

# 5280



SC21-7789-0  
S5280-33

## **IBM 5280 Distributed Data System**

**Sort/Merge Reference/Operation Manual**

Program Number 5708-SM1



SC21-7789-0  
S5280-33

# **IBM 5280 Distributed Data System**

**Sort/Merge Reference/Operation Manual**

Program Number 5708-SM1

## Preface

This manual is intended for users of the 5280 Sort/Merge Program Product. It is designed to be a user's manual and reference guide for operators and programmers. This manual assumes the reader has a basic knowledge of the 5280 system operation and its functions.

The first chapter explains the general content of the manual and introduces the sort/merge programs. This chapter also explains some of the concepts of sort and merge. Chapter two and three discuss each program individually.

### Related Publications

- *IBM 5280 General Information, GA21-9350*
- *IBM 5280 System Concepts, GA21-9352*
- *IBM 5280 Utilities Reference/Operation Manual, SC21-7788*
- *IBM 5280 Message Manual (to be available at a later date)*

### First Edition (January 1980)

This edition applies to release 01, modification 0 of Program Product 5708-SM1 and to all subsequent versions and modifications until otherwise indicated in new editions or technical newsletters.

Changes are periodically made to the information herein; changes will be reported in technical newsletters or in new editions of this publication.

This publication contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious, and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental. It is possible that this material may contain reference to, or information about, IBM products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that IBM intends to announce such IBM products, programming, or services in your country.

Use this publication only for the purposes stated in the *Preface*.

Publications are not stocked at the address below. Requests for copies of IBM publications and for technical information about the system should be made to your IBM representative or to the branch office serving your locality.

This publication could contain technical inaccuracies or typographical errors.

Use the Reader's Comment Form at the back of this publication to make comments about this publication. If the form has been removed, address your comments to IBM Corporation, Product Information Development, Department 997, 11400 Burnet Road, Austin, Texas 78758.

IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

<b>CHAPTER 1. AN OVERVIEW OF SORT/MERGE</b> . . . . .	<b>1</b>	<b>CHAPTER 3. MERGE OPERATION</b> . . . . .	<b>49</b>
The Sort Program . . . . .	2	Loading the Merge Program . . . . .	49
The Merge Program . . . . .	5	Specifying the Entry Method (Prompt 30-60) . . . . .	50
Command Data Set Display . . . . .	5	Creating a Command Data Set (Prompt 30-65) . . . . .	51
Prompts . . . . .	5	Using a Command Data Set (Prompt 30-65) . . . . .	52
Loading the Sort/Merge Programs . . . . .	6	Command Data Set Information (Prompt 30-68) . . . . .	53
Command Data Set Information . . . . .	7	Specifying the Input Data Sets (Prompts 30-30 and 30-31) . . . . .	54
Diskette Security . . . . .	8	Merge Input 1 (Prompt 30-30) . . . . .	54
Input Data Set . . . . .	8	Merge Input 2 (Prompt 30-31) . . . . .	54
Output Data Set . . . . .	9	Specifying the Output Data Set Exchange Type (Prompt 30-61) . . . . .	55
Merging Multivolume Data Sets . . . . .	10	Select Data Exchange Type (Prompt 30-62) . . . . .	55
Data Exchange Type . . . . .	11	Specifying the Output Data Set (Prompt 30-32) . . . . .	56
Exchange Limitations . . . . .	12	Specifying the Merge Record Key (Prompt 30-63) . . . . .	57
Record Key . . . . .	13	Specifying an Alternate Collating Sequence (Prompt 30-64) . . . . .	58
Sort Record Key . . . . .	15	Performing Merge (Prompt 30-67) . . . . .	59
Record Subset Sort . . . . .	16	Merge In Process (Prompt 30-36) . . . . .	59
Merge Record Key . . . . .	17	Specifying Multivolume Data Sets . . . . .	60
Work Data Set (Sort Only) . . . . .	18	End of Input Volume (Prompt 30-33) . . . . .	60
Changing the Collating Sequence . . . . .	19	End of Output Volume (Prompt 30-34) . . . . .	61
Record Selection (Sort Only) . . . . .	22	Next Output Volume (Prompt 30-35) . . . . .	61
Completion/Termination . . . . .	30	Merge Completed (Prompt 30-78) . . . . .	62
Utility Terminated (Prompt 30-79) . . . . .	30	Restarting Merge . . . . .	62
Error Recovery . . . . .	31		
Errors During Data Entry . . . . .	31	<b>CHAPTER 4. COMMAND DATA SET DISPLAY OPERATION</b> . . . . .	<b>63</b>
Errors During Processing . . . . .	31		
Restarting Sort/Merge . . . . .	32	<b>APPENDIX A. PERFORMANCE CONSIDERATIONS</b> . . . . .	<b>67</b>
		<b>APPENDIX B. THINGS TO REMEMBER</b> . . . . .	<b>69</b>
<b>CHAPTER 2. SORT OPERATION</b> . . . . .	<b>33</b>	<b>APPENDIX C. THE EBCDIC COLLATING SEQUENCE</b> . . . . .	<b>71</b>
Loading the Sort Program (Prompt 05-00) . . . . .	33	<b>GLOSSARY</b> . . . . .	<b>73</b>
Specifying the Entry Method (Prompt 30-60) . . . . .	34	<b>INDEX</b> . . . . .	<b>75</b>
Creating a Command Data Set (Prompt 30-65) . . . . .	35		
Using a Command Data Set (Prompt 30-65) . . . . .	36		
Command Data Set Information (Prompt 30-68) . . . . .	37		
Selecting the Sort Type (Prompt 30-00) . . . . .	38		
Specifying the Input Data Set (Prompt 30-01) . . . . .	38		
Specifying the Output Data Set Exchange Type (Prompt 30-61) . . . . .	39		
Select Data Set Exchange Type (Prompt 30-62) . . . . .	39		
Specifying the Record Subset (Prompt 30-02) . . . . .	40		
Specifying the Sort Record Key (Prompt 30-63) . . . . .	41		
Specifying the Output Data Set (Prompt 30-03) . . . . .	42		
Specifying a Work Data Set (Prompt 30-04) . . . . .	43		
Specifying an Alternate Collating Sequence (Prompt 30-64) . . . . .	44		
Selecting the Records to be Sorted (Prompt 30-05) . . . . .	45		
Performing Sort (Prompt 30-67) . . . . .	46		
Sort In Process (Prompt 30-06) . . . . .	47		
Sort Completed (Prompt 30-78) . . . . .	47		
Restarting Sort . . . . .	48		



## Chapter 1. An Overview of Sort/Merge

This chapter discusses the sort and merge programs, how to load and use them, and your interaction with the system. Material is arranged to provide a step-by-step explanation of the operation of each utility. For this reason, it is important to read the material in sequence.

After using this manual, the reader should be able to:

- Understand the purpose of sort/merge.
- Perform the steps required to:
  - load the sort and merge programs from a diskette.
  - start the operation.
  - create and display a command data set
  - terminate the operation.
- Respond to the screen displays (prompts). Examples of prompts are provided sequentially as they would appear in an actual operation. Response choices are listed following each prompt.
- Recover from errors caused when sort or merge is being used. Error messages and the suggested responses to them are listed in the *Message Manual* to assist you with an error.

With both programs, the diskette data sets must be in the diskette drive when they are identified. The sort/merge program diskette may be removed after the program has been loaded.

The sort data sets are opened in the sequence: input, output, work. The merge data sets are opened in the sequence: input 1, input 2, output. If the proper data set diskettes are not inserted in the proper diskette drives, the status line is blinked. The information on the status line indicates which of the data sets caused the error. To continue processing, press the Reset key, modify the prompt data as required and then press the Enter key. Be sure that data set diskettes are not removed from their drive until the program ends, because errors could occur.

The merge program supports multivolume input and output (either or both), but two or more drives are required. A two-drive system provides you with multivolume output when necessary. For complete multivolume support you must be able to dedicate a drive to each multivolume data set. See *Merging Multivolume Data Sets* in this chapter.

## THE SORT PROGRAM

Sort allows you to change the order of your records. The records from the original data set are used to create a new data set with the records in the sorted order. The input data set is not altered.

