

**THE NORTHEASTERN
FOREST-INVENTORY
DATA-PROCESSING SYSTEM.
III. OPERATION OF
SUBSYSTEM EDIT.**



by
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PREFACE

THIS paper is the third 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.

III-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, subsystem EDIT. Detailed instructions for solving editing problems with the standard version of program EDIT are given in the following chapters.

A general description of the program outputs, inputs, logic and procedures, which should be read before attempting to use the program, is presented in part II of this series. It is particularly important to understand how the user sets up his own processing

logic by the order and content of the operation cards (sec. 120) in the job control deck.

The program was written in the standard IBM FORTRAN IV language, for use with Yale University's IBM 7094/7040 Direct Coupled Computer System under the IBSYS DCS operating system with IJOB processor.¹ It will operate with little or no modification on other comparable systems. Part IV in 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 publications and information about the FORTRAN IV program decks can be obtained from the Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pennsylvania 19082.

III-B. CONTROL CARD FORMATS

The description and specification of an editing 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 contain, and where appropriate, the purpose and use of the information required. 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 can be complete.

1. Job Control Cards (Sec. 100)

The first two cards in the control deck are the title card (item 101) and the pass identification card (item 102). They contain a descriptive job title and identification of the run within the job. The update option (columns 9-15 in item 102) may be ignored unless output tables are being formed by add operations. Both cards must always be present in the control deck (fig. 1).

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

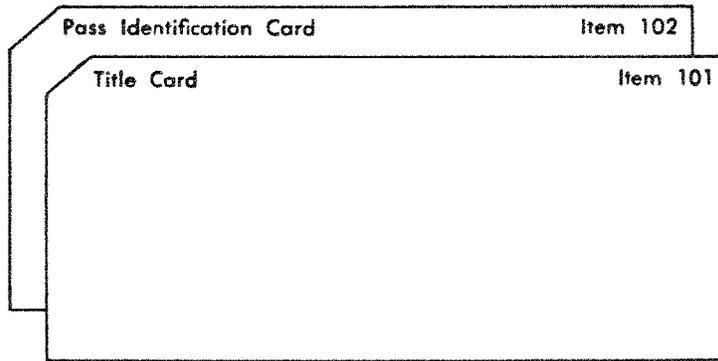


Figure 1. — Order of the job control cards in the job control deck.

TITLE CARD — ITEM 101

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

PASS IDENTIFICATION CARD — ITEM 102

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-4	PASS	= card label.
5	b	
6-7	XX	= 2 numeric characters, giving the pass identification number. The number must be right-justified in the field. It will be punched in the header cards of the punched output.
8	b	
9-15	bbbbbb	= No update tables (see sec. 140) of initial values for tables produced in add operations (see item 131) are in the control deck. The initial values of the output tables are set at zero.

UPDATE		= Update tables of initial values are in the control deck. The initial values of the output tables are read from the UPDATE tables.
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2. Input Table Cards (Sec. 110)

This section describes each type of card required in the job control deck to provide the input tables used in editing operations (see part II-D and part III-B, sec. 120).

The no input tables card (item 111) is to be used if the job does not require input tables. In this case, no other cards from this section need be used (fig. 2A).

Up to 40 input tables may be put in the job control deck and the tables may be in any order (fig. 2B). 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 115).

Three types of card are required for each input table, and the cards for each input table must appear as a set in the control deck.

The first card of each set is the input table name card (item 112) which gives a unique name to the table and specifies the number of entries in the table.

The second card of the set is the input table format card (item 113) which describes the format of each entry in the table.

The remaining cards of each set are repetitions of the input table entry card (item 114) in which a single table entry is punched. There must be as many of these cards as there are table entries, and they must be arranged so that the entry values are in ascending order within each table.

The card following the last input table entry card of a given table must either be the input table name card for the next table, or an input table finish card.

NO INPUT TABLES CARD — ITEM 111

<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 112

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	AAAAAA	= 6 alphameric characters, giving a unique name by which the table that follows 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	XXXXXX	= 5 numeric characters, giving the number of entries in the table just named. The number must be right-justified in the field.

INPUT TABLE FORMAT CARD — ITEM 113

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1	b	
2	X	= 1 numeric character, giving the total number of fields contained in an entry of the table. The maximum allowable number is 9.
3	b	
4	X	= 1 numeric character, giving the number of columns occupied by the first (leftmost) field of an entry in the table.
5-20	bXb . . . X	= Repetitions of columns 3-4 format, giving the number of columns occupied by the remaining fields of an entry in the table, if any.
21	(= left parenthesis.
22-80	AAA . . . A	= Up to 59 alphameric characters ending with a right parenthesis, and containing a FORTRAN format specification (blanks not permitted) which describes the format of the entries in the table. All fields must be specified as decimal integers (I).

INPUT TABLE ENTRY CARD — ITEM 114

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-80	XXX . . . X	= A maximum of 9 numeric characters, giving a single table entry, according to the format given in the appropriate input table format card (item 113, columns 21-80). If the entries of a table contain 9 fields, the values for the first (leftmost) field cannot exceed 7.

INPUT TABLE FINISH CARD — ITEM 115

<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 tables and the no input tables card (item 111) has been used.

