

**THE NORTHEASTERN
FOREST-INVENTORY
DATA-PROCESSING SYSTEM.
VI. OPERATION OF
SUBSYSTEM TABLE.**



by
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PREFACE

THIS paper is the sixth in a series of ten papers prepared to describe the forest-inventory data-processing system of the Northeastern Forest Experiment Station. This system was devised for using modern, large-scale, high-speed computers in processing forest-inventory data. The series will comprise the following papers:

- I. Introduction.
- II. Description of subsystem EDIT.
- III. Operation of subsystem EDIT.
- IV. Information for programmers -- subsystem EDIT.
- V. Description of subsystem TABLE.
- VI. Operation of subsystem TABLE.
- VII. Information for programmers -- subsystem TABLE.
- VIII. Description of subsystem OUTPUT.
- IX. Operation of subsystem OUTPUT.
- X. Information for programmers -- subsystem OUTPUT.

VI-A. INTRODUCTION

ONE of the major projects of the U. S. Forest Service is a nationwide forest survey, which is designed to obtain useful and timely information about the timber resources of the United States. In the course of the surveys, which are made mainly on a state-by-state basis, great masses of detailed data are collected about timber volumes, growth, timber cut, and other characteristics of the timber resource.

In recent years the volume of information obtained from forest-survey field plots has increased greatly. The task of compiling and analyzing this mass of data with mechanical computing machines was both cumbersome and time-consuming.

A solution to this problem was seen in the development of the high-speed electronic computers. The Northeastern Forest Experiment Station, which was responsible for conducting the forest survey of the heavily forested Northeastern States, investigated the possibilities and devised the Northeastern Forest-Inventory Data-Processing System.

This paper tells about the operation of a part of the system, program TABLE, which is specifically designed to reduce large volumes of sample data (data sets) to tables of statistics for the samples. The output of these sample summaries, in turn, is designed for use with program OUTPUT, part VIII of this series, to produce equivalent tables of statistics for the sampled populations. Detailed instructions for solving data-reduction problems with the standard version of the program are given in the following chapters.

A general description of the program outputs, inputs, logic and procedures is presented in program TABLE, part V of this series. The material covered in the general description should be thoroughly digested before attempting to use the program. It will also

be helpful to read the general description of program OUTPUT before proceeding to use this program.

The program is written in the standard IBM FORTRAN IV language, and is operative at the Yale University Computer Center on an IBM 7094/7040 Direct-Coupled System under IBSYS DCS operating system with IBJOB processor.¹ It will operate with little or no modification on other comparable systems. Part VII of this series contains a selection of programming information that will be useful if the standard version of the program must be modified for any reason.

Copies of these program write-ups and information on the FORTRAN IV program decks may be obtained from the Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pennsylvania 19082.

VI-B. CONTROL CARD FORMATS

The description and specification of a table-compilation job is presented to the computer through a special deck of data cards referred to as the job control deck. Each card in this deck contains specific pieces of information arranged in a definite format.

In this chapter each type of control card is described. The description gives the format of the cards, the information they must contain; and where appropriate, the purpose and use of the required information. Consequently, this chapter may be used both as a detailed list of instructions for coding the description of a job, and as an outline to follow in the initial stages of job specification in order that the specifications be complete.

1. Job Control Cards (Sec. 300)

The first two cards in the control deck are the title card (item 301) and the output option card (item 302). They contain the job identification and the general instructions concerning the kind of output required. Both cards must always be present (fig. 1).

¹Mention of a particular product should not be construed as an endorsement by the Forest Service or the U. S. Department of Agriculture.

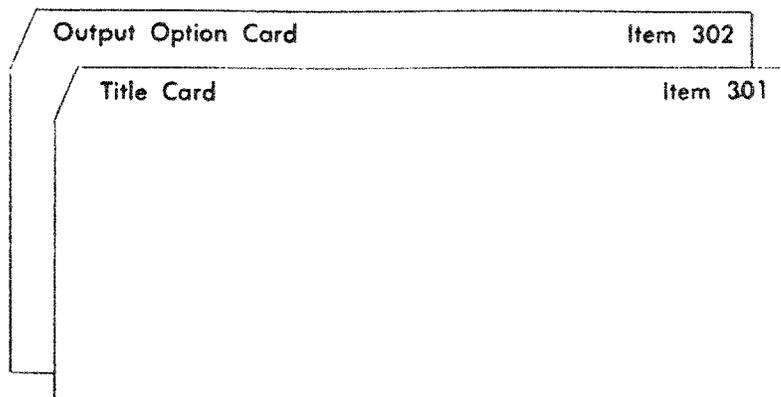


Figure 1. — Order of the job control cards in the job control deck.

TITLE CARD — ITEM 301

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-72	AAA . . . A	= 72 alphameric characters, giving a descriptive title for the job. The title will appear at the top of each page of printed output.

OUTPUT OPTION CARD — ITEM 302

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	OPTION	= Card label.
7-8	bb	
9	1	= Form and output tables of sampling unit sums over sets of sampling units.
	2	= Form and output tables of sampling unit means over sets of sampling units.
	3	= Form and output tables of sampling unit means and of their variances over sets of sampling units.
	4	= Form and output tables of sampling unit means, their variances, and of covariances of table cells with table totals over sets of sampling units.
10-11	bb	
12-16	bbbb	= Output written on tape in binary mode. (See part VII-E for format.) This option is used for a normal processing run.
	DEBUG	= Output is printed in binary coded decimal (BCD) mode. (See part VII-E for format.) This option may be used when debugging a new control deck.

