUENCE      61-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:   35.      TOTAL WEIGHT UP: 57633.0
 PAYLOAD MARGIN:   7367.    LOAD FACTOR:   .88666
 SHUTTLE DELTAV:    581.

FLT. NO.     4      LAUNCH SITE: ETR

 PAYLOADS:    TDRSS/WESTAR
               61002
 SHUTTLE SEQUENCE      61-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:   35.      TOTAL WEIGHT UP: 57633.0
 PAYLOAD MARGIN:   7367.    LOAD FACTOR:   .88666
 SHUTTLE DELTAV:    581.

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FLT. NO.    5     LAUNCH SITE: ETR

 PAYLOADS:   RCA
                62
 SHUTTLE SEQUENCE      68-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  18.      TOTAL WEIGHT UP:  9375.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .14423
 SHUTTLE DELTAV:   581.

FLT. NO.    6     LAUNCH SITE: ETR

 PAYLOADS:   SBS
               63001
 SHUTTLE SEQUENCE      63-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  21.      TOTAL WEIGHT UP:  9375.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .14423
 SHUTTLE DELTAV:   581.

FLT. NO.    7     LAUNCH SITE: ETR

 PAYLOADS:   SBS
               63002
 SHUTTLE SEQUENCE      63-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  21.      TOTAL WEIGHT UP:  9375.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .14423
 SHUTTLE DELTAV:   581.

FLT. NO.    8     LAUNCH SITE: ETR

 PAYLOADS:   SYNCOM 1V
                64
 SHUTTLE SEQUENCE      64-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  12.      TOTAL WEIGHT UP: 13844.2
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .21299
 SHUTTLE DELTAV:   581.

FLT. NO.    9     LAUNCH SITE: ETR

 PAYLOADS:   TELESAT
               80001
 SHUTTLE SEQUENCE      80-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  18.      TOTAL WEIGHT UP:  8521.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .13109
 SHUTTLE DELTAV:   581.

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FLT. NO.    1     LAUNCH SITE: ETR

 PAYLOADS:    GOES
                57
 SHUTTLE SEQUENCE     57-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  22.      TOTAL WEIGHT UP: 13994.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .21529
 SHUTTLE DELTAV:   581.

FLT. NO.    3     LAUNCH SITE: ETR

 PAYLOADS:    TDRSS/WESTAR
              61001
 SHUTTLE SEQUENCE     61-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  35.      TOTAL WEIGHT UP: 57633.0
 PAYLOAD MARGIN:  7367.     LOAD FACTOR:  .88666
 SHUTTLE DELTAV:   581.

FLT. NO.    4     LAUNCH SITE: ETR

 PAYLOADS:    TDRSS/WESTAR
              61002
 SHUTTLE SEQUENCE     61-D
 ALTITUDE               160.
 INCLINATION            28.5
 TOTAL LENGTH UP:  35.      TOTAL WEIGHT UP: 57633.0
 PAYLOAD MARGIN:  7367.     LOAD FACTOR:  .88666
 SHUTTLE DELTAV:   581.

FLT. NO.   12     LAUNCH SITE: ETR

 PAYLOADS:    P&A SL1 LM+P
                 92
 SHUTTLE SEQUENCE     92-A
 ALTITUDE              135.
 INCLINATION            57.0
 TOTAL LENGTH UP:  60.      TOTAL LENGTH DOWN:  60.
 TOTAL WEIGHT UP: 35000.0    TOTAL WEIGHT DOWN: 32000.0
 PAYLOAD MARGIN:      0.    LOAD FACTOR: 1.00000
 SHUTTLE DELTAV:   466.

FLT. NO.   20     LAUNCH SITE: ETR

 PAYLOADS:    INTELSAT V      SBS
                 59     63002
 SHUTTLE SEQUENCE     59-D        63-D
 ALTITUDE               160.        160.
 INCLINATION            28.5        28.5
 TOTAL LENGTH UP:  53.      TOTAL WEIGHT UP: 25718.0
 PAYLOAD MARGIN: 32000.     LOAD FACTOR:  .39566
1704:>
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FLT. NO.   40     LAUNCH SITE: ETR

 PAYLOADS:   RCA            SBS             TELESAT
                  62    63001     80001
 SHUTTLE SEQUENCE      62-D       63-D         80-D
 ALTITUDE                160.        160.        160.
 INCLINATION             28.5       28.5        28.5
 TOTAL LENGTH UP:  57.      TOTAL WEIGHT UP: 27271.0
 PAYLOAD MARGIN: 32000.    LOAD FACTOR:  .41955
 SHUTTLE DELTAV:   581.