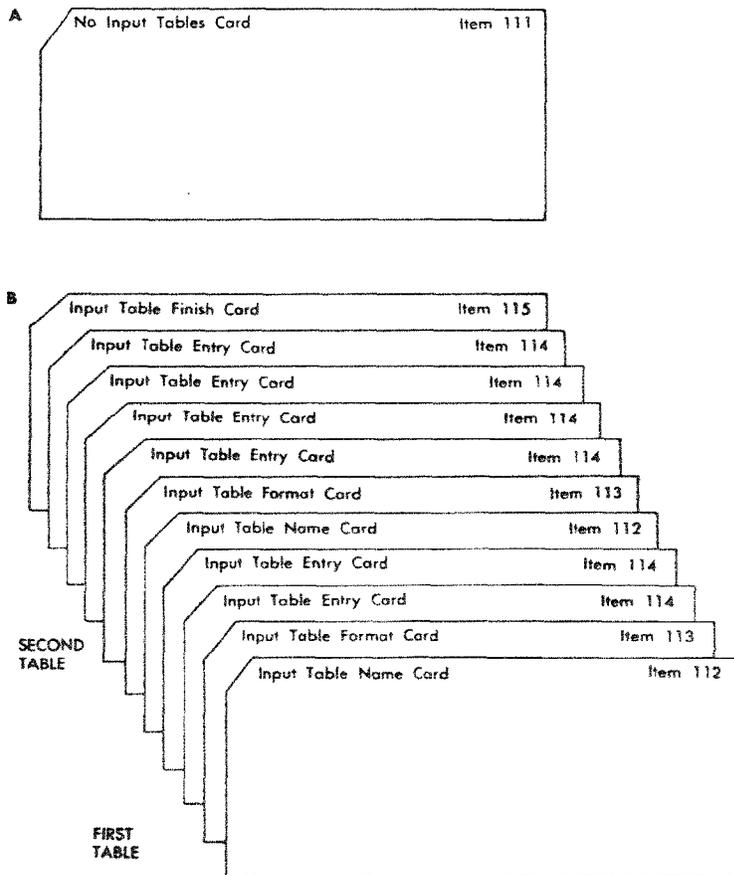


Figure 2. — Order of the input table cards in the job control deck: **A**, when the job requires no input tables; **B**, when the job requires two input tables, with two or four entries, respectively.

3. Operation Cards (Sec. 120)

The control cards described in this section are used to call or activate the editing operations (see part II-D). Consequently, there must be at least one card from this group in the job control deck to make the program operative. There may be up to 100 of these cards in the deck (fig. 3).

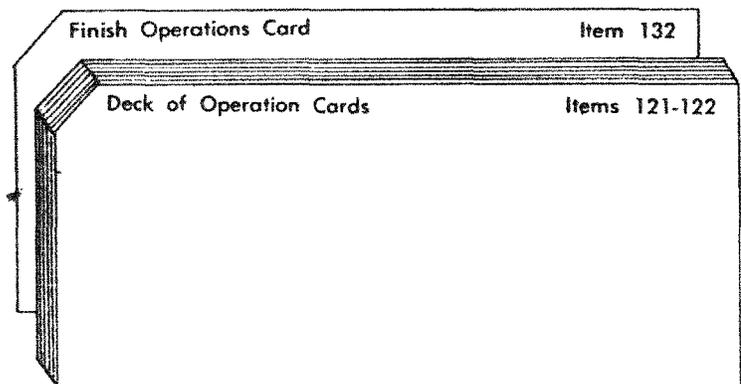
There is one type of card for each of the 11 editing operations but they have more or less common formats. In general, the cards contain the name of a particular operation, the identification numbers of the data fields to be used in the operation, and the names of input tables or values of constants to be used.

Each type of card may appear in the control deck as often as required by the editing problem (subject to the maximum number restriction). The nature of the problem also dictates the order in which the cards are placed in the deck because the operations are executed in sequence from first card to last for each input record.

The group of operation cards must always be followed in the control deck by the finish operations card (item 132) which simply signals the end of this group of cards.

It should also be noted that the values in all data fields used in the FIX, ARITHE, and ADD operations must be expressed as floating-point numbers at the time of their use. For all other operations the data field values must be expressed as fixed-point numbers. The FLOAT and FIX operations are to be used in making any conversions that are necessary.

Figure 3.—Order of operation cards in the job control deck. The deck of operation cards may contain up to 100 cards. The order of the items in the deck and number of times each one appears are dictated solely by the requirements of the job.



FLOAT OPERATION CARD — ITEM 121

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-5	FLOAT	= The name of the operation that will float a fixed point number according to the scale provided on the operation card.
6-7	bb	
8-11	XXX ^Y	= Where XXX is the data field to be floated and Y is the desired number of places to the right of the decimal.
12	,	
13-51		Repetitions of the columns 8-12 format for each data field to be floated. No comma is necessary after the last data field and its scale.

FIX OPERATION CARD — ITEM 122

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-3	FIX	= The name of the operation which will fix a floating-point number according to the scale provided on the operation card.
4-7	bbbb	
8-11	XXX ^Y	= Where XXX is the data field to be fixed and Y is the number of positions to the right of the decimal to be preserved from the original floating-point number.
12	,	
13-51		Repetitions of the columns 8-12 format for each data field to be fixed. No comma is necessary after the last data field and its scale.

LIST CHECK OPERATION CARD — ITEM 123

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	LISTbC	= The name of the operation that checks the value in a data field against a list of values in a table.
7	L	= Legal values are contained in the table named in columns 68-73.
	I	= Illegal values are contained in the table named in columns 68-73.
8-10	XXX	= 3 numeric characters, giving the identification number of the data field to be checked. The number must be right-justified in the field.
11-67	bbb . . . b	= 57 blanks.
68-73	AAAAAA	= 6 alphameric characters, giving the name of the input table to be used in the operation.

The name must be left-justified in the field, and must be exactly as given on the appropriate input table name card (item 112).

CROSS CHECK OPERATION CARD — ITEM 124

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	CROSSC	= The name of the operation that checks the consistency of the values among several data fields of an input record.
7	L	= Legal values are contained in the input table named in columns 68-73 of this card.
	I	= Illegal values are contained in the input table named in columns 68-73 of this card.
8-10	XXX	= 3 numeric characters, giving the identification number of the first data field to be used in this operation. The number must be right-justified in the field. Up to 9 data fields may be identified in the following columns of this card for use in this operation. The numbers must be listed in the order in which the values of the data fields appear in the input table named in columns 68-73 of this card.
11-12	bb	
13-52	XXX . . . X	= Repetitions of the columns 8-12 format, giving the identification numbers of the remaining data fields to be used in this operation.
53-67	bbb . . . b	= 15 blanks.
68-73	AAAAAA	= 6 alphameric characters, giving the name of the input table to be used in this operation. The name must be left-justified in the field, and must appear exactly as given in columns 1-6 of the appropriate input table name card (item 112).