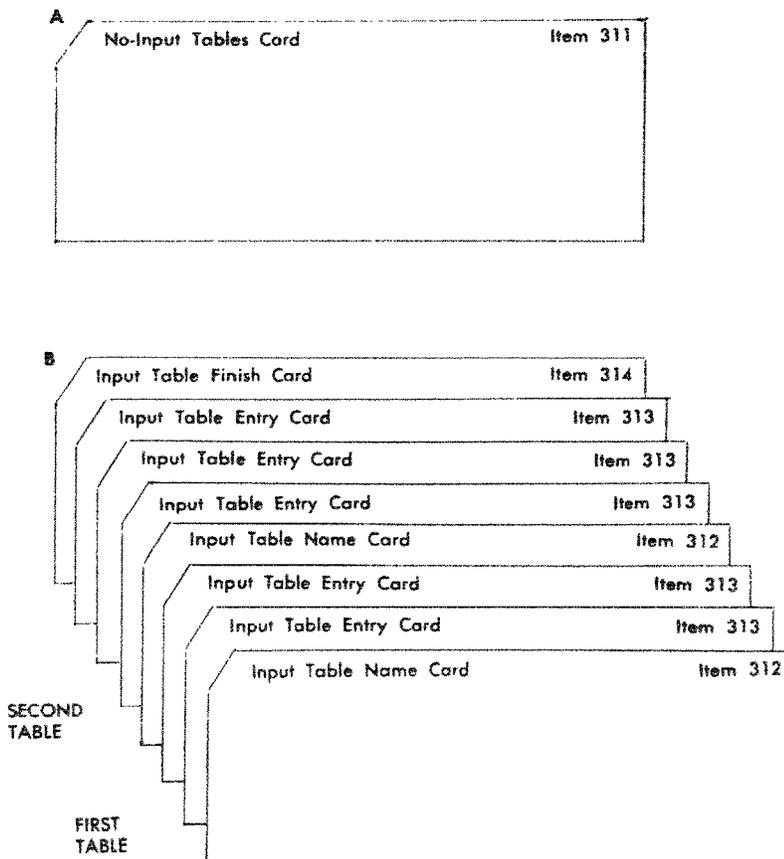
2. Input Table Cards (Sec. 310)

This section describes each type of card required in the control deck to provide the input tables used in the table indexing operations (see part V-D).

The no-input tables card (item 311) is to be used if the job does not require input tables for indexing. In this case no other input table cards need be used (fig. 2-A).

Any number of input tables may be put in the control deck, and

Figure 2. — Order of the input table cards in the job control deck; **A**, when the job requires no input tables; **B**, when the job requires two input tables, with two and three entries, respectively.



the tables may be in any order. However, all tables must be placed in the control deck as a group, and the last card of the group must be the input table finish card (item 314).

Two types of card are required for each input table, and the cards for each input table must appear as a set. The first card of each set is the input table name card (item 312) that gives a unique name to the table and controls the input of the table to the computer. The remaining cards of each set are repetitions of the input table entry card (item 313), in which a single input table entry appears. As many of these cards follow the input table name card as there are entries in the table (fig. 2-B).

The card following the last input table entry card (item 313) for a table must either be an input table name card (item 312) or an input table finish card (item 314).

NO-INPUT TABLES CARD — ITEM 311

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-15	NOINPUTb-TABLES	= A control word signifying that there are no input tables in the control deck.

INPUT TABLE NAME CARD — ITEM 312

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	AAAAAA	= 6 alphameric characters, giving a unique name by which the input table is referenced to an operation. The user may assign any name he wishes but the name must be left-justified in the field.
7-15	bbb . . . b	= 9 blanks.
16-20	XXXXX	= 5 numeric characters, giving the number of entries in the table just named. The number must be right-justified in the field.
21	b	
22	1	= There is only one field in a table entry.
	2	= There are two fields in a table entry. This option is required for tables to be used with the LOOKUP and the RANGE operations.

INPUT TABLE ENTRY CARD — ITEM 313

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-4	XXXX	= 4 numeric characters, containing the value of the first field of a table entry. The number must be right-justified in the field.

5-8 XXXX = 4 numeric characters, containing the value of the second field of a table entry, if any. The value must be right-justified in the field. A second field is required only if the table is to be used in the LOOKUP or the RANGE operations.

INPUT TABLE FINISH CARD — ITEM 314

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	FINISH	= A control word signifying the end of all input tables. This card must always follow the last table entry card of the last input table in the control deck. It should not be used if there are no input tables and the no input tables card (item 311) has been used.

3. Output Table Definition Cards (Sec. 320)

The control cards described in this section are used to define the output tables that are to be compiled from the input data for this job. The maximum number of tables that may be defined in one run is 40, and the maximum dimensions of any table are 50 rows by 50 columns, including the row and column totals that are automatically supplied by the program. The definition of output tables is subject to the additional restriction that the total number of cells in all tables defined is limited by the sampling option chosen and the available storage in the computer. This restriction is discussed further in part VII-C.

The definition of an output table gives the information required to produce the output table from the input data. The information is contained in a group of cards for each output table defined. The groups may be placed in the control deck in the order that the tables are to appear in the final output; but within the group for a given table, the order of the cards must be exactly as described below (fig. 3).