The sort program offers four types of sorted output. These are:

- Full record sort
- Address out sort
- Record subset sort
- Index/key sort

The differences among the sort type options are in the format or contents of the output as follows:

**Note:** In the following examples names are sorted in ascending alphabetical order.

1. *Full record* writes the entire record to the output data set in sorted order.

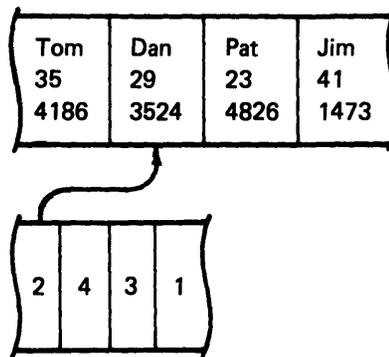
Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Each full record is written to your output data set.

Dan	Jim	Pat	Tom
29	41	23	35
3524	1473	4826	4186

2. **Address out** writes relative record numbers to the output data set. The address out data set contains a 4-byte binary relative record number corresponding to the position of the record in your input data set. In effect, you have created an index for your data set. Using DE/RPG you can read the relative record numbers from your address out data set and directly access records from the input data set. (See the *IBM 5280 DE/RPG User's Guide*, SC21-7804 or the *IBM 5280 DE/RPG Reference Manual*, SC21-7787 for details.)

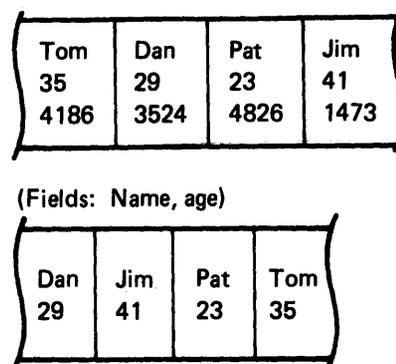
Because entire input records are not written, an address out sort is faster than the other sort types. (See *Performance Considerations* in Appendix A for more information.) The output of the sort also requires less diskette space since the address out data set contains only a 4-byte binary relative record number instead of the full record length.



Only a relative record number is written to your output data set to act as an index in referencing your records.

Notice that the first record is record number 2.

3. **Record subset** combines specified fields from the input record to form the records written to the output data set. Records in the output data set contain only those fields you specified from each input record. Fields in the subset might be repeated, resulting in the possibility of a subset being longer than the input record length. The total length of all specified fields must not exceed 1,024 characters.



Your output contains a subset of data fields from your input data set.

4. *Index/key* writes an index/key to the output data set. The index/key consists of a key field and a relative record number. The key is an input record field you select. The relative record number corresponds to the location of the record in the input data set. Only one field can be selected for the index/key, and it must not be more than 28 bytes long.

Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Your output contains a key field plus a relative record number.

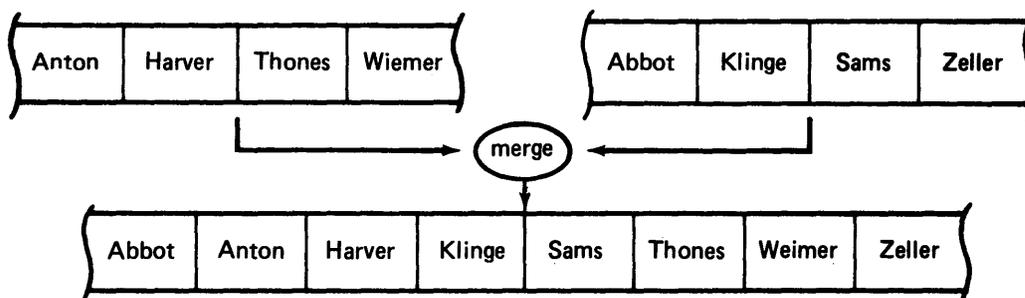
Dan	Jim	Pat	Tom
2	4	3	1

(Key field: Name)

## THE MERGE PROGRAM

Merge combines records from two diskette data sets (input) already in sequence to create a new data set (output). Each input data set can be on more than one diskette (multivolume), and the output can be written on more than one diskette.

Neither of the input data sets is altered. The order of the output records is determined by the key used to control the merge process. The key is data that is used to select which record is to be placed next in the output data set. Both input data set keys must be arranged in the same sequence or the merge program will terminate with an error. If there are duplicate records in input 1 and input 2, the input 1 record is written ahead of the input 2 record.



## COMMAND DATA SET DISPLAY

Command data set display allows you to review the parameters associated with a sort or merge program. The parameters for a sort or merge job can be displayed on the screen or printed on a printer. Chapter 4 provides details of the program.

## PROMPTS

Prompts are messages displayed on the screen to help you enter necessary data for the sort or merge program. Prompts will guide you through the operation. Samples of these prompts are used in each section of this manual to explain the necessary steps in your interaction with the system. A prompt number appears in the lower right corner of each prompt and is used to refer to that prompt throughout the manual.

When entering data such as a data set name, you enter the data via the keyboard and advance to the next field. After you have entered the data required for a prompt, press the Enter key. The next prompt will be displayed.

## LOADING THE SORT/MERGE PROGRAMS

The 5280 system will present the load prompt after the IPL for your system has been completed. The load prompt is displayed again at the end of the operation when you exit the program. The load prompt is displayed as follows:

```
X XXXX XXX
```

```
Program name: _____
```

```
Device address: _____
```

```
Partition number: ____
```

```
Press ENTER
```

```
05-00
```

Insert the sort/merge diskette in the appropriate diskette drive. Specify the device address of the drive, and the partition you plan on using.

To load the sort utility, enter

```
SYSSORT
```

To load the merge utility, enter

```
SYSMERGE
```

If you want the program loaded in a particular partition (foreground or background) specify the number of that partition. When you press the Enter key without specifying a particular partition the system places your program in the partition assigned to your keyboard.

Press the Enter key to continue.

## COMMAND DATA SET INFORMATION

All the information that you specify for controlling a sort or merge operation can be saved on a diskette as a command data set.

Any job that will be run again (payroll, customer billing, etc.) using the same parameters, can be run by using the appropriate command data set. Command data sets can be created without performing a sort or merge operation at the time of parameter entry. When creating a command data set it may be necessary, for further reference, to review the parameters associated with your sort or merge program. See Chapter 4, *Command Data Set Display* for more details.

It is necessary to create a new command data set if any of the parameters of a job are changed. For example, a sort of your best customers, having zero balances due, arranged by sales territory would require a different command data set than the same customers arranged by account number.

The command data set diskette can be removed from the diskette drive after the command data set information prompt (30-68) is displayed.

When specifying a device address, you can enter either a logical or physical device address. A *logical device address* is a two digit identifier that represents a device within your work station (such as D1 for a drive, P1 for a printer). A *physical device address* (such as 4400) identifies a specific physical device. (See *System Concepts* for more detail.)

**Note:** The sort/merge command data set cannot be written to an ASCII diskette.

## DISKETTE SECURITY

If you attempt to access a diskette that is volume protected, you must enter a matching owner identification. The owner identification is a volume protection feature that prevents unauthorized access to information on a diskette.

The following is an example of the volume protection prompt that is displayed:

```
X XXXX-XXXX-XX XXXXXXXX
Diskette is volume protected.
Device DDDD. Data set SSSSSSSS.
Enter owner identifier to access volume.
```

```
-----
```

Press ENTER

05-01

**Note:** The diskette drive address where the volume protected diskette is located is shown here as dddd. The data set name is shown here as ssssssss.

When the prompt is displayed, enter the owner identifier that matches the owner identifier on the diskette. Press Enter to continue.

## INPUT DATA SET

Neither the sort nor merge program alters the input data set. With either program, you determine the order in which the records are grouped in the output data set. For example, assume your input data set is a list of employees arranged numerically by serial number. The records in the data set also include the employees name, age, sex, department and years of service. You can sort out all employees with over 25 years of service and list them alphabetically in your output data set. Your input remains as it was.

The sort program does not support multivolume input data sets. The merge program does support them and will request subsequent volumes.