CROSS RANGE CHECK OPERATION CARD — ITEM 125

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	CROSSR	= The name of the operation that checks the value in a data field against a range of values determined by the value in one other data field.
7	b	
8-10	XXX	= 3 numeric characters, giving the identification number of the data field that determines the range of values to be used in the operation. The number must be right-justified in the field.

11-12	bb	
13-15	XXX	= A repetition of the columns 8-10 format, giving the identification number of the data field to be checked in the operation.
16-67	bbb . . . b	= 52 blanks.
68-73	AAAAAA	= 6 alphameric characters, giving the name of the input table to be used in the operation. The name must be left-justified in the field, and must be exactly as given on the appropriate input table name card (item 112).

SEQUENCE CHECK OPERATION CARD — ITEM 126

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	SEQUEN	= The name of the operation that checks the sequence of values in a data field from one record to the next.
7	b	
8-10	XXX	= 3 numeric characters, giving the identification number of the data field to be checked. The number must be right-justified in the field.
11-53	bbb . . . b	= 43 blanks.
54-59	XXXXXX	= 6 numeric characters, giving the initial value in the data field to be checked. The number must be right-justified in the field.
60	b	
61-66	XXXXXX	= 6 numeric characters, giving the increment or decrement between values in the data field. The number must be right-justified in the field. The number must be preceded by an arithmetic sign in the field: a (+) for increment, and a (—) for decrement.

LOGIC OPERATION CARD — ITEM 127

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-5	LOGIC	= The name of the operation that determines the truth value of a logical expression and uses it to select an appropriate course of action.
6-7	bb	
8-10	AAA	= 3 alphameric characters, giving the identification number of the data field or the name of the constant (see columns 54-59 and 61-66 below) that is the subject of the simple logical statement being constructed. The identification number must be right-justified in the field.

11-12	EQ	= A relational operator meaning "is equal to"; or
	GE	= The operator meaning "is greater than or equal to"; or
	LE	= The operator meaning "is less than or equal to"; or
	LT	= The operator meaning "is less than"; or
	GT	= The operator meaning "is greater than"; or
	NE	= The operator meaning "is not equal to"; and acting as the verb in the simple logical statement being constructed.
13-15	AAA	= 3 alphameric characters, giving the identification number of the data field or the name of the constant (see columns 54-59 and 61-66 below) that is the predicate of the simple logical statement being constructed. The identification number must be right-justified in the field.
16-17	AN	= A logical connective meaning "and"; or
	OR	= The connective meaning "or"; or
	TH	= The connective meaning "if then"; by which the preceding statement and the simple statement following are compounded; or
	bb	= No logical statement follows.
18-25	AAA . . . A	= Repetition of columns 8-15 formats, giving the second simple statement in the compound statement being constructed. Leave blank if there is no second statement.
26-27	AA	= Repetition of columns 16-17 format, giving the second logical connective, if any.
28-35	AAA . . . A	= A repetition of columns 8-15 formats, giving the third simple statement, if any.
36-37	AA	= A repetition of columns 16-17 format, giving the third logical connective, if any.
38-45	AAA . . . A	= A repetition of columns 8-15 formats, giving the fourth simple statement, if any.
46	b	
47	T	= A character meaning "true"; or
	F	= The character meaning "false" is the truth value of the logical statement in columns 8-45 that will alter the processing of the current input record according to the contents of columns 48-50 (see below). On an occurrence of the truth value not specified here, processing proceeds to the next operation in sequence.

48-50	bbb	= 3 blank characters meaning an error is to be recorded for the current input record; or
	XXX	= 3 numeric characters, giving the number of following operations to skip. These courses of action are taken only under the condition specified in column 47.
51-53	bbb	= 3 blanks.
54-59	XXXXXX	= 6 numeric characters, giving the value of the constant named CO1 to be used in this operation. The number must be right-justified in the field.
60	b	
61-66	XXXXXX	= 6 numeric characters, giving the value of the constant named CO2 to be used in this operation. The number must be right-justified in the field.

ARITHMETIC OPERATION CARD — ITEM 128

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	ARITHE	= The name of the operation that evaluates an arithmetic expression and stores the result in a data field.
7	b	
8-10	XXX	= 3 numeric characters, giving the identification number of the data field in which the value of the arithmetic expression is to be stored. The number must be right-justified in the field.
11-12	=b	= An equal sign and a blank character that mark the beginning of the arithmetic expression to be evaluated.
13-15	AAA	= 3 alphameric characters, giving the identification number of the data field or the name of the constant (see columns 54-59 and 61-66 below) to be used as the first value in the expression. The identification number must be right-justified in the field.
16-17	+b	= An addition sign and a blank character, or
	-b	= A subtraction sign and a blank character, or
	*b	= An asterisk representing multiplication and a blank character, or
	/b	= A slash representing division and a blank character, or
	**	= 2 asterisks representing exponentiation. This pair of characters gives the arithmetic operation to be performed with the value of the entire expression to the left of the sign and the value of the single data field or constant immediately to the right of the sign.

18-20	AAA	= 3 alphameric characters, giving the identification number of the data field or the name of the constant (see columns 54-59 and 61-66 below) to be used in the preceding arithmetic operation. The identification number must be right-justified in the field.
21-50	AAA . . . A	= Repetitions of columns 16-20 formats, giving the operation symbols and data fields or constants to be used for the remaining terms of the expression. The expression may contain a total of 8 terms.
51-53	bbb	= 3 blanks.
54-59	XXXXXX	= 6 numeric characters, giving the value of the constant named CO1 to be used in this operation. The number must be punched with a decimal point since this entire operation is performed in floating point arithmetic.
60	b	
61-66	XXXXXX	= 6 numeric characters, giving the value of the constant named CO2 to be used in this operation. The number must be punched with a decimal point.