FLT. NO.   48     LAUNCH SITE: ETR

 PAYLOADS:   SYNCOM 1V       TELESAT          INSAT-INDIA
                  64    80002        82
 SHUTTLE SEQUENCE      64-D       80-D         82-D
 ALTITUDE                160.        160.        160.
 INCLINATION             28.5       28.5        28.5
 TOTAL LENGTH UP:  51.      TOTAL WEIGHT UP: 31740.2
 PAYLOAD MARGIN: 32000.    LOAD FACTOR:  .48831
 SHUTTLE DELTAV:   581.

INPUT OPTION :
 STATISTICS FOR CURRENT FLIGHT SCHEDULE

      AVERAGE NUMBER OF PAYLOADS PER FLIGHT = 1.71
      TOTAL NUMBER OF TUGS REQUIRED =    0
      TOTAL NUMBER OF INITIAL OMS KITS REQUIRED =    0
      TOTAL NUMBER OF SECOND AND THIRD OMS KITS REQUIRED =    0

DO YOU WANT ANOTHER SCHEDULE ?
    1: YES.
    0: NO .

SELECT AN OPTION: ( 5 TO TERMINATE )
 RUN FINISHED NORMALLY
@BRKPT PRINT$
EOF:1743 SCAN:37
0:>
```

```
XXXXXXXXXXXXXXXXXXX  STATISTICAL ANALYSIS FOR 1981  XXXXXXXXXXXXXXXXXXX
TOTAL NUMBER OF COMBINATIONS GENERATED:     134
       NUMBER OF FEASIBLE COMBINATIONS:      48
       NUMBER OF INFEASIBLE COMBINATIONS:    86

TOTAL ELAPSED TIME:        854
       (ALL TIMES ARE IN MILLISECONDS)
       AVERAGE TIME PER FEASIBLE COMBINATION:     17
       AVERAGE TIME PER GENERATED COMBINATION:     6

DO YOU WANT TO STORE THE FEASIBLE COMBINATION DATA?
    0: NO
    1: YES


         E R R O R   S T A T I S T I C S

        0 FAILED : MISSION TYPE NOT ALLOWED
        6 FAILED : UP WEIGHT CONSTRAINT
        0 FAILED : DOWN WEIGHT CONSTRAINT
        0 FAILED : NEEDED DEDICATED TUG
        0 FAILED : NUMBER OF TUG PAYLOADS > 3
        0 FAILED : LENGTH & WEIGHT CONSTRAINT
       36 FAILED : UP LENGTH > BAY LENGTH
        0 FAILED : DOWN LENGTH > BAY LENGTH
        0 FAILED : DISCIPLINE MIX
        0 FAILED : SEQUENCE DEPENDENT TESTS
        0 FAILED : RCS WEIGHT > CAPACITY
       44 FAILED : REDUNDANT PAYLOAD
        0 FAILED : INCLINATION RANGE > .5
SPECIFY VALUE INDEX OF FLIGHTS TO BE USED IN TRAFFIC MODEL SELECTION

1981      OCCURRENCE TABLE
    PAYLOAD     FEASIBLE COMBINATIONS
  1)     57     1   13   14   15   16   17   18   34   35   36   37   38