A read share option is allowed with sort/merge. In other words, more than one user can concurrently read data from the same input data set. For example, one user can be running a sort program while another user is printing out the sort input data set. However, no user can alter the input data set while another user is accessing that data set. If an operator is entering changes to a data set, no sort/merge user can access that same data set until the first user has finished writing to the data set. (See *System Concepts* for more detail on sharing data sets.)

## OUTPUT DATA SET

The sort output data set must be on a single diskette. The data set name and device address must be valid and the name not yet used on that diskette. You can enter up to 8 characters for the data set name. Once the program begins processing the diskette must remain online until the end of the job.

The merge program requests multivolume support for the output data set when required. See *Merging Multivolume Data Sets* in this chapter for an explanation, and see *Specifying Multivolume Data Sets* in Chapter 3 for the entry procedure.

Each program assigns space for the output data set on the output diskette. The space is assigned after the last data set on the diskette.

The sort program determines the maximum size needed and assigns space accordingly. The number of records allocated for the output data set is equal to the number of records in the input data set (including deleted records) plus approximately 10 percent. Record length depends upon the sort type selected.

The merge program allocates all remaining space after the last data set on the diskette. You cannot insert records into the data set once the merge program has completed. Merge frees up any unused diskette space at the end of the operation.

Output data sets for either program *do not* contain deleted records from the input data set. If you want to enlarge your output data set to make it possible to insert records into the data set, you must use the diskette copy utility. The diskette copy utility allows you to allocate data set space, add deleted records and then copy the output data set to the new data set. See the *Utilities Reference/Operation Manual* for more details.

**Note:** If you are using a new IBM-supplied diskette, it might have one large preallocated data set. Use the diskette label maintenance utility or the diskette/data set clear utility to free the data set label. (See *Utilities Reference/Operation Manual* for more detail.)

## MERGING MULTIVOLUME DATA SETS

Merge allows multivolume data sets. When one volume of a data set is completed, you are prompted for the next volume. (Multivolume data sets are also discussed under *Specifying Multivolume Data Sets* in Chapter 3.)

All the volumes of the data set do not need to be included in the merge. The volumes included, though, must be sequentially processed.

Example:

### VALID VOLUME ORDERING

- A. 1, 2, 3
- B. 3, 4
- C. 4

### INVALID VOLUME ORDERING

- A. 2, 3, 1
- B. 3, 5

Multivolume data sets for merge input and output are independent of each other. A multivolume input data set does not mean the output data set has to be multivolume. Likewise, an output data set can be multivolume if your system has more than one diskette drive, whether or not the input data set is multivolume. You must be able to dedicate a diskette drive to each multivolume data set.

If you continue merge on another volume, prompt 30-35, insert next volume, is displayed and merge is continued on the new volume. If the allocation of the new volume fails, the status line blinks. After you press the Reset key, the output prompt 30-35 is redisplayed. The error code appears on the status line indicating the reason for failure, and the sequence repeats.

## DATA EXCHANGE TYPE

Data exchange defines the format used in recording data. You can use diskettes and exchange the data recorded on them with a system or device different from the one that recorded the data.

Sort/merge supports three data exchange types; Basic exchange, H exchange, and I exchange. The main difference between Basic and H data exchange is physical record length. Basic exchange has a physical record length of 128 bytes and H exchange has a physical record length of 256 bytes. Both Basic and H exchange have records formatted as unblocked and unspanned.

I exchange allows the use of any available standard physical record size by using the blocked and spanned record format.

Each data exchange type has specific requirements for data set format that must be met to assure exchange capabilities. See the *System Concepts* manual for more information on diskette exchange.

Unless you choose to specify the output data set exchange type, the sort/merge program creates Basic exchange type output for Basic exchange type input, and H exchange type output for H exchange type input. All other valid exchange types of input create I exchange type output. Address out and index/key sorts create I exchange type output.

**Note:** The merge program references the input 1 data exchange type when assigning an exchange type to the output. Input 1 and input 2 may have different exchange types.

You can indicate on the following prompt whether or not you want to specify the output data set exchange type:

```
Do you want to specify output data set exchange type?
```

```
Options are
```

```
1. Yes
```

```
2. No
```

```
Select option:  _ Press ENTER
```

```
30-61
```

If you choose option 1 (Yes), the next prompt is select exchange type (30-62).  
If you choose option 2 (No), prompt 30-62 will not appear.

When you indicate option 1 (Yes) to specify the output data set exchange type,  
the following prompt is displayed:

```
Select exchange type for output data set.  
Options are  
1. BASIC          3. I  
2. H  
Select option:   _   Press ENTER
```

30-62

Select an output data set exchange type and press the Enter key to continue. If the data exchange type you choose for the output data set is incompatible with the output diskette, an error will occur. When you press the Reset key, the prompt (30-61) will be displayed, allowing you to correct the incompatibility. Exchange type I is compatible with all diskette format types. It is recommended for better performance on the 5280 system. (See *Exchange Limitations* next in this chapter).

### Exchange Limitations

There are restrictions on which data exchange type you can assign to your output data set. You must consider what type of diskette you are using (diskette 1, 2, or 2D). You must consider your sector size (128, 256, 512, 1024) when selecting an exchange type for your output data set.

The following chart illustrates the restrictions:

Diskette Surface Type	Initialized Sector Size	Output Exchange Type
1	128	Basic or I
	256	Only I
	512	Only I
2	128	Basic or I
	256	Only I
	512	Only I
2D	256	H or I
	512	Only I
	1024	Only I

For example, if you are using a diskette 2D that has been initialized with 256-byte sectors, your output must be H or I on a diskette 2D. Even though other diskette types have 256-byte sectors, H exchange type is only supported by diskette 2D.

With the 5280 system it is most efficient to create and assign exchange type I on your data sets for processing. Basic exchange type is efficient for exchange with other systems and is supported by many IBM systems. See *System Concepts* for more detail.

## RECORD KEY

How your records are sorted or merged (alphabetically by last names or numerically by account number, for example) is determined by the record key.

The record key consists of fields of data you specify to be examined. The data field specified first is examined first, and so on until all designated data fields are examined. Collectively the data in the specified fields is referred to as a record key.

A maximum of six fields of data can be read from the input data set to form the record key, and the total length of the key can be as long as 64 characters of data.

**Note:** In an index/key sort only one data field may be designated and cannot exceed a length of 28 bytes.

The system prompts you to designate four parameters (or characteristics) for each field of data you include in the record key. A sequence type, data type, record position, and field length must be entered in the display format for each field of data. The fields are processed in the order they appear on the display.

The following prompt is displayed:

```
Enter the following for each field to be compared.
```

```
Sequence(1=Ascend,2=Descend)/Data type(1=Char,2=Num)/Position/Length:
```

```
_ / _ / ____ / __ _ / _ / _ / ____ / __ _ / _ / _ / ____ / __ _  
_ / _ / ____ / __ _ / _ / _ / ____ / __ _ / _ / _ / ____ / __ _
```

```
Press ENTER
```

```
30-63
```

Possible entries for each parameter are:

**Sequence**

You can enter 1 for ascending sequence or enter 2 for descending sequence with respect to the collating sequence.

**Data type**

You can enter 1 to indicate character or positive numeric data, or you can enter 2 to indicate positive or negative numeric data.

**Note:** A field that might contain a negative value (such as an account balance) must be designated a data type 2. All other data can be designated as a data type 1.

**Position**

This parameter is the starting position of the field within the input record. The value in this field cannot exceed the logical record length.

**Length**

This parameter is the number of characters in the data field.

- Data type 1 can be 1-64 characters long.
- Data type 2 can be 1-16 digits long.
- The length of this field cannot exceed 28 characters if an index/key sort has been specified.

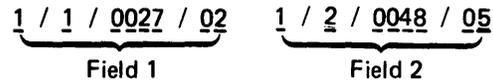
**Note:** The total value of the position and length cannot be greater than the logical record length plus one.