GENERATE OPERATION CARD — ITEM 129

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	GENERA	= The name of the operation that supplies new values for one or more data fields from an input table.
7	b	
8-10	XXX	= 3 numeric characters, giving the identification number of the first data field to be used in this operation. The number must be right-justified in the field. Up to 9 data fields may be identified in the following columns of this card for use in this operation. The numbers of the data fields to be used in searching the input table named in columns 60-65 of this card must be listed first, and in the order that their values appear in that table. The last numbers listed identify the data fields for which values are to be generated.
11-12	bb	
13-52	XXX . . . X	= Repetitions of the columns 8-12 format, giving the identification numbers of the remaining data fields to be used in this operation.

53-58	bbb . . . b	= 6 blanks.
59	X	= 1 numeric character, giving the number of data fields identified in the above list, that are to be used in searching the input table used for identification.
60-67	bbb . . . b	= 8 blanks.
68-73	AAAAAA	= 6 alphameric characters, giving the name of the input table to be used as identification in this operation. The name must be left-justified in the field, and must appear exactly as given in columns 1-6 of the appropriate input table name card (item 112).

CALCULATE OPERATION CARD — ITEM 130

<i>Columns Contain —</i>	<i>Explanation</i>
1-9 CALCUL	= The name of the operation that may be programmed (in FORTRAN IV) by the user to perform any special calculations he requires to obtain new values for data fields.

ADD OPERATION CARD — ITEM 131

<i>Columns Contain —</i>	<i>Explanation</i>
1-3 ADD	= The name of the operation that forms an output table by summing the value in a selected data field into a selected cell of the output table each time an input record is processed.
4-7 bbb . . . b	= 4 blanks.
8-10 XXX	= 3 numeric characters, giving the identification number of the first data field to be used in this operation. The number must be right-justified in the field. Up to 9 data fields may be identified in the following columns of this card for use in this operation. The numbers of the data fields to be used in searching the input table named in columns 68-73 of this card must be listed first, and in the order that their values appear in that table. The last number listed identifies the data field to be summed into the output table (only if 54-59 blank).
11-12 bb	
13-52 XXX . . . X	= Repetitions of the columns 8-12 format, giving the identification numbers of the remaining data fields to be used in this operation.
53 b	

54-59	XXX . . . X	= Constant to be accumulated in table. Punch with decimal. If blank, the data field appearing last in the list in columns 8-52 will be summed in table.
60-67	bbb . . . b	= 6 alphameric characters, giving the name of the input table to be used for identification in this operation. The name must be left-justified in the field, and must appear exactly as given in columns 1-6 of the appropriate input table name card (item 112).
68-73	AAAAAA	
74	b	= 6 alphameric characters, giving the name of the output table to be formed in this operation. The name must be left-justified in the field. This field defines the output table. No other reference is necessary.
75-80	AAAAAA	

FINISH OPERATIONS CARD — ITEM 132

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-6	FINISH	= A control word signifying the end of the set of operation cards in the control deck.

4. Update Table Cards (Sec. 140)

The use of the group of control cards described in this section is optional. The cards contain job identification and summary information and all tables referred to in the add operation cards (item 131) of the job control deck; hence, they are not used unless the add operation is being used in the editing job. Even then, it is not always necessary that this group of cards be in the job control deck.

Ordinarily, these cards will not be used during the first pass of a set of input data through program EDIT. However, they may be used during a first pass if there is any reason that the tables should have non-zero initial values.

Normally, the update table cards will be used only on a subsequent pass of a set of input data for which editing was not completed in the first pass, either because errors were detected in some input records, or because of a premature processing halt.

Since the entire group of cards is automatically punched at the end of every processing run, the punched table output from a previous pass with a set of input data may be used as the group

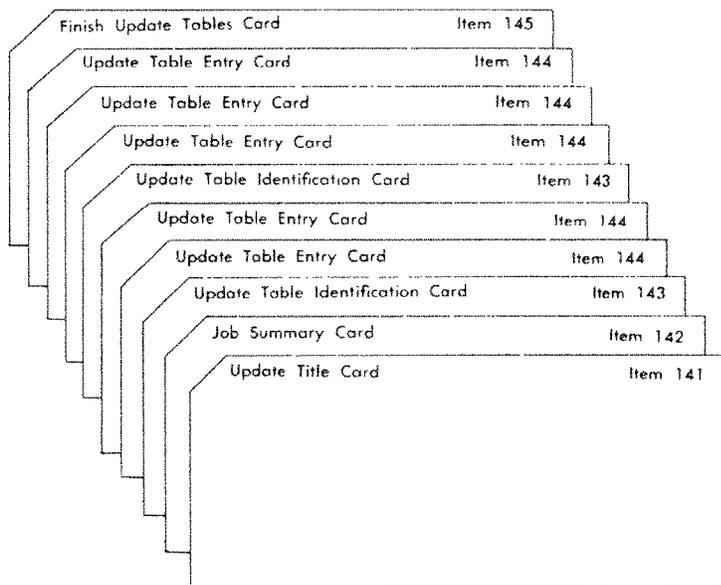


Figure 4. — Order to the update table cards in the job control deck. The entire group of cards is optional; if used, the setup must be comparable to this illustration, which shows 2 update tables with 8 and 12 entries, respectively.

of update table cards to be inserted in the job control deck for a subsequent pass (fig. 4).

UPDATE TITLE CARD — ITEM 141

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-72	AAA . . . A	= 72 alphameric characters, giving a descriptive title for the job. This card will generally be a duplicate of the first title card (item 101) but this is not necessary. It is used only to identify the UPDATE tables which follow it.