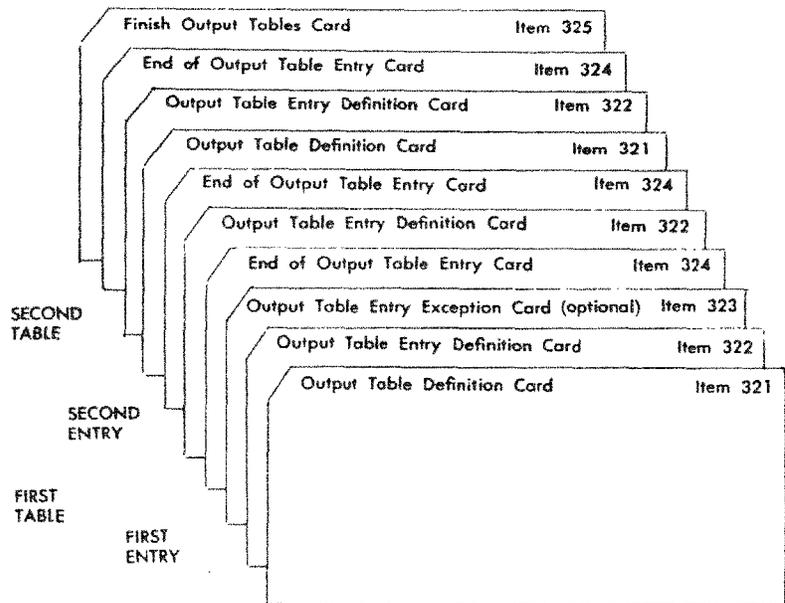
The first card in a group of cards defining an output table is the output table definition card (item 321). In this card the user assigns the table a unique name, gives its dimensions, and specifies the number of entries in the table per sampling unit.

Next in the group comes a set of cards (described below) in

which the first table entry is completely defined. There must be as many of these sets as there are entries specified on the first card.

In the set of cards defining a table entry, the first card is the output table entry definition card (item 322). In this card the user gives the identification number of the input data field to be used as the table entry, and tells how to determine the row and the column of the table in which the entry is to be summed (part V-D). The last card in the set is the end of output table entry card (item 324), which simply signals the end of the set. Between these two cards may appear as many output table entry exception cards (item 323) as necessary to give the conditions under which the normal entry will not be made. Only one condition can be given on a card. The use of these cards is subject to the additional

Figure 3. — Order of the output table definition cards in the job control deck. This setup calls for two output tables, with two and one entries, respectively. The first entry of the first output table carries one condition for "excepting" the entry.



restriction that there may not be more than 150 of them in the control deck for all entries in all tables.

Finally, the end of all output table definitions is signaled by the finish output tables card (item 325) that must always be present in the control deck (fig. 3).

OUTPUT TABLE DEFINITION CARD — ITEM 321

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-12	DEFINEbTABLE	= Card label.
13	b	
14-19	AAAAAA	= 6 alphameric characters, giving a unique name by which the output table may be referenced. The user may assign any name he wishes, but the name must be left-justified in the field.
20-23	bbbb	
24-25	XX	= 2 numeric characters, giving the number of rows in the output table (exclusive of a row for column totals which is provided automatically). The number must be less than 50, and must be right-justified in the field.
26	A	= The alphameric character, X, signifying "by," as in "rows by columns."
27-28	XX	= 2 numeric characters, giving the number of columns in the output table (exclusive of a column for row totals which is provided automatically). The number must be less than 50, and must be right-justified in the field.
29-32	bbbb	
33	X	= 1 numeric character, giving the total number of entries to be made in the table from each sampling unit processed. The number cannot exceed four.

OUTPUT TABLE ENTRY DEFINITION CARD — ITEM 322

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	AAAAAA	= 6 alphameric characters, giving the name of the output table in which the entry will be made. The name must be left-justified in the field, and must appear exactly as given in columns 14-19 of the output table definition card (item 321).
7-11	bbbbbb	
12-17	LISTbb	= Define the row index of the table entry as

		the position number, in a list of all possible values, of the value in the data field identified in columns 19-21 of this card.
	RANGEb	≡ Define the row index of the table entry as the position number, in a list of all appropriate ranges, of the range that contains the value of the data field identified in columns 19-21 of this card.
	LOOKUP	≡ Define the row index of the table entry as the value in a list that is paired with the value in the data field identified in columns 19-21 of this card.
	EQUATE	≡ Define the row index of the table entry as the value in the data field identified in columns 19-21 of this card.
	CONSTb	≡ Define the row index of the table entry as the constant contained in columns 19-21 of this card.
18	b	
19-21	XXX	≡ 3 numeric characters, giving the value required in the operation named in columns 12-17 of this card. The value must be right-justified in the field. If the named operation is LIST, RANGE, LOOKUP, or EQUATE; the value will be the identification number of the required data field. If named operation is CONST, the value will be the value of the required constant.
22	b	
23-28	AAAAAA	≡ 6 alphameric characters, giving the name of the input table containing the list required in the operation named in columns 12-17 of this card. The name must be left-justified in the field, and must appear exactly as given in columns 1-6 of an input table name card (item 311).
29	b	
30-35	LISTbb	≡ Define the column index of the table entry as the position number, in a list of all possible values, of the value in the data field identified in columns 37-39 of this card.
	RANGEb	≡ Define the column index of the table entry as the position number, in a list of all appropriate ranges, of the range which contains the value in the data field identified in columns 37-39 of this card.
	LOOKUP	≡ Define the column index of the table entry as the value in a list that is paired with the value in the data field identified in columns 37-39 of this card.