**Sort Record Key**

Assume you specified that the following records:

1	10	27	35	48	58
Customer Number	Customer Name	Region	Salesman	Balance	Overdue (days)
4961	National Foods	03	Thompson	300.00	
6446	Morgan Hardware	02	Mitchell	500.00	60
4429	Davis Paints	02	Mitchell	100.00	
2905	Office Supply	01	Norton	700.00	30
6881	Burton Drug	03	Thompson	485.00	45
5280	King's Drive-In	01	Norton	197.00	
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
5407	Mel's TV Repair	01	Norton	890.00	60

Apply the following sort record key to the records:



The records will be in ascending order according to region (the numeric field that is at position 27 and is 2 characters long). Also, within each territory, the records will be listed in ascending order according to balance amount (the numeric field that is at position 48 and is 5 bytes long). Although the decimal point appears in the example, it does not occupy a position value in the data set.

The sorted output would look like:

5280	King's Drive-In	01	Norton	197.00	
2905	Office Supply	01	Norton	700.00	30
5407	Mel's TV Repair	01	Norton	890.00	60
4429	Davis Paints	02	Mitchell	100.00	
6446	Morgan Hardware	02	Mitchell	500.00	60
2784	Casper Books	02	Mitchell	650.00	60
4961	National Foods	03	Thompson	300.00	
6881	Burton Drug	03	Thompson	485.00	45
6697	Dan's Fixit	03	Thompson	525.00	45

Your records are resequenced to satisfy both of the fields you specified.

If there are input records in which the sort key is the same, they will be written to the output data set in the order they appear in the input data set. For example, assume the input data set contains: T. Baker, F. Anderson, H. Baker, G. Carr. If the records are sorted on the last name, the output will be: F. Anderson, T. Baker, H. Baker, G. Carr.

## Record Subset Sort

When you specify a record subset sort, you will have to indicate the fields to be in the output. A record subset sort combines specified fields from input records to form the records written to the output data set. To indicate which fields you want in the output record, you must enter a position and length for each.

Position indicates the starting position of the field within the input record, and the length indicates the number of characters in the field. Refer to the previous group of records. A subset might consist of the Customer Number, Salesman and Account Balance.

For example:

<u>0001 / 0004</u>	<u>0035 / 0012</u>	<u>0048 / 0005</u>
Field 1	Field 2	Field 3

Three fields would compose the output record with a total length of 21 (4 + 12 + 5) characters. The first starts in position 1 (character 1) and is 4 characters long. The second starts in position 35 (character 35) and is 12 characters long, the third starts in position 48 (character 48) and is 5 characters long.

A maximum of 24 fields may be specified (12 on each of two prompts). If you press the Enter key with data in the last position/length pair of the first prompt, the prompt is displayed a second time. The second prompt is not displayed if the last position/length pair of the first prompt is not filled.

The following is an example of the record subset prompt:

Enter position/length of each field to be in output record:

----- / -----    ----- / -----    ----- / -----    ----- / -----  
----- / -----    ----- / -----    ----- / -----    ----- / -----  
----- / -----    ----- / -----    ----- / -----    ----- / -----

Press ENTER to continue

30-02

If no data is entered on the record subset prompt, the program defaults to the position/length values to be specified for the sort record key. The output data set records would then contain the fields specified for the record key.

## Merge Record Key

In a merge program, records from either input data set must have the same field characteristics. Records from either input data set must also be the same record length.

Assume you want to merge the records of several new customers into an alphabetic listing of all your customers. You specify the following merge record key:

1 / 1 / 0010 / 17  
Field 1

The listing of your present customers looks like this:

Account Number	Customer Name	Region	Salesman	Account Balance	Overdue (days)
6730	American News	01	Norton	890.00	60
6881	Burton Drug	03	Thompson	485.00	45
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
4429	Davis Paints	02	Mitchell	100.00	
5280	King's Drive-In	01	Norton	197.00	
5407	Mel's TV Repair	01	Norton	225.00	30
6446	Morgan Hardware	02	Mitchell	500.00	60
4961	National Foods	03	Thompson	300.00	
2905	Office Supply	01	Norton	700.00	30

The listing of your new customers appears as follows. Remember, both data sets must already be in sequence or your merge will terminate.

Account Number	Customer Name	Region	Salesman	Account Balance	Overdue (days)
3490	Gene's Plumbing	01	Norton	150.00	
2382	Hammel Meats	03	Thompson	215.00	
6727	Nichol's Electric	03	Thompson	85.00	
4968	Porter Dairy	02	Mitchell	135.00	
5473	Vick's Delivery	03	Thompson	245.00	

After the two data sets are merged, the new listing of all your customers looks like this:

<b>Account Number</b>	<b>Customer Name</b>	<b>Region</b>	<b>Salesman</b>	<b>Account Balance</b>	<b>Overdue (days)</b>
6730	American News	01	Norton	890.00	60
6881	Burton Drug	03	Thompson	485.00	45
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Flowers	03	Thompson	525.00	45
4429	Davis Paints	02	Mitchell	100.00	
3490	Gene's Plumbing	01	Norton	150.00	
2382	Hammel Meats	03	Thompson	215.00	
5280	King's Drive-In	01	Norton	197.00	
5407	Mel's TV Repair	01	Norton	225.00	30
6446	Morgan Hardware	02	Mitchell	500.00	60
4961	National Foods	03	Thompson	300.00	
6727	Nichol's Electric	03	Thompson	85.00	
2905	Office Supply	01	Norton	700.00	30
4968	Porter Dairy	02	Mitchell	135.00	
5473	Vick's Delivery	03	Thompson	245.00	

#### **WORK DATA SET (Sort Only)**

To allow for the difference in the needs of each sort, the sort program always requests a diskette for the creation of a work data set. You might or might not specify a work data set. However, if the partition storage is not large enough and no work data set is available, the sort program will terminate.

The work data set must be contained on a single diskette. The work data set is assigned space on a specified diskette following the last allocated data set on that diskette. When a work data set is necessary, the output data set is assigned space prior to the work data set being assigned space. When the two are on the same diskette, the output data set is also assigned space physically ahead of the work data set.

The diskette space used for the work data set is freed upon completion of the sort.

The available storage in the partition being used is normally sufficient for an average simple sort. However, the amount of work area needed in the partition varies greatly depending on the complexity of the sort. Input record length, key length, number of records, partition size, and the number of options specified will affect the amount of work area needed.

To avoid program termination if a work data set is needed and not available, it is best to always have a work data set available. The maximum number of records you would need in a work data set is 2 1/2 times the number of records in the input data set.

## CHANGING THE COLLATING SEQUENCE

If necessary, you can alter the standard EBCDIC collating sequence. (See Appendix C for the U.S./Canada chart of the EBCDIC collating sequence and hex value. See the *System Concepts* manual for all other available EBCDIC collating charts.) That is, you can specify that certain characters be treated as though they have a different value within the collating sequence. For example, instead of A B C D E F followed later by a b c d e f, you might want the sequence to be: A a B b C c D d E e F f.

This option allows you to treat a character as if it has a value in the sequence normally assigned to another character. Both the new and the original character will have the same apparent value in the sequence and will be considered equal. If the two characters are not to appear equal, you must also assign a new value to the original character.

When responding to prompt 30-64, you will notice that the graphic character will not appear on the display until after you have entered both characters in the hex value. For example, an A appears only after you enter both the C and 1 for the hex value C1. If you enter a nondefined character (one that has no graphic representation on the EBCDIC chart) a solid rectangular block (■) appears on the display.

**Note:** The alternate collating sequence changes are applied only to record key fields specified with a character data type. The changes are also applied to character constants specified in the select records prompt (30-05).

You can specify a change when the following prompt is displayed:

```
Enter original/new HEX values for each change to collating sequence:
```

```
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --
```

```
Press ENTER to continue
```

```
30-64
```

### EXAMPLE 1

Assume you want the blank treated the same as the Z. You enter:

40/E9

Whenever the program encounters a blank (hex 40), the system treats the blank the same as it does a Z (hex E9). All blanks then are collated in sequence as if they were Zs.

### EXAMPLE 2

If you want the program to sort B before A, enter:

C1/C2 C2/C1

The first entry (C1/C2) assigns the A (C1) the B (C2) value and the characters share that value. The B (C2) then receives the A (C1) value with the second entry (C2/C1). The characters A (C1) and B (C2) have exchanged collating values and the program sorts the B ahead of the A.