  2)     59     2   13   19   20   21   22   23
  3)  61001     3
  4)  61002     4
  5)     62     5   14   19   24   25   26   27   34   35   39   40   41
                42  43   44
  6)  63001     6   15   24   29   36   40   45   47
  7)  63002     7   20   28   30   39   41   46
  8)     64     8   16   21   25   28   31   32   34   36   37   38   39
                42  43   45   46   48
  9)  80001     9   17   26   31   35   40   44   47
 10)  80002    10   22   29   33   37   42   45   48
 11)     82    11   18   23   27   30   32   33   38   41   43   44   46
                47  48
 12)     92    12
  SPECIFY SOLUTION STRATEGY FOR TRAFFIC MODEL SOLUTION
 TRAFFIC MODEL CONTAINS THE FOLLOWING  7 MISSIONS
          1         3        4        12        20        40        48
 THE SELECTED TRAFFIC MODEL VALUE IS       7
 DO YOU WISH TO SEE INFORMATION ON THESE MISSIONS?
1642:)
```

APPENDIX A

FORMAT OF THE FEASIBLE COMBINATION FILE

The feasible combination file is unformatted and contains one record for each feasible combination generated by the program. Each record contains the following information.

Word no.	Symbol	Dimension	Type	Description
1	MM	1	I	Flight number
2	M	1	I	Number of payloads on this flight
3 - 8	IC	6	I	Payload numbers
9 - 14	IB	6	I	Optimal payload sequence
15 - 20	NAME1	6	A	Alphanumeric mission type
21	LAUNCH	1	I	A flag set to 1 or 2, indicating the Eastern or Western Test Range
22	NTUGPL	1	I	Number of TSV payloads
23	IFTUG	1	I	TSV number used for this mission
24 - 29	ICTUG	6	I	Payload numbers of the TSV payloads
30	NOKITS	1	I	Number of OMS kits used
31	PWMARG	1	R	Additional payload weight the Orbiter could carry on this flight
32	PCTUSE	1	R	Percentage of first OMS kit that is used
33	FLOAD	1	R	Load factor

Word no.	Symbol	Dimension	Type	Description
34	POINC	1	R	Inclination of the first orbit
35	POALT	1	R	Altitude of the first orbit
36 - 41	ALT	6	R	Orbital altitude of each payload
42 - 47	XINC	6	R	Orbital inclination of each payload
48	TOTLU	1	R	Total length up
49	TOTLD	1	R	Total length down
50	TOTWU	1	R	Total weight up
51	TOTWD	1	R	Total weight down
52	TUGDV	1	R	Total TSV ΔV used
53	ORBDV	1	R	Total Orbiter ΔV used
54 - 59	IG	6	A	Array of alphabetic mission types
60 - 71	ICC	12	I	Cost coefficients
72 - 83	IDENT	12	A	An array of two-word alphanumeric payload names

APPENDIX B

FORMAT OF THE TRAFFIC MODEL FILES

The traffic model file is formatted and contains seven unique card images. The format below identifies the data required to process one traffic model.

CARD 1

Word no.	Symbol	Format	Columns	Dimension	Type	Description
1	LENGTH	I6	1 - 6	1	I	Number of missions in this traffic model
2	FLAG	A6	7 - 12	1	I	Hollerith word "*CASE*"
3	CASE	I6	13 - 18	1	I	Number of the traffic model

CARD 2 TO 7

The next set of cards is in groups of six; the number of sets for the traffic model is identified by the word "LENGTH" of the first card.

Card no.	Word no.	Symbol	Format	Columns	Dimension	Type	Description
2	1	RECORD	I4	1 - 4	83	I	Flight number
2	2		I4	5 - 8		I	Number of payloads on this flight
2	3		6I6	9 - 44		I	Payload numbers
2	4		614	45 - 68		I	Optimal payload sequence
2	5		2A6	69 - 80		A	Alphanumeric mission type
3	1		4A6	1 - 24		A	

Card no.	Word no.	Symbol	Format	Columns	Dimension	Type	Description
3	2		I2	25 - 26		I	A flag set to 1 or 2, indicating the Eastern or Western Test Range
3	3		I2	27 - 28			Number of TSV payloads
3	4		I2	29 - 30		I	TSV number used for this mission
3	5		6I4	31 - 54		I	Payload numbers of the TSV payloads
3	6		I2	55 - 56		I	Number of OMS kits used
3	7		F10.0	57 - 66		R	Additional payload weight the Orbiter can carry on this flight
3	8		F5.0	67 - 71		R	Percentage of the first OMS kit that is used
3	9		F5.0	72 - 76		R	Load factor
4	1		F7.1	1 - 7		R	Inclination of the first orbit
4	2		F7.1	8 - 14		R	Altitude of the first orbit
4	3 - 8		6 F7.1	15 - 56		R	Orbital altitude of each payload
4	9 - 10		2 F7.1	57 - 70		R	Orbital inclination of each payload
5	1 - 4		4 F7.1	1 - 28		R	
5	5		F7.1	29 - 35		R	Total length up
5	6		F7.1	36 - 42		R	Total length down
5	7		F7.1	43 - 49		R	Total weight up
5	8		F7.1	50 - 56		R	Total weight down
5	9		F7.1	57 - 63		R	Total TSV ΔV used

Card no.	Word no.	Symbol	Format	Columns	Dimension	Type	Description
5	10		F7.0	64 - 70		R	Total Orbiter ΔV used
5	11 - 16		6A1	71 - 76		A	Array of alphabetic mission types
6	1 - 12		12I6	1 - 72		I	Cost coefficients
7	1 - 12		12A6	1 - 72		A	An array of two-word alphanumeric payload names