JOB SUMMARY CARD — ITEM 142

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-5	PASSb	= Card label.
6-7	XX	= 2 numeric characters, giving the number of the pass to which the summary information applies. It is the same number that was

given in columns 6-7 of the pass identification card (item 102) for that pass.

8-29	bNO.bRECORDSb- PROCESSED	
30-35	XXXXXX	= 6 numeric characters, giving the number of input records processed in the pass. Unless an error procedure caused a premature halt in processing, this number will be the same as that given in column 20-25 of the input record control card (item 151) for that pass.
36-47	bNO.bCORRECT	
48-53	XXXXXX	= 6 numeric characters, giving the number of input records that passed all editing checks.
54-63	bNO.bERROR	
64-69	XXXXXX	= 6 numeric characters, giving the number of input records that failed to pass all editing checks.

UPDATE TABLE IDENTIFICATION CARD — ITEM 143

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-14	THEbFOLLOWINGb	
15-19	XXXXX	= 5 numeric characters, giving the number of table entry cards for the table named below. The number is right-justified in the field.
20-35	bCARDSbAREbPASSb	
36-37	XX	= 2 numeric characters, giving the number of the pass from which the table was obtained as output. The number is right-justified in the field and is the same as the one that appears in columns 6-7 of the job summary card (item 142).
38-44	bTABLEb	
45-50	AAAAAA	= 6 alphanumeric characters, giving the name of the table which follows. The name is left-justified in the field, and must correspond exactly to a table name as given in columns 68-73 or 75-80 of an add operation card (item 131) of this pass.

UPDATE TABLE ENTRY CARD — ITEM 144

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-3	CD.	
4-8	XXXXX	= 5 numeric characters, giving consecutive identification numbers for the card. The number is right-justified in the field, and the number of the first card in any table is 1.

9	b	
10-24	XXX . . . X	= 5 numeric characters, giving the value of an entry in a table. The number is punched in E conversion. Up to 4 sequential table entries may be given in the following columns of this card.
25	b	
26-72	XXX . . . X	= Repetition of the columns 10-24 formats, giving the identification number and values of up to three additional entries in the table.
73-74	bb	
75-80	AAAAAA	= 6 alphameric characters, giving the name of the table to which these entries belong. The name is left-justified in the field, and must appear exactly as given in columns 45-50 of the update table identification card (item 143).

FINISH UPDATE TABLES CARD — ITEM 145

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-21	bbb . . . b	= 21 blanks.
22-27	FINISH	= A control word signifying the end of all update table cards.

5. Input Record Description Cards (Sec. 150)

The control cards in this section describe the physical condition of the input records.

The input record control card (item 151) must always appear in the job control deck. It contains the number of fields per input record, the mode in which the records are written, and the total number of records to be processed.

The input record format card (item 152) must always follow the input record control card. It contains the FORTRAN format specification for printing error messages and, if input records are written in BCD mode, for reading those records. The format continuation card (item 153) is present only if needed to complete the format specification (fig. 5).

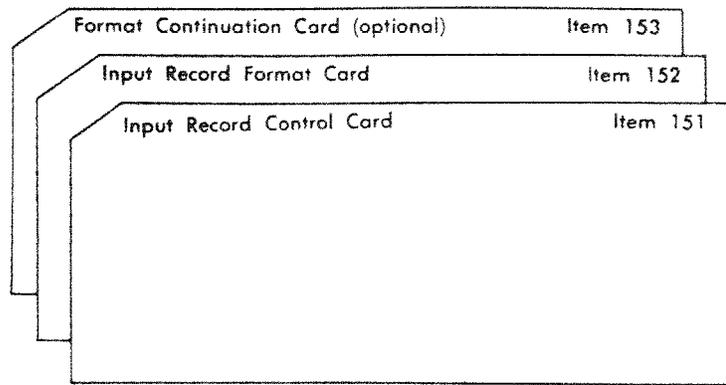


Figure 5. — Order of the input record description cards in the job control deck.

INPUT RECORD CONTROL CARD — ITEM 151

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

INPUT RECORD FORMAT CARD — ITEM 152

<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 153).
2	b	
3	(= Left parenthesis.
4-80	AAA . . . A	= Up to 77 alphameric characters, ending with a right parenthesis, and containing a FORTRAN format specification that de-

scribes the format of the input records. This format specification is used to read BCD input data and to print error messages.

FORMAT CONTINUATION CARD (OPTIONAL)

ITEM 153

<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 152).

6. Output Record Description Cards (Sec. 160)

The control cards in this section describe the physical conditions specified for the correct record output and the error record output.

The output record control card (item 161) gives the number of data fields to be written in the correct output records and the mode of these records. It also provides the controls concerning the recording of error records and the maximum number of errors to be allowed before termination of the job. This card must always appear in the job control deck.

The output record format card (item 162) is used only if the correct record output is to be written in the BCD mode. It contains the FORTRAN format specification for these records. The

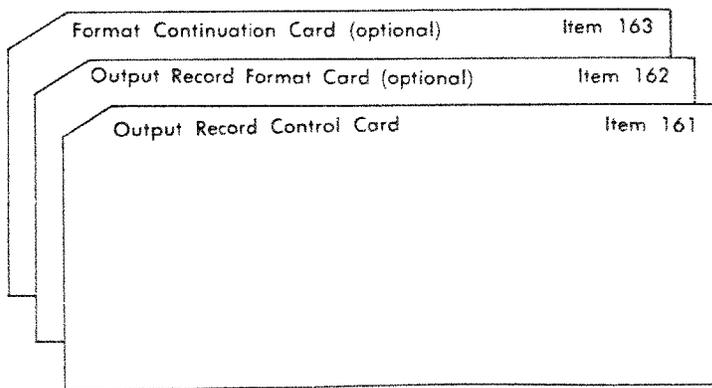


Figure 6. — Order of the output record description cards in the job control deck.