### EXAMPLE 3

If you want all dollar signs (5B on the EBCDIC chart) collated ahead of the letter H (C8) you could enter:

5B/C8 C8/C9 C9/CA

This tells the system to assign the 5B (\$) the C8 (H) value, the C8 (H) the C9 (I) value, and the C9 (I) the CA (unassigned) value. Each set of parameters has reassigned the next character one value down on the collating sequence. You normally reassign character values up or down until you reach an available blank space or a space occupied by a seldom used special character in the EBCDIC chart. This allows each character its own collating value rather than sharing a value with another character and the two appearing equal as in example 1.

If you specify collating values in the last entry spaces of the prompt, the prompt is displayed again after you press the Enter key. This allows you to enter any number of changes (18 on each prompt). Be aware that the last value you assign a hex character is the one that is effective. For example, if you specify C1/C3 and later specify C1/C4, the C1(A) is not sorted as C3(C), it is sorted as C4 (D).

**Note:** If you use an ASCII input diskette, sort/merge will translate it into EBCDIC. Therefore, any collating sequence changes you make affect the EBCDIC collating sequence.

This page is intentionally left blank.

## RECORD SELECTION (Sort Only)

When all of the records from the input data set are not needed for a sort, record selection permits you to eliminate unnecessary records. For example, assume that you need an alphabetic listing of all customer accounts within the state. Using record selection you could eliminate from the alphabetic sort all the accounts with addresses outside the state.

Records can be included in a sort or omitted from the sort according to the data contained in specific fields. Record selection displays a prompt (30-05) allowing you to specify which fields of data should be examined and under what conditions the record can be used in the sort.

This examination is a comparison between the data contained in the field you select from within the input data set record and a second item of data. The comparison is the relationship between the two items of data (for example, is item 1 greater than item 2). One condition can be specified on each select records prompt. The following is the select records prompt:

```
Select records to sort. Specify condition 01. Enter
Option (1=Omit,2=Include,3=Include all):
Field 1 position:
Field length:
Field 2 position:
Logical (1=Or,2=And):
Data type (1=Char,2=Num):
Compare (1=GT,2=LT,3=EQ,4=GE,5=LE,6=NE):
(or) Constant:
Press ENTER to continue
```

The screenshot shows a terminal-style prompt for selecting records to sort. It includes several input fields with numbered callouts: 1 points to the 'Option' field, 2 to 'Field 1 position', 3 to the 'Option' field, 4 to 'Field length', 5 to the 'Compare' field, 6 to 'Field 2 position', 7 to the 'Press ENTER to continue' text, and 8 to the 'Logical' field. The prompt ID '30-05' is visible in the bottom right corner.

If all records in the input data set are to be sorted, enter no conditions on the prompt the first time it appears. Press the Enter key to continue.

To sort only a subset of the records, you must describe the conditions the records must satisfy to be used in the sort. You describe the conditions by entering parameters or characteristics of the conditions on the prompt. You can enter up to 15 conditions.

## **1** OPTION

First you must enter the include/omit option, that is, whether the record will be included in or omitted from the sort if it satisfies all the parameters you will enter on this prompt.

You enter 1 (omit) to indicate that any records should be eliminated from the sort if they satisfy the parameters you enter on this prompt. You enter 2 (include) to indicate that any records should be included in the sort if they satisfy the parameters you are about to specify.

The omit condition indicates which records you *do not* want in the sort. You must then indicate which records you *do* want in the sort. You must have at least one include condition, whether it is option 2 or option 3 (include all), to have any records in the sort.

Include all is most often used when only omit conditions have been specified. For example, assume you have various records numbered 1 through 10. First you specify a condition to omit all 2s and then another omit condition to omit all 4s. Then you specify a 3 (include all) to include all other records (1, 3, 5, 6, 7, 8, 9, and 10) in the sort.

## **2** FIELD 1 POSITION

The second parameter you must specify is field 1 position. Field 1 is the field of data from within the input record that you want examined and compared to a second item of data. You identify field 1 by entering the position where the field begins within the input record. The position cannot be greater than the logical record length.

## **3** DATA TYPE

Once you specify where field 1 begins, next enter what kind of data is contained in the field. You can enter 1 (char) to indicate character or positive numeric data.

**Note:** If an alternate collating sequence change has been indicated, it is applied to character fields.

Or you can enter 2 (num) to indicate positive or negative numeric data.

**Note:** A field which might contain a negative value (such as an account balance) must be designated a data type 2. All other data can be designated as a data type 1.

#### **4 FIELD LENGTH**

To further describe the field 1 data, you next enter the length of the field:

- Data type 1 fields can be 1 - 256 characters long.
- Data type 2 field can be 1-16 digits long.

**Note:** The field length plus starting position of field 1 must be less than or equal to the logical record length plus 1.

#### **5 COMPARE**

Next you must specify how you want field 1 compared to the second item of data. There are six possible ways to compare the data. Enter the number of the comparison:

- 1 – Field 1 is greater than (GT) item 2.
- 1 – Field 1 is less than (LT) item 2.
- 3 – Field 1 is equal to (EQ) item 2.
- 4 – Field 1 is greater than or equal to (GE) item 2.
- 5 – Field 1 is less than or equal to (LE) item 2.
- 6 – Field 1 is not equal to (NE) item 2.

#### **6 FIELD 2**

Field 1 is compared to a second item of data. The second item can be either a second field of data from within the input record (field 2) or data you enter through the keyboard (constant).

Consider the following when specifying field 2:

- Specify the starting position within the input record.
- The starting position cannot be greater than the logical record length.
- Field 2 must be left blank if a constant is to be specified.

An example of field 2 as the second field of comparison is: Assume each customer account is assigned a specific dollar amount of credit. You would compare the account balance (field 1) to the credit amount (field 2) to determine if the customer has reached his maximum credit.

**Note:** If an alternate collating sequence change has been indicated, it is applied to character fields.

## 7 CONSTANT

Consider the following when specifying a constant:

- Each constant can be no more than 20 characters long if the data is data type 1.

**Note:** If an alternate collating sequence change has been indicated, it is applied to the character constants.

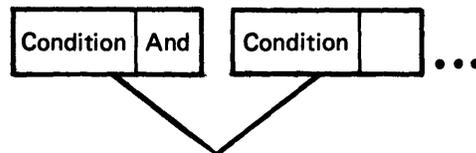
- Each constant must be a sign (+ or - or a blank) and up to 16 digits if the data is data type 2. A blank in the first position of the constant can be used to indicate a positive value.
- If a sign is entered for numeric data, it must occupy the first position of the constant field.
- The total of all constants in a single sort must not be longer than 100 characters.
- If a constant is specified, field 2 must be blank.

An example of a constant as the second item of comparison is: Assume you want a listing of all customer accounts that placed orders today. The date of the order (field 1) is compared to today's date (constant), which you enter through the keyboard.

**Note:** To enter the hexadecimal value for your constant, you must use the hex command key sequence. If there is no graphic to represent the hexadecimal on the EBCDIC collating chart, a solid rectangular block (■) appears on the display. To enter a hexadecimal value, first press the Cmd key and then the 2 hex keys for each displayed character.

## 8 LOGICAL

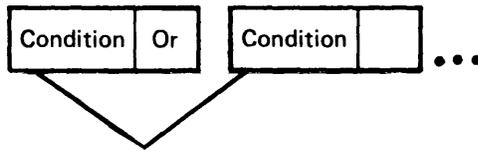
This parameter specifies whether or not a condition is *linked* to the next condition specified. If the condition is to be linked to the next condition, 2 (and) is specified. For example:



These two conditions are linked together and each condition must be satisfied before a record will be included or omitted.

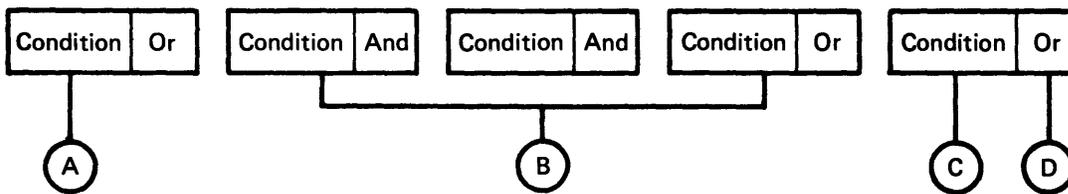
**Note:** Include and omit conditions cannot be linked together.