	EQUATE	=	Define the column index of the table entry as the value in the data field identified in columns 37-39 of this card.
	CONSTb	=	Define the column index of the table entry as the constant contained in columns 37-39 of this card.
36	b		
37-39	XXX	=	3 numeric characters, giving the value required in the operation named in columns 30-35 of this card. The value must be right-justified in the field. If the named operation is LIST, RANGE, LOOKUP, or EQUATE; the value will be the identification number of the required data field. If the named operation is CONST, the value will be the required constant.
40	b		
41-46	AAAAAA	=	6 alphameric characters, giving the name of the input table which contains the list required in the operation named in columns 30-35 of this card. The name must be left-justified in the field, and must appear exactly as given in columns 1-6 of an input table name card (item 311).
47	b		
48-50	XXX	=	3 numeric characters, giving the identification number of the data field to be entered in the output table. The number must be right-justified in the field.

OUTPUT TABLE ENTRY EXCEPTION CARD
(OPTIONAL) — ITEM 323

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-2	IF	= Card label.
3	b	
4-6	XXX	= 3 numeric characters, giving the identification number of the data field required in the exception operation. The number must be right-justified in the field.
7	b	
8-11	E.bb	= This entry is not made if the value in the data field identified in columns 4-6 is equal to the value of the constant in columns 13-17 of this card.
	L.E.	= This entry is not made if the value in the data field identified in columns 4-6 is less than or equal to the value of the constant in columns 13-17 of this card.

	G.E.	=	This entry is not made if the value in the data field identified in columns 4-6 is greater than or equal to the value of the constant in columns 13-17 of this card.
	N.E.	=	This entry is not made if the value in the data field identified in columns 4-6 is not equal to the value of the constant in columns 13-17 of this card.
12	b		
13-17	XXXXX	=	5 numeric characters, giving the value of the constant required in the exception operation.
18	b		
19-35	NObENTRYbINb-TABLE	=	Card label.
36	b		
37-42	AAAAAA	=	6 alphameric characters, giving the name of the output table to which the entry and the exception apply. The name must be left-justified in the field, and must appear exactly as given in columns 14-19 of the output table definition card (item 321).

END OF OUTPUT TABLE ENTRY CARD — ITEM 324

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-3	END	= A control word signifying the end of a set of output table entry and exception cards. This card must follow every set of these cards and must be present even if there are no exception cards.

FINISH OUTPUT TABLES CARD — ITEM 325

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	FINISH	= A control word signifying the end of all output table definition cards. It must always follow the last end-of-output table entry card in control deck.

4. Input Record Description Cards (Sec. 330)

This group of cards contains a description of the physical configuration of the input data and of the kind of information contained in the data fields of each record. The individual cards are described below in the order that they must appear in the job control deck (fig. 4).

The first four types of control cards are used to describe the physical form of the input data. The input record control card (item 331) must always be present. It contains the number of data fields in each record, the mode in which the records are written, and the total number of records to be processed. The input record format card (item 332) is optional; it is used only if the input records are written in the binary coded decimal (BCD) mode. It contains a FORTRAN format specification which describes each input data field. The format continuation card (item 333) is also optional, being used only if the entire format specification cannot be punched in item 332.

Although the input data fields can be described by any appropriate format specification, special note should be made of the fact that values of data fields to be entered into output tables must be expressed at floating-point numbers, and values of data fields to be used in setting row and column indexes must be expressed as fixed-point numbers before the output tables can be made. If possible, therefore, data-field values should be expressed properly in the input file (whether written in binary or BCD). Otherwise, they will have to be converted to the proper expression in the CALCUL subroutine (part VII-B).

The input record identification fields card (item 334) must always be present. It is used to record the data fields that uniquely identify the data set, the sampling unit, and the subunit, if any, to which each record in the input data belongs. (See part V-C). A change in the value of any one of the data-set identification fields signals the end of a data set and causes the execution of the final computations and output of the summary tables for the data set. The data set identification will also appear in the output file preceding the output tables for the data set. A change in the value of any one of the sampling-unit identification fields signals the end of the sampling unit input records and causes the sampling-unit facsimile output tables to be summed into the data set output tables.

The remaining three types of control cards are used to classify the data fields of input records according to the way that the information they contain was observed (see part V-C). The input

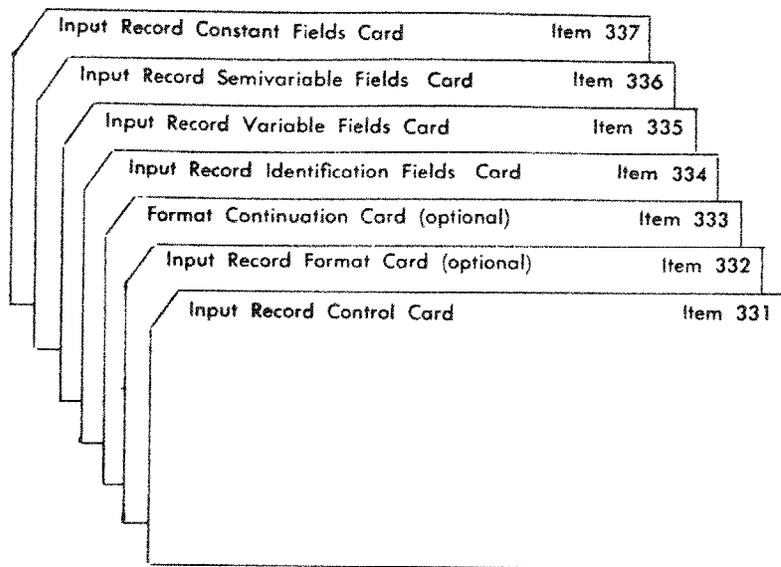


Figure 4. — Order of the input record description cards in the job control deck. The optional items are not needed when the data input tape file is written in the binary mode.