Format Continuation Card (item 163) is used only if needed to complete the format specification (fig. 6).

OUTPUT RECORD CONTROL CARD — ITEM 161

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-13	OUTPUTb- RECORD	= Card label.
14	b	
15	0	= No output of correct records.
	1	= Output correct records on tape in binary mode.
	2	= Output correct records on tape in binary coded decimal (BCD) mode.
	3	= Output correct records on punched cards (BCD).
16	b	
17-19	XXX	= 3 numeric characters, giving the total number of data fields in the correct output record. The number must be right-justified in the field. The number is the sum of the number of input fields and the number of new fields generated or calculated. It must not exceed 132.
20	b	
21-32	ERRORbOUTPUT	= Card label.
33	b	
34	0	= No error output.
	1	= All error messages are to be printed.
35	b	
36-40	XXXXX	= 5 numeric characters, giving the number of errors allowable in the run. The number must be right-justified in the field. If the number of records in which errors are detected exceeds this number, the run will be terminated and all output tables will be punched for use as UPDATE tables in a subsequent pass (see UPDATE table cards, item 140).

OUTPUT RECORD FORMAT CARD (OPTIONAL) ITEM 162

<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 (see item 164).
2	b	

- 3 (= Left parenthesis.
- 4-80 AAA . . . A = Up to 77 alphameric characters, ending with a right parenthesis, and containing a FORTRAN format specification (blanks not allowed) that describes the correct record output. This specification is needed only if a 2 or a 3 is in column 15 of the output record control card (item 161).

FORMAT CONTINUATION CARD (OPTIONAL)

ITEM 163

<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 162).

7. Output Table Description Cards (Sec. 170)

The use of the group of control cards described in this section is optional. The cards are intended primarily to describe the output format to be used if tables produced by add operations (item 131) are to be printed, but they may also be used to print any

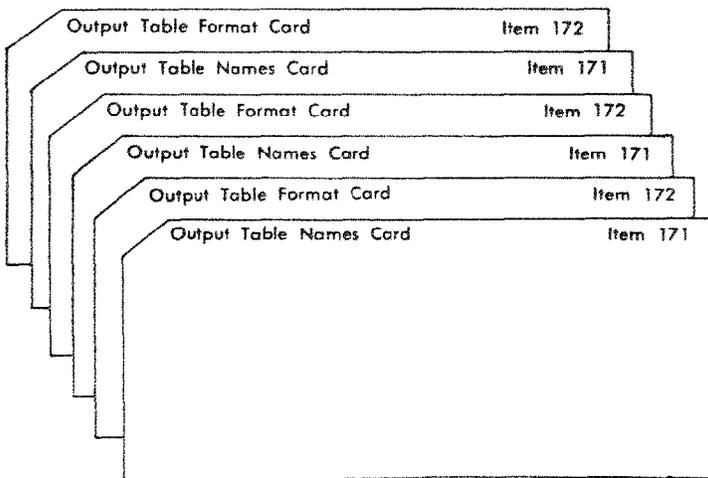


Figure 7. — Order of the output table description cards in the job control deck. Use of this group is optional. This figure illustrates a case in which three sets of output tables are to be printed.

tables used in processing. If this group of cards is not in the job control deck, no tables will be printed.

The first card in the group, the output table names card (item 171), simply lists the names of up to four tables to be printed side by side. All tables named must be the same length. The output table format card (item 172) follows. It contains a FORTRAN format specification for one line of printed table output.

This pair of cards may be repeated as often as necessary, one pair after the other, to describe all the required table output (fig. 7).

OUTPUT TABLE NAMES CARD — ITEM 171

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-11	TABLEbNAMES =	Card label.
12-13	bb	
14-19	AAAAAA	= 6 alphameric characters, giving the name of the table to be printed in the first column of the table output. The name must be left-justified in the field, and must appear exactly as given in columns 68-73 or 75-80 of an add operation card (item 131). The name is used to select the table to be printed and is printed at the top of every page of table output. The names of up to four tables to be printed side by side may be listed in the following columns of this card. The order in which they are listed determines the order in which they are printed. Table names may be repeated if necessary. The tables must all be the same length.
20	b	
21-41	AAAAAA	= Repetitions of the columns 14-20 format, giving the names of the remaining tables to be printed in the table output.

OUTPUT TABLE FORMAT CARD — ITEM 172

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1	(= Left parenthesis.
2-72	AAA . . . A	= Up to 71 alphameric characters, ending with a right parenthesis, and containing a FORTRAN format specification for a line of printed table output. No blanks are allowed in the specification. The specification should be written so that the column

for each table is centered under the table name that is printed at the top of each page. The table names are written as follows:

TABLE 1 in print positions 13-18
TABLE 2 in print positions 42-47
TABLE 3 in print positions 71-76
TABLE 4 in print positions 99-104

8. End of Job Card (Sec. 180)

The end of job card (item 181) must always be the last card of the job control deck. It simply signals the end of the job specification.

END OF JOB CARD — ITEM 181

<i>Columns</i>	<i>Contain —</i>	<i>Explanation</i>
1-10	ENDbOFbJOB	= A control word.

III-C. OPERATING INSTRUCTIONS

This chapter is a resume of information about program EDIT which is helpful in setting up and processing jobs. It includes a list of program restrictions on the size of a processing job; a description of the job control deck and data input setups; a summary of the use of sense switches, sense lights, and program halts; and a list of the messages which may be printed during execution.

1. Program Restrictions

The restrictions are as follows: (a) the total number of data fields in a record (input plus generated) must not exceed 132; (b) no input table entry may contain more than nine digits; (c) an input table entry containing nine 1-digit fields must not have a value greater than seven in the leftmost field; (d) the entries of a table must be arranged in ascending order; (e) the number of tables must not exceed 30; (f) the number of operations per record cannot exceed 100; and (g) the total number of table entries may not exceed 8,000.