If the condition is not linked to the next condition specified, 1 (or) is entered for this parameter. One or the other condition must be satisfied before a record is included or omitted. For example:



If either condition is satisfied, the record will be included or omitted.

Also, 1 (or) must be specified when the last condition is specified. The following illustration shows how multiple conditions are used by the sort program.



If this condition **A** is satisfied, or the next group of conditions **B** is satisfied, or the last condition **C** is satisfied, the record will be included or omitted. This parameter **D** is specified because condition **C** is the last condition.

After the information has been entered for a select records prompt, press the Enter key. The prompt is displayed again unless it is the fifteenth condition. If there are no more conditions to be specified, enter no data and press the Enter key to continue.

**Note:** Record selection prompting will continue until a blank prompt is entered, or an include all option is entered, or until 15 conditions have been entered.

When a 2 (and) is specified for the logical parameter, the option parameter (include/omit) specified for the condition is automatically repeated on the next prompt.

### EXAMPLE 1

Assume you have the following records:

1	10	27	35	48	58
Customer Number	Customer Name	Region	Salesman	Account Balance	Overdue (days)
4961	National Foods	03	Thompson	300.00	
6448	Morgan Hardware	02	Mitchell	500.00	60
4429	Davis Paints	02	Mitchell	100.00	
2905	Office Supply	01	Norton	700.00	30
6881	Burton Drug	03	Thompson	485.00	45
5280	King's Drive-In	01	Norton	197.00	
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
5407	Mel's TV Repair	01	Norton	890.00	60

Let's sort all records that have a balance greater than or equal to \$500.00 and are more than 30 days overdue. All this information cannot be entered in one condition because you have two comparisons: balance to \$500.00, and days overdue to 30 days. This requires two conditions.

The first condition indicates to include all records that have a value greater than or equal to \$500 in field 1, which begins at position 48 and is 5 characters long. (Although the decimal point appears in the above example, it does not occupy a position value in the data set.)

```
Select records to sort. Specify condition 01. Enter
Option (1=Omit,2=Include,3=Include all): 2
Field 1 position: 0048 Data type (1=Char,2=Num): 2
Field length: 005 Compare (1=GT,2=LT,3=EQ,4=GE,5=LE,6=NE): 4
Field 2 position: ---- (Or) Constant: +50000-----
Logical (1=Or,2=And): 2 Press enter to continue 30-05
```

**Note:** The 2 (and) connects condition 1 with the next condition. A 2 (include) already appears as the option for condition 2.

The second condition indicates to include all records that have a value greater than 30 in field 1, which begins at position 58 and is 2 characters long.

```
Select records to sort.   Specify condition 02.   Enter
Option (1=Omit,2=Include,3=Include all):       2
Field 1 position:           0058   Data type (1=Char,2=Num):           1
Field length:              002    Compare (1=GT,2=LT,3=EQ,4=GE,5=LE,6=NE):     1
Field 2 position:          _____ (Or) Constant: 30_____
Logical (1=Or,2=And):      1      Press enter to continue           30-05
```

**Note:** The 1 (or) ends the series of conditions.

Because these are all the records to be included, no more conditions are needed. When the next blank prompt appears, press the Enter key with no data on the prompt.

The records that would be selected are:

6446	Morgan Hardware	02	Mitchell	500.00	60
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
5407	Mel's TV Repair	01	Norton	890.00	60

Consider the same example, but with omit as the option. All records that satisfied the conditions would be omitted instead of included. If there were only omit conditions specified, no records would be sorted. Therefore, an option 3 (include all) is used to indicate that all records not previously included or omitted are to be included in the sort. (It also indicates that no more conditions are to be entered.)

The following records would be selected using the omit option and on the third prompt the option 3 (include all).

4961	National Foods	03	Thompson	300.00	
4429	Davis Paints	02	Mitchell	100.00	
2905	Office Supply	01	Norton	700.00	30
6881	Burton Drug	03	Thompson	485.00	45
5280	King's Drive-In	01	Norton	197.00	

If you have both include and omit conditions specified in your sort, be careful of the order in which you specify the conditions. The sort program processes the conditions in the order they are specified. Therefore, you should specify the include statements before the omit statements so that no records you want included will be eliminated by the omit statement before the include statement is processed.

## COMPLETION/TERMINATION

The sort or merge operation either ends successfully or terminates with an error.

If the sort or merge operation is successful, you are given a choice to restart or exit the program.

If the operation terminates with an error, you are given the appropriate error code on the status line. See *Error Recovery*, next in this chapter, for what to do when an error occurs.

### Utility Terminated (Prompt 30-79)

Termination can occur due to an unrecoverable error or you can request termination.

If a termination error occurs, the status line blinks an error code. After noting the error code, press the Reset key.

You can request termination with command EOJ (end-of-job).

In either case, after the Reset key or command EOJ is pressed, the following prompt is displayed:

```
X XXXX-XXXX-XX XXXXXXXX
```

```
Utility terminated.
```

```
Options are
```

```
1. Restart
```

```
2. Exit
```

```
Select option: _ Press ENTER
```

```
30-79
```

**Note:** Sort or Merge appears in place of Utility in this prompt depending on the program you are using.

Examine the status line to determine the error code and refer to the *Message Manual* for a description of the error condition and a suggested response.

Select an option number and press the Enter key to continue. Option 1 allows you to rerun the sort or merge. Refer to *Restarting Sort/Merge* in this chapter. When your program is in a foreground partition, option 2 allows you to load a different program using the program load prompt. When your program is in a background partition and you choose option 2, the program will exit the partition.

## **ERROR RECOVERY**

Errors can occur during data entry prior to program processing, or during the execution of the program. In both cases, the status line blinks and the error code is displayed on the status line. You should note the error code *before* pressing the Reset key.

### **Errors During Data Entry**

Errors can occur anytime during data entry if incorrect data is entered into a field. For example, entering numeric data when alphabetic data is required or entering an invalid data set name creates an error condition.

When a data entry error occurs, the status line blinks and the error code is displayed on the status line. First, examine the status line and note the error code, then press the Reset key to stop the blinking. Refer to the *Message Manual* for an explanation of the error and suggested response.

### **Errors During Processing**

Errors may still occur after your program has started processing. Some errors will cause termination of your program while others are recoverable. The status line blinks and the error code is displayed. Note the error code and reference the *Message Manual* for an explanation of the error and suggested response.

If the error is recoverable (such as an open diskette drive door), correct the error. When you press the Reset key your program will continue without termination or damage to your data.

If the error is unrecoverable, (such as a too small partition) your program will terminate when you press Reset. See *Completion/Termination* in this chapter for an example of the program termination prompt. This prompt gives you the choice of exiting or restarting the program.

Your choice to restart or exit depends upon the type of error that caused the termination. If the error can be corrected while you are reentering data in response to the prompts, select restart. If the error must be corrected before you attempt to restart the program, select exit and correct the error.

## **RESTARTING SORT/MERGE**

If termination occurs it is sometimes necessary to restart the program by loading the sort/merge diskette.

Both program completed and program terminated prompts offer you the choice to exit or restart. Before you choose to restart, the Sort/Merge program diskette must be placed in the drive from which it was originally loaded. When you enter the restart option, the program will reload and no further action is required.

If the program diskette is not placed in its original drive before you respond to the completion or termination prompt, the program load prompt will be displayed. You must then enter the program name (SYSSORT or SYSMERGE), and specify a device address and partition. (See *Loading the Sort/Merge Program* in this chapter for more details.)

### LOADING THE SORT PROGRAM (PROMPT 05-00)

When the load prompt is displayed, insert the sort/merge diskette in the appropriate diskette drive.

```
X XXXX XXX  
Program name: _____  
Device address: _____  
Partition number: ____
```

Press ENTER

05-00

Enter SYSSORT to identify the sort utility.

Next enter the device address of the diskette drive and the partition number you intend to use. If you do not specify a partition, the system places your program in the partition assigned to your keyboard.

Press the Enter key to continue.