record variable fields card (item 335) is used to record the identification numbers of data fields that contain attributes observed on subdivision of subunits. The input record semivariable fields card (item 336) is used to record the identification numbers of data fields that contain attributes observed on subunits of sampling units. The input record constant fields card (item 337) is used to record the identification numbers of data fields that contain attributes observed on a sampling unit as a whole.

Every data field (input or otherwise) that is recorded in any other control card of the control deck or is used in the `CALCUL` subroutine must be identified on one of the above three field cards. Other data fields in the input record may also be identified in these cards, but this is optional. If a field is not identified in one of these cards, it will be automatically deleted from every input record.

INPUT RECORD CONTROL CARD -- ITEM 331

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-12	INPUTbRECORD	= Card label.
13	b	
14-16	XXX	= 3 numeric characters, giving the total number of data fields in each input record. The number must be right-justified in the field. The maximum number is 132.
17	b	
18	1	= The input records are in binary mode.
	2	= The input records are in binary coded decimal (BCD) mode.
19	b	
20-25	XXXXXX	= 6 numeric characters, giving the total number of input records to be processed. This is the sum of the numbers of input records in each data set to be processed. The number must be right-justified in the field.

INPUT RECORD FORMAT CARD (OPTIONAL)

ITEM 332

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1	0	= There is no format continuation card.
	1	= The format specification is continued on the next card (item 333).
2	b	
3	(= Left parenthesis.
4-80	AAA . . . A	= Up to 77 alphanumeric characters, ending with a right parenthesis, and containing a FORTRAN format specification that describes the format of the input records if they are in the BCD mode. Data fields to be used in indexing operations must have an I (fixed-point) specification; those to be used as table entries must have E or F (floating-point) specifications.

FORMAT CONTINUATION CARD (OPTIONAL)

ITEM 333

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-72	AAA . . . A	= A continuation of the FORTRAN format specification described for the previous card (item 332).

INPUT RECORD IDENTIFICATION FIELDS CARD

ITEM 334

<i>Columns</i>	<i>Contain ---</i>	<i>Explanation</i>
1-11	DATAbSETbID	= Card label.
12	b	
13-15	XXX	= 3 numeric characters, giving the identification number of a data field in an input record in which the data set (sample stratum) is identified. The number must be right-justified in the field. Up to 5 data set identification fields may be identified in the following columns, and the identification numbers may be listed in any order.
16-27	XXX . . . X	= Repetitions of columns 13-15 format, giving the identification numbers of the remaining data fields by which the data set is identified.
28	b	
29-41	SAMPLINGb UNIT	= Card label.
42	b	
43-45	XXX	= 3 numeric characters, giving the identification number of a data field in an input record in which the sampling unit is identified. The number must be right-justified in the field. Up to five sampling-unit identification fields may be identified in the following columns, and the identification numbers may be listed in any order.
46-57	XXX . . . X	= Repetitions of columns 43-45 format, giving the identification numbers of the remaining data fields by which the sampling unit is identified.
58	b	
59-66	SUBbUNIT	= Card label.
67	b	
68-70	XXX	= 3 numeric characters, giving the identification number of the data field in an input record in which a subunit, if any, of a sampling unit is identified. The number must be right-justified in the field.

INPUT RECORD VARIABLE FIELDS CARD --- ITEM 335

<i>Columns</i>	<i>Contain ---</i>	<i>Explanation</i>
1-8	VARIABLE	= Card label.

9-11	XXX	= 3 numeric characters, giving the identification number of a data field in an input record in which the values vary from one record to another within the set of records for a sampling unit. The following columns may be used to identify up to 24 variable data fields for use in processing, and the identification numbers may be listed in any order.
12-80	XXX . . . X	= Repetitions of columns 9-11 format, giving the identification numbers of the remaining data fields that contain variable values.

INPUT RECORD SEMIVARIABLE FIELDS CARD

ITEM 336

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-8	SEMIVAR	= Card label.
9-11	XXX	= 3 numeric characters, giving the identification number of a data field in an input record in which the values vary only from one set of subunit records to another; and are constant within the sets of subunit records. The number must be right-justified in the field. The following columns may be used to identify up to 24 semivariable data fields for use in processing. The identification numbers may be listed in any order.
12-80	XXX . . . X	= Repetitions of the columns 9-11 format, giving the identification numbers of the remaining data fields that contain semivariable values.

INPUT RECORD CONSTANT FIELDS CARD — ITEM 337

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-8	CONSTANT	= Card label.
9-11	XXX	= 3 numeric characters, giving the identification number of a data field in an input record in which the values are constant within the set of records for a sampling unit. The number must be right-justified in the field. The following columns may be used to identify up to 24 constant data fields for use in processing. The identification numbers may be listed in any order.
12-80	XXX . . . X	= Repetitions of the columns 9-11 format, giving the identification numbers of the remaining data fields that contain constant values.