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 IV of this series.

2. Job Control Deck Setup

The job control deck consists of all the punched cards through which processing specifications, necessary constants, tables, and other data (exclusive of the data to be processed) are entered

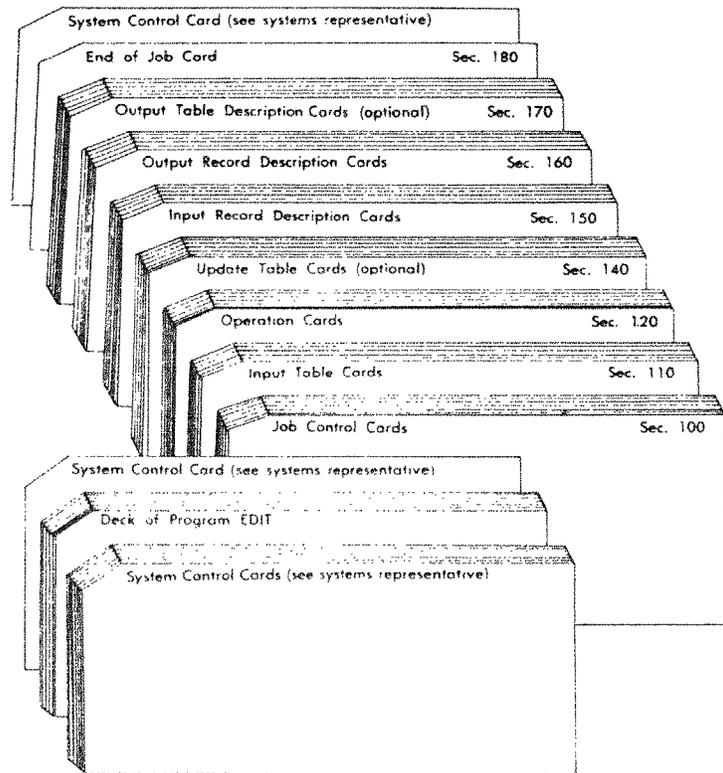


Figure 8.—The job control deck setup, illustrating the kinds of cards that are necessary and the order in which they must be arranged.

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 8.

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 are not described here in detail because they vary from one computer system to another. For more information about them, see the systems representative at the computer center where the processing is to be done.

3. Input Data Setup

Data input must be in the form of a single magnetic tape file of records, each record having the same format and containing no more than 132 data fields. Multiple record files for a job must either be processed in multiple passes of the program or be put into a single record file.

The input tape file may be written either in the binary or the binary coded decimal (BCD) mode, and the tape mode must be specified in column 18 of the input record control card (item 151).

To get the input data into the required form, see your systems representative or use appropriate IBM 1401 programs.

The data input tape is not read from the monitor input unit (see below), as are the program deck and the job control deck. Consequently, it must contain only the file of input data and nothing else.

4. Tape Assignments

In the standard version of program EDIT 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 error records, other messages, and tables.
7	Monitor punch for update tables.
15	Input data in binary or BCD.
19	Output of correct records in binary or BCD.

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 EDIT. All sense switches will be set at normal monitor settings.

Sense light 1 is turned on when an error is found in an input record. Sense light 2 is turned on when an error is found in scanning the job control deck. No other sense lights are used.

6. Use of Program Halts

There are no halts in program EDIT.

7. Use of the Overlay Feature

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

<i>Link</i>	<i>Contains Subprograms</i>
0	MAINE, PACK, UNPACK, RESTAR
1	MAGIC
2	CONTRL
3	EDIT, LEFTAB, ALLTAB, ERCARD
4	ENDMAG

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.

Other messages may also appear in the printed output. They will be produced by the operating system under which this program is being executed.

FIRST CONTROL CARD IS NOT PASS IDENTIFICATION CARD

Message 1. This message occurs if the pass identification card label (columns 1-4, item 102) is incorrect. The card may be punched incorrectly, or may be out of order in the deck. Correct the error and start processing from the beginning.

CARD OUT OF SEQUENCE :

TABLE AAAAAA : CARD NUMBER YYYYY

Message 2. This message is printed if the cards comprising an input table (item 114) are not in ascending order, as required. AAAAAA is the table name in columns 1-6 of item 112. YYYYY is the card number in the table. Correct the error and start processing from the beginning.

TABLE AAAAAA CONSISTING OF YYYYY CARDS HAS BEEN READ CORRECTLY

Message 3. This message is printed each time an input table has been read successfully. AAAAAA is the name of the table punched in columns 1-6 of the input table name card (item 112). YYYYY is the number of cards read for the table, taken from columns 16-20 of item 112.

TABLE NUMBER XX HAS EXCEEDED MACHINE CAPACITY

Message 4. This message is printed if the total number of entries in the input tables (item 113) is greater than available storage in the computer (see part IV C). XX is the number of the table in the input deck that was being read when available storage was exceeded. 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.

OPERATION NAME HAS BEEN MISSPELLED

Message 5. Message prints if the operation name punched in columns 1-6 of the immediately preceding edit operation does not correspond to one of those mentioned in items 121-131. Card may be punched incorrectly or the finish operation card (item 132) may be missing. Correct and start processing from the beginning.

AN OPERAND IS NOT SPECIFIED CORRECTLY

Message 6. Message prints if the operands in the immediately preceding arithmetic operation is not from the list specified in item 128. Correct and start processing from the beginning.

THE SYMBOL AAAAAA IS INVALID

Message 7. Message prints if a relational operator or connective in the immediately preceding logic operation is not one of those allowed. AAAAAA is the symbol which is punched incorrectly. Correct and start processing from the beginning.