## SPECIFYING THE ENTRY METHOD (PROMPT 30-60)

After you load the sort utility program, the following entry method prompt is displayed:

```
SYSSORT - SORT
Select parameter entry method.
Options are
  1. Keyboard entry          3. Keyboard entry and create command data set
  2. Command data set
Select option:  _ Press ENTER
```

30-60

Option 1 indicates that you are entering the job parameters through the keyboard. If you choose option 1, see *Selecting the Sort Type (Prompt 30-00)*, in this chapter to indicate your sort type.

Option 2 indicates the parameters are to be read into the system from a command data set diskette. If you choose option 2, see *Using a Command Data Set (Prompt 30-65)*, which is discussed in this chapter.

Option 3 indicates you are entering the parameters through the keyboard, and also are creating a command data set for later use. If you choose option 3, see *Creating a Command Data Set (Prompt 30-65)*, which is discussed next in this chapter.

Press the Enter key to continue.

## CREATING A COMMAND DATA SET (PROMPT 30-65)

When you indicate that you are creating a command data set, the following prompt is displayed:

```
Insert command data set diskette and enter
```

```
Data set name:  .....
```

```
Device address: .....
```

```
Press ENTER
```

```
30-65
```

Enter a data set name that has not already been used on that diskette and then specify the device address. Be sure a diskette is inserted in the drive you specify. The command data set is allocated by sort.

After the data for this prompt has been entered, see *Selecting The Sort Type (Prompt 30-00)*, in this chapter.

## USING A COMMAND DATA SET (PROMPT 30-65)

When you indicate you are using the parameters of an existing command data set, the following prompt is displayed:

```
Insert command data set diskette and enter  
Data set name:  _____  
Device address:  _____
```

Press ENTER

30-65

Enter the data set name and the device address for the command data set. Be sure the correct diskette is inserted in the drive you specify.

Press the Enter key to continue.

After the data for this prompt has been entered, see *Command Data Set Information (Prompt 30-68)*, in this chapter.

## COMMAND DATA SET INFORMATION (PROMPT 30-68)

When you use a command data set, the parameters are read from the data set into the 5280 system. The data sets to be used are displayed on the following prompt:

Insert diskette(s) for the following.

	Data set name	Device
Input	- XXXXXXXXXXXXXXXXX	XXXX
Output	- XXXXXXXXXXXXXXXXX	XXXX
Work	- XXXXXXXXXXXXXXXXX	XXXX

Press ENTER

30-68

At this time you may remove the command data set diskette.

Insert the necessary diskettes for the input, output, and work data sets on the devices indicated. (If no device address is displayed for the work data set, no work data set is to be used.) Your sort is now ready to process.

Press the Enter key to continue.

Next, see *Sort In Process (Prompt 30-06)* in this chapter.

## SELECTING THE SORT TYPE (PROMPT 30-00)

When you choose to enter parameters from the keyboard, you first indicate your sort type.

The following prompt is displayed to allow you to select the sort type:

```
Select sort type.  
Options are  
  1. Full record    3. Record subset  
  2. Address out   4. Index/key  
Select option:    _ Press ENTER
```

30-00

Select one of the options and press the Enter key to continue. A detailed explanation of the sort types is given in Chapter 1 under *The Sort Program*.

## SPECIFYING THE INPUT DATA SET (PROMPT 30-01)

Once you designate the type of sort you want, you must identify your input data set. The following prompt is displayed:

```
Insert INPUT diskette and enter  
Data set name:  _____  
Device address:  _____  
  
Press ENTER
```

30-01

Enter the data set name and the device address for your input data set. Be sure the diskette containing the input data set is in the proper diskette drive.

Press the Enter key to continue.

The input data set must be on a single diskette. Input data sets may not be removed during program operation.

### SPECIFYING THE OUTPUT DATA SET EXCHANGE TYPE (PROMPT 30-61)

When you are performing a full record sort or a record subset sort, you can select the output data set exchange type. Address out and Index/key sorts automatically create I exchange type. This prompt does not appear then. In all other cases, the following prompt is displayed:

```
Do you want to specify output data set exchange type?
```

```
Options are
```

1. Yes
2. No

```
Select option:  _ Press ENTER
```

30-61

If you enter 1, indicating that you will specify the output data set exchange type, see *Select Data Set Exchange Type (Prompt 30-62)*, next in this chapter.

If you enter 2, the program specifies the output data set exchange type. See *Specifying The Record Subset (Prompt 30-02)*, in this chapter.

Press the Enter key to continue.

### SELECT DATA SET EXCHANGE TYPE (PROMPT 30-62)

When you indicate you want to specify the output data set exchange type, the following prompt is displayed:

```
Select exchange type for output data set.
```

```
Options are
```

1. BASIC
2. H
3. I

```
Select option:  _ Press ENTER
```

30-62

Select an output data set exchange type and press the Enter key. Exchange types are discussed under *Data Exchange Type* in Chapter 1.

## SPECIFYING THE RECORD SUBSET (PROMPT 30-02)

When you are performing a record subset sort, the following prompt is displayed:

Enter position/length of each field to be in output record:

\_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_  
\_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_  
\_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_    \_\_\_\_ / \_\_\_\_

Press ENTER to continue

30-02

You can enter 12 fields into the prompt and the prompt will repeat once, allowing you to enter 12 more fields. If you do not make an entry into the last field, the display does not display again.

If you enter no data in the first prompt and press the Enter key, the output record format will default to the sort record key fields. See *Specifying The Sort Record Key (Prompt 30-63)*, which is discussed next.

## SPECIFYING THE SORT RECORD KEY (PROMPT 30-63)

The record key indicates how you want the records sorted in the output data set. You need to specify the data to be extracted from the input record to form the record key.

You must specify all four parameters for each field, up to a maximum of six fields of data in the display format:

Sequence / Data type / Position / Length

The following prompt is displayed to specify the record key:

```
Enter the following for each field to be compared.  
Sequence(1=Ascend,2=Descend)/Data type(1=Char,2=Num)/Position/Length:  
_ / _ / ____ / __  _ / _ / ____ / ____  _ / _ / ____ / ____  
_ / _ / ____ / __  _ / _ / ____ / ____  _ / _ / ____ / ____  
Press ENTER
```

30-63

See *Record Key* in Chapter 1 for more detail on the explanation and restrictions for each field.

## SPECIFYING THE OUTPUT DATA SET (PROMPT 30-03)

The diskette storage for the output data set is unassigned because sort allocates the storage. You must, however, specify the output data set name and device.

**Note:** The sort program will not allocate output data sets on an ASCII diskette for address out or index/key sorts.

The following prompt is displayed:

```
Insert OUTPUT diskette and enter
```

```
Data set name:  _____
```

```
Device address:  _____
```

```
Press ENTER
```

```
30-03
```

Enter the output data set name and the device address for the output data set diskette. Be sure the diskette containing the output data set is in the proper diskette drive. If there is not enough storage available on the diskette specified, you will receive an error. Press the Reset key and the prompt will display again, allowing you to specify a different diskette.

Press the ENTER key to continue.

## SPECIFYING A WORK DATA SET (PROMPT 30-04)

A diskette work data set is necessary if there is not enough partition storage available to sort all the records from the input data set. If needed, the work data set is automatically assigned by sort, but only if you have specified a device address.

**Note:** The sort program will not allocate the work data set on an ASCII diskette.

The following is displayed:

```
Insert WORK diskette and enter
Data set name:   SYSUT001
Device address:  ----
```

Press ENTER

30-04

If no work data set is to be assigned or used, simply press the Enter key to continue. Remember, if a work data set is needed and not available, your program will terminate.

When a work data set is to be used, enter the correct device address. Be sure that a diskette is inserted in the drive you specify. To avoid termination if a work data set is needed and not available, it is best to always have a work data set available. The maximum number of records you would need in a work data set is 2-1/2 times the number of records in the input data set.

Press the Enter key to continue.

## SPECIFYING AN ALTERNATE COLLATING SEQUENCE (PROMPT 30-64)

After you finish responding to the work data set prompt (30-04), the following display gives you the option of altering the collating sequence for your job.