5. End of Control Deck Card — Item 340

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-19	ENDbOFb- CONTROLb- DECK	= A control word signifying the last card in the control deck.

VI-C. OPERATING INSTRUCTIONS

This chapter gives information necessary to set up and process sample summarization jobs with program TABLE. It is, in part, a resume of information given elsewhere.

1. Program Restrictions

The standard version of the program carries restrictions on the overall size and on certain dimensions of a problem that can be handled in a single-processing run. They are:

1. The number of data fields in each input record must be no greater than 132.
2. The number of variable data fields must be no greater than 24.
3. The number of semivariable data fields must be no greater than 24.
4. The number of constant data fields must be no greater than 24.
5. The number of data fields used for data set identification must be no greater than five.
6. The number of data fields used for sampling unit identification must be no greater than five.
7. The subunit identification, if any, must be contained in a single-data field.
8. The total number of cells in all input and output tables must be no greater than 10,000.
9. The number of input tables must be no greater than 80.
10. The number of output tables must be no greater than 40.
11. The number of rows in each output table must be no greater than 50.

12. The number of columns in each output table must be no greater than 50.
13. The number of output table entries in each output table must be no greater than four.
14. The total number of output table entry exceptions for all output tables must be no greater than 150.

These restrictions result primarily from the way in which the available storage capacity of the computer has been allocated to various uses in the standard version of the program. However, the program has been constructed so that the more important of these allocations can readily be changed if a problem of substantially different relative dimensions is encountered. The modification of dimensioned space is described in part VII of this series.

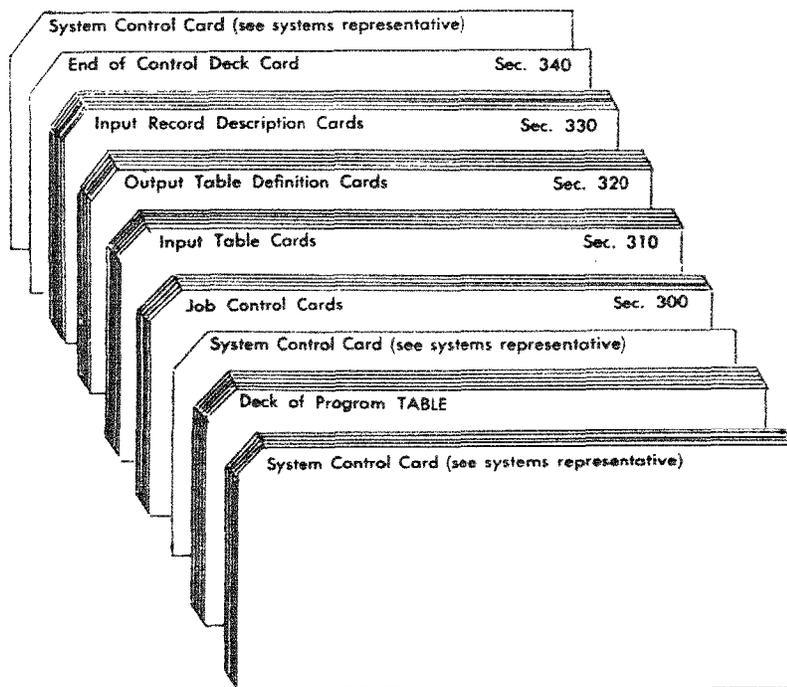


Figure 5.—The job control deck setup, illustrating the kinds of cards that are necessary and the order in which they must be arranged.

2. Job Control Deck Setup

The job control deck consists of all the punched cards through which processing specifications, necessary constants, and other data (exclusive of the data to be processed) are entered into the computer. These cards, and the logical groups into which they fall, have been described in the previous chapter. The assembly of the groups of control cards to form the job control deck, as well as the placement of that deck in the monitor input deck, are shown in figure 5.

It should be noted that the monitor input deck consists of the program deck, followed by the control deck, with system control cards interspersed. The latter cannot be described in detail here because they will vary from one computer system to another. For more information about them, see the systems representative at the computer center where the processing will be done.

3. Input Data Setup

Data input must be in the form of a single magnetic tape file of records. Multiple record files for a job must either be gotten into a single file or be processed in multiple passes of the program. The file may be written either in binary or BCD mode.

Each record must have the same format and contain no more than 132 data fields. Values in data fields to be entered in output tables should be expressed as floating-point numbers, while those in data fields to be used in setting row and column table indexes should be expressed as fixed-point numbers.

The records must be sorted by sampling unit, and the sets of records for each sampling unit must be sorted by the data set (sample) to which they belong. Additional sorting is permitted but not required. It will depend on how the output is to be used (see program OUTPUT).

Normally, the input tape file will have been produced in the correct form by the processing of the original data through programs EDIT and SORT. (For information about the first see part II of this series, and for the second see your computer systems representative.) However, if the input tape file is not produced

in the correct form, use appropriate IBM 1401 programs or see your systems representative.

4. Tape Assignments

In the standard version of program TABLE the FORTRAN logical tape assignments are as follows:

<i>Unit</i>	<i>Use</i>
5	Monitor input for program deck and job control deck.
6	Monitor print for job summary and debug output.
15	Sorted input tape file in binary or BCD.
19	Output of sample summary tables in binary only.