ILLEGAL COMBINATION OF CONNECTIVES OR OPERATIONS

Message 8. Message prints if the logic statement in the immediately preceding logic operation is not one of the types specified. Correct and start processing from the beginning.

**XXXXX PROGRAM STEPS HAVE BEEN CALLED
FOR YYYYY PROGRAM STEPS HAVE BEEN
PROVIDED FOR — CORRECT**

Message 9. Message prints when the number of operation cards (item 121-131) in the data deck exceeds the value of the variable NOPER (see part IV C). In the standard version NOPER equals 100. XXXXX is the total number of operation cards read and YYYYYY is the value of NOPER. Change the number of operation cards or change the value of NOPER (see part IV C). Start processing from the beginning.

**TABLE NAME CANNOT BE FOUND
CHECK INPUT TABLES AND FUNCTION CARDS AAAAA**

Message 10. Message prints if an input table mentioned on an ADD (item 131), GENERATE (item 129), CROSSCHECK (item 124), or CROSS RANGE (item 125) operation card cannot be found among the input table. AAAAA is the name of the table which cannot be found. The table name may be misspunched on the operation card or the table may be missing from the control deck. Correct and start processing from the beginning.

MAXIMUM NUMBER OF INPUT TABLES EXCEEDED

Message 11. Message prints if the number of input tables (items 112-115) exceeds the value of the variable NTBLE (see part IV C). Reduce the number of input table or change the value of NOPER (see part IV C). Correct and start processing from the beginning.

INCORRECT CARD IN UPDATE TABLES

Message 12. Message prints if the job summary card (item 142) or the update table identification card (item 143) or the update title card (item 141) is missing or out of order. Correct and start processing from beginning.

**UPDATE TABLE AAAAAA CANNOT BE FOUND
AMONG ADD OPERATION TABLES**

Message 13. Message prints if the table name punched in columns 45-50 of the update table identification card (item 143) does not agree with one of the table names punched in columns 75-80 of the add operation card (item 131). AAAAAA is the table name from the update table identification card. Correct and start processing from the beginning.

**UPDATE TABLE CARDS
OUT OF ORDER TABLE AAAAAA**

Message 14. Message prints if the cards comprising an update table are out of sequence according to the sequence number punched in columns 4-8 of the update table entry card (item 144) or if the table name punched in columns 75-80 of the same card is not identical to the name punched in columns 45-50 of the update table identification card (item 143). AAAAAA is the table name punched in columns 45-50 of the update table identification card (item 143). Correct and start processing from the beginning.

INPUT RECORD CONTROL CARD INCORRECT

Message 15. Message prints if columns 1-6 of the input record control card (item 151) are not punched INPUTb or if the card is out of order. Correct and start processing from beginning.

ERROR IN RECORD OUTPUT CONTROL CARD CARD LABEL INCORRECT

Message 16. Message prints if columns 1-6 of the output record control card are not punched OUTPUT or if the card is missing or out of order. Correct and start processing from beginning.

ERROR ON PROGRAM STEP XXX IN THE FOLLOWING RECORD

Message 17. Message prints above the input record in which the error was found. XXX is the number of the operation card (items 121-131) in the control deck which found the error. This message only occurs if option for error output is taken on the output record control card (column 34, item 161). Correct the record and process again in a subsequent pass.

XXXXXX ERRORS HAVE OCCURRED

Message 18. Message prints if the maximum allowable number of errors is exceeded, record output control card (columns 36-40, item 161). XXXXXX is the number of errors to the point. The run is terminated and a set of update table is punched (items 142-145). Processing must be started from the beginning using the update option on the pass identification control card (columns 9-15, item 102) and altering the input record control card (item 151, columns 20-25) to conform with the number of records remaining to process. (It will be necessary to remake the input tape so that it contains only the unprocessed records.)

PASS XX PROCESSED YYYYY RECORDS OF WHICH ZZZZ WERE FOUND CORRECT

Message 19. Message prints after all input records have been processed. XX is the pass identification number from columns 6-7 of the pass identification card (item 102). YYYYY is the total number of records processed and should be the same as columns 20-25 of the input record control card (item 151). ZZZZ is the total number of records found correct; that is, the number of records written on the output tape or the number of cards punched depending upon the option taken in column 15 of the output record control card (item 161).

THE INVALID TABLE NAME AAAAAA HAS BEEN REQUESTED FOR OUTPUT

Message 20. Message prints if one of the names punched on the output table name card (item 171) does not correspond with the name of an input table (columns 1-6, item 112) or a table generated by an ADD operation (columns 75-80, item 131). AAAAAA is the offending table name punched

on the output table name card (item 171). Correct the card and start from the beginning changing columns 20-25 of the input record control card (item 151) to 000000 and using the update option (columns 9-15, item 102) with the update tables punched for the current pass (items 142-145). This will cause only the final output table to be processed.

THE TABLE AAAAA DOES NOT HAVE THE SAME
LENGTH AS OTHERS REQUESTED FOR OUTPUT

Message 21. Message prints if one or more of the tables mentioned on an output table name card (item 171) is not of the same length as the other to be printed beside it. AAAAA is the name of the table taken from the output table name card. Correct the card and use the same restart procedure described for message 20.

TABLE OUTPUT CONTROL CARD INCORRECT.
IT STARTS AAAAA

Message 22. Message prints if columns 1-11 of the output table name card (item 171) is not punched TABLEbNAMES. AAAAA is columns 7-11 of the offending card. Correct the card and use the same restart procedure described for message 20.

ADD TABLE DEFINED IN OPERATION XXX
HAS EXCEEDED MACHINE CAPACITY

Message 23. This message is printed if the total number of entries in the input tables (item 113) plus the total number of cells occupied by ADD operation tables is greater than available storage in the computer (see part IV C). XXX is the number of the operation which defined the table which exceeded the maximum. The number or size of input table and/or ADD tables must be reduced, or the available storage must be increased before processing can be started again from the beginning.