These tape assignments can be changed to fit local conditions by loading appropriate file routines with the program. See your systems representative or the section entitled FORTRAN files in the IBM IBJOB processor manual, file number 7090-27.

5. Use of Sense Switches and Sense Lights

No sense switches are used in program TABLE. All sense switches will be set at normal monitor settings.

No sense lights are used.

6. Use of Program Halts

There are no halts in program TABLE.

7. Use of the Overlay Feature

The standard version of program TABLE is constructed so that the overlay feature can be used when sufficient storage is not available for program and data. The configuration is as follows:

<i>Link</i>	<i>Contains Subprograms</i>
0	MAINT
1	CONTRL
2	TABLE, CALCUL, STONO, GETNO, VARIAN

8. Messages Printed During Execution

The messages listed below are those produced by the program during execution. Each message, with its consequences, is described; and the appropriate action, if any, is indicated.

FIRST INPUT CARD IS INCORRECT

Message 1. This message means either that the output option card (item 302) is missing from the control deck or that the card label in columns 1-6 is punched incorrectly. Correct the error and start processing from the beginning.

TABLE AAAAAA CONSISTING OF XXXXX CARDS HAS BEEN READ CORRECTLY

Message 2. This message prints each time an input table has been read successfully. AAAAAA is the table name punched in columns 1-6 of the input table name card (item 312). XXXXX is the number of entries read for the named table, taken from columns 16-20 of the input table name card (item 312).

INPUT TABLE AAAAAA EXCEEDED MACHINE CAPACITY

Message 3. This message is printed if the total number of entries in all input tables (sec. 310) exceeds the computer storage available (see appendix B). AAAAAA is the name of the input table being read when available storage was exceeded, as punched in columns 1-6 of an input table name card (item 312). The number or size of input tables must be reduced, or the available storage must be increased before processing can be started again from the beginning.

TABLE DEFINITION CARDS ARE OUT OF ORDER. TABLE AAAAAA

Message 4. This message is printed if columns 1-6 of the output table definition card (item 321) are misspunched, or if the cards which define the output tables are not in the proper sequence (see sec. 320). AAAAAA is the first six columns of the offending card. Correct the error and start again from the beginning.

MORE THAN 4 ENTRIES IN TABLE AAAAAA

Message 5. This message is printed if column 33 of an output table definition card (item 321) is punched with a zero or a number greater than four. AAAAAA is the name of the table, punched in columns 14-19 of the same card. Correct the error and start processing from the beginning.

TABLE AAAAAA HAS EXCEEDED AVAILABLE STORAGE

Message 6. This message is printed if the total number of entries in all input tables (see sec. 310), plus the space required for all output tables (see sec. 320), has exceeded the total storage available (see part VII C). AAAAAA is the name of the output table being defined when available storage was exceeded. It corresponds to columns 14-19 of an output table definition card (item 321). The number or size of input and output tables must be reduced, or available storage must be increased before processing can be started again from the beginning.

**AN OPERATION HAS BEEN MISSPELLED
IT STARTS — AAAAAA**

Message 7. This message is printed if columns 12-17 or 30-35 of an output table entry definition card (item 322) are not punched with a valid operation name. AAAAAA is the operation name punched in the offending card. Correct the error and start processing from the beginning.

**THE NAME AAAAAA IS NOT THE NAME
OF AN INPUT TABLE**

Message 8. This message is printed if the name punched in columns 23-28 or 41-46 of an output table entry definition card (item 322) does not correspond to the name of an input table as punched in columns 1-6 of an input table name card (item 312). AAAAAA is the input table name punched in the offending card. Correct the error and start processing from the beginning.

**THE TABLE NAME AAAAAA GIVEN ON AN
EXCEPTION CARD, DOES NOT AGREE
WITH TABLE DEFINITION CARD**

Message 9. This message is printed if the name punched in columns 37-42 of the output table entry exception card (item 323) does not agree with the name punched in columns 14-19 of the output table definition card (item 321). AAAAAA is the name punched in columns 37-42 of the output table exception card. Correct the error and start processing from the beginning.

THE EXCEPTION DEFINED BY AAAAAA IS INCORRECT

Message 10. This message is printed if the relational operator punched in columns 8-11 of the output table exception card (item 323) is not one of those listed. Correct the error and start processing from the beginning.

INPUT CONTROL CARD IS NOT CORRECT

Message 11. This message is printed if columns 1-6 of the input record control card (item 331) are punched incorrectly or if a card is out of order. Correct the error and start processing from the beginning.

FIELD IDENTIFICATION CONTROL CARD IS INCORRECT

Message 12. This message is printed if columns 1-6 of the input record identification fields card (item 334) are punched incorrectly or a card is out of order. Correct the error and start processing from the beginning.

**CARD ENUMERATING VARIABLE FIELDS
IS INCORRECT. AAAAAA**

Message 13. This message is printed if columns 1-6 of the input record variable field card (item 335) are punched incorrectly. AAAAAA are the

characters punched in the first six columns of the card. Correct the error and start processing from the beginning.

CARD ENUMERATING SEMIVARIABLE FIELDS
IS INCORRECT. AAAAAA

Message 14. This message is printed if columns 1-6 of the input record semivariable field card (item 336) are punched incorrectly. AAAAAA are the characters punched in the first six columns of the card. Correct the error and start processing from the beginning.

CARD ENUMERATING CONSTANT FIELDS
IS INCORRECT. AAAAAA

Message 15. This message is printed if columns 1-6 of the input record constant field card (item 337) are punched incorrectly. AAAAAA are the characters punched in the first six columns of the card. Correct the error and start processing from the beginning.

SOME FIELD HAS BEEN DEFINED AT
TWO OR MORE LEVELS

Message 16. This message is printed if the same field appears on two or more of the cards described in items 335 to 337. Correct the error and start processing from the beginning.

THE FIELD USED FOR AN ENTRY IN TABLE
AAAAAA HAS NOT BEEN DEFINED

Message 17. This message is printed if the field to be used for a table entry (columns 48-50 of the output table entry definition card, item 322) has not been defined on one of the input record field cards (items 335 to 337). AAAAAA is the name punched in columns 14-19 of the output table definition card (item 321). Correct the error and start processing from the beginning.

FIELD USED FOR TABLE AAAAAA HAS NOT BEEN
DEFINED OR THE ROW OR COLUMN INDEX IS
ON A LOWER LEVEL THAN THE TABLE ENTRY

Message 18. This message is printed if the field to be used for a row or column index (columns 19-21 or columns 37-39 of the output table entry definition card (item 322) has not been defined on one of the input record field cards (items 335 to 337) or if the row or column field are defined on a lower level than the table entry field; that is, if the entry field is defined as a variable, the row and column fields can be defined at any level; if the entry field is defined as a semivariable, the row and column field cannot be defined at the variable level; if the entry field is defined as a constant, the row and column fields must be defined at the constant level. AAAAAA is the name of the table to which the entry or row or column field applies, that is, the name punched in columns 14-19 of the output table definition card (item 321). Correct the error and start processing from the beginning.

UNDEFINED DATA FIELD XXXXXX

Message 19. This message is printed if the argument NDAFL to subroutine GETNO or STONO has not been defined on one of the input record field identification cards (items 335 to 337). Correct the error and start processing from the beginning.

ALL DEFINITION AND IDENTIFICATION CARDS READ

Message 20. This message prints if all control cards have been read and no errors have been detected.

THE NUMBER OF INPUT RECORDS IS YYYYYY IN
EXCESS OF THE ZZZZZ ALLOWABLE IN
SAMPLING UNIT NO. XXXXX XXXXX XXXXX
XXXXX XXXXX

Message 21. This message prints when the number of input records for a sampling unit is greater than the value ZZZZZ of the variable LTRCD which dimensions the sampling unit storage array TREE. Processing is continued using the first ZZZZZ records read for the sampling unit. If, at the end of the run, the accumulated errors cannot be tolerated, increase the value of LTRCD (see part VII-C) and rerun the job.

THE ROW OR COLUMN INDEX CANNOT BE FOUND
FOR OUTPUT TABLE AAAAAA, ENTRY NO. ZZZZZ,
IN SAMPLING UNIT NO. XXXXX XXXXX XXXXX
XXXXX XXXXX, RECORD NO. YYYYYY.

Message 22. This message is printed when a correspondence cannot be found between a field in the input for the sampling unit and a table used in a LIST, LOOKUP, or RANGE operation. The entry in question is not made in the output table but processing continues. If the error cannot be tolerated, the input data field, the input table, or both must be corrected and the job must be rerun from the beginning.

THE ROW OR COLUMN INDEX IS TOO LARGE FOR
OUTPUT TABLE AAAAAA, ENTRY NO. ZZZZZ.
IN SAMPLING UNIT NO. XXXXX XXXXX XXXXX
XXXXX XXXXX, RECORD NO. YYYYYY

Message 23. This message is printed when the value of a row or column index exceeds the number of rows or columns punched in columns 24-25 or columns 27-28 of the output table definition card (item 321) for output table AAAAAA. The entry in question is not made in the output table but processing continues. If the error cannot be tolerated, it must be corrected and the job must be rerun from the beginning.

THE ROW OR COLUMN INDEX IS ZERO FOR OUTPUT
TABLE AAAAAA, ENTRY NO. ZZZZZ, IN SAMPLING
UNIT NO. XXXXX XXXXX XXXXX XXXXX X,
RECORD NO. YYYYY

Message 24. This message is printed when a row or column index is set equal to zero. The entry in question is not made in the output table but processing continues. If the error cannot be tolerated, it must be corrected and the job must be rerun from the beginning.

YYYYY SAMPLE UNITS READ IN DATA SET XXXXX
XXXXX XXXXX XXXXX XXXXX

Message 25. This message is printed at the end of each data set processed. The data set identification is taken from the data fields identified in columns 13-27 of the input record identification fields card (item 334). YYYYY is the number of sampling units in the data set that were actually processed.

XXXX DATA SETS HAVE BEEN PROCESSED

Message 26. This message is printed at the termination of the run. XXXX is the number of data sets actually processed.

THE NAMES OF THE TABLES AAAAAA	NUMBER OF ROWS XX	NUMBER OF COLUMNS YY
!	!	!
!	!	!
!	!	!

Message 27. These are summaries which are printed at the end of processing and list all output tables produced. They are listed by the name (AAAAAA) given in columns 14-19 of the output table definition card (item 321), and the number of rows (XX) and number of columns (YY) (including totals) for each table is given.