Enter original/new HEX values for each change to collating sequence:

```
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --
```

Press ENTER to continue

30-64

Either press the Enter key to continue or enter the original collating (hex) value and the new collating (hex) value for each change. Remember that both characters in the hex value must be entered before the graphic character appears on the prompt. An entry in the last pair of entry spaces causes the prompt to repeat. Appendix C shows the EBCDIC collating values. For more detail, see *Changing the Collating Sequence* in Chapter 1.

## SELECTING THE RECORDS TO BE SORTED (PROMPT 30-05)

The select records option permits you to describe the kind of records you want to include in the sort.

The following is displayed to allow you to enter the conditions that describe the records you want to include or omit from the sort operation:

```
Select records to sort.   Specify condition 01.   Enter
Option (1=Omit,2=Include,3=Include all):   _
Field 1 position:      ----   Data type (1=Char,2=Num):      -
Field length:         ---    Compare (1=GT,2=LT,3=EQ,4=GE,5=LE,6=NE):  -
Field 2 position:     ----   (Or) Constant:      -----
Logical (1=Or,2=And):  _     Press enter to continue                               30-05
```

You can specify up to 15 conditions (one per prompt). Only the records satisfying the conditions are included in or omitted from the sort. The **and** connects the conditions of a series, and the **or** ends a series.

**Note:** To enter a hexadecimal value for your constant, you must use the hex command key sequence. See *Select Records* in Chapter 1 for more detail.

After you have entered the data, press the Enter key to continue.

## PERFORMING SORT (PROMPT 30-67)

After you create a command data set, the program is ready to perform the sort. You must indicate whether or not you want to perform the sort. The following prompt is displayed:

```
Command data set created. Do you want to perform sort?
```

```
Options are
```

```
1. Yes
```

```
2. No
```

```
Select option: _ Press ENTER
```

```
30-67
```

Option 1 indicates that the sort should be performed. When you have created the command data set, you might want to choose option 1 to ensure the sort you have designed completes successfully. If you choose option 1, the next prompt will be SYSSORT in process (Prompt 30-06), which is discussed next in this chapter.

Option 2 indicates you only want to create a command data set and not actually perform the sort. If you choose option 2, the next prompt is sort completed, (prompt 30-78).

### **SORT IN PROCESS (Prompt 30-06)**

The following display will be visible during the sort operation unless an entry is made through the keyboard.

```
SYSSORT in process.
```

30-06

The display is for your information only and no response is possible.

### **SORT COMPLETED (PROMPT 30-78)**

If the sort is successful, or if you indicated when creating a command data set that no sort is to be performed (option 2 of prompt 30-67), the following is displayed:

```
X          SYSSORT  ++++++
Sort completed.
Options are
  1. Restart
  2. Exit
Select option:  _  Press ENTER
```

30-78

The number of records included in the sort is displayed on the prompt (represented here by ++++++), for your information.

Select your option and press the Enter key to continue. Option 1 allows you to run sort again. Refer to *Restarting Sort* in this chapter. When your program is in a foreground partition, option 2 displays the program load prompt, allowing you to load a different program. When your program is in a background partition and you choose option 2, the program will exit the partition.

## **RESTARTING SORT**

You must insert the sort/merge diskette to restart the sort program if one of the following conditions occurs:

1. Sort terminates after you respond to the command data set prompt (30-65) when running from an existing command data set.
2. Sort terminates after you have responded to the last record select prompt (30-05).

Insert the sort/merge diskette into the drive used to load the program initially and press the Enter key to continue. If the diskette is not in the proper drive, the load prompt will be displayed. For more detail see *Restarting Sort/Merge* in Chapter 1.

**LOADING THE MERGE PROGRAM**

When the load prompt is displayed, insert the sort/merge diskette in the appropriate drive.

```
X XXXX XXX
Program name: _____
Device address: _____
Partition number: ____

Press ENTER
```

05-00

Enter **SYSMERGE** to load the merge utility.

Next enter the device address of the diskette drive and the partition number you intend to use. If you do not specify a partition, the system places your program in the partition assigned to your keyboard.

Press the Enter key to continue.

## SPECIFYING THE ENTRY METHOD (PROMPT 30-60)

After you load the merge utility program, the following prompt is displayed:

```
SYSMERGE - MERGE
Select parameter entry method.
Options are
  1. Keyboard entry          3. Keyboard entry and create command data set
  2. Command data set
Select option:  _  Press ENTER
```

30-60

Option 1 indicates you are entering the job parameters through the keyboard. If you choose option 1, see *Specifying the Input Data Sets (Prompts 30-30 and 30-31)* in this chapter.

Option 2 indicates the parameters are to be read into the system from a command data set diskette. If you choose option 2, see *Using a Command Data Set (Prompt 30-65)* in this chapter.

Option 3 indicates you are entering the parameters through the keyboard, and also are creating a command data set for later use. If you choose option 3, see *Creating a Command Data Set (Prompt 30-65)* next in this chapter.

Press the Enter key to continue.

## CREATING A COMMAND DATA SET (PROMPT 30-65)

When you selected option 3 of prompt 30-60, you indicated that you are creating a new command data set. The following prompt is displayed:

```
Insert command data set diskette and enter  
Data set name:  -----  
Device address:  -----
```

Press ENTER

30-65

Enter a data set name that has not already been used on the diskette and then specify the device address. The command data set is allocated by merge. Be sure a diskette is inserted in the drive you specify.

After the data for this prompt has been entered, see *Specifying the Input Data Sets (30-30 and 30-31)* in this chapter.

Press the Enter key to continue.

## USING A COMMAND DATA SET (PROMPT 30-65)

When you selected option 2 of prompt 30-60, you indicated you are using the parameters from an existing command data set. The following prompt is displayed:

```
Insert command data set diskette and enter  
Data set name: _____  
Device address: _____
```

Press ENTER

30-65

Enter the data set name and the device address for the command data set. Be sure the correct diskette is inserted in the drive before you identify your command data set.

Press the Enter key to continue.

After the data for this prompt has been entered, see *Command Data Set Information (Prompt 30-68)* next in this chapter.

## COMMAND DATA SET INFORMATION (PROMPT 30-68)

When you use a command data set, the parameters are read from the command data set into storage. The data sets to be used are displayed on the following prompt:

```
Insert diskette(s) for the following.
```

	Data set name	Device
Input1	- XXXXXXXXXXXXXXXXX	XXXX
Input2	- XXXXXXXXXXXXXXXXX	XXXX
Output	- XXXXXXXXXXXXXXXXX	XXXX

```
Press ENTER
```

```
30-68
```

At this time, you can remove the command data set diskette. Insert the appropriate diskettes on the devices indicated. Your merge is now ready to process.

Be sure that data sets are inserted properly or errors will occur.

Press the Enter key to continue.

Next, see *Merge In Process (Prompt 30-36)* in this chapter.

## SPECIFYING THE INPUT DATA SETS (PROMPTS 30-30 AND 30-31)

After choosing option 1 or 3 of the *Entry Method* (prompt 30-60), you must identify your input. The merge program combines data from two data sets. The two data sets are referred to as input 1 and input 2.

### Merge Input 1 (Prompt 30-30)

To identify input 1, the following prompt is displayed:

```
Insert INPUT 1 diskette and enter  
Data set name:  _____  
Device address:  _____
```

Press ENTER

30-30

Enter the first input data set name and the device address. Be sure the diskette is loaded in the correct diskette drive.

Press ENTER to continue.

### Merge Input 2 (Prompt 30-31)

To identify the second input data set, the following prompt is displayed:

```
Insert INPUT 2 diskette and enter  
Data set name:  _____  
Device address:  _____
```

Press ENTER

30-31

Enter the second input data set name and device address. The second input diskette must be loaded in the correct diskette drive at this time. The second input data set must have the same record length as the first input data set.

Press the Enter key to continue.

### SPECIFYING THE OUTPUT DATA SET EXCHANGE TYPE (PROMPT 30-61)

You must indicate whether you or the merge program will determine the output data set exchange type. The following prompt is displayed:

```
Do you want to specify output data set exchange type?  
Options are  
1. Yes  
2. No  
Select option:  _ Press ENTER
```

30-61

Enter 1 to indicate that you will specify the data exchange type of the output data set. Then see *Select Exchange Type (Prompt 39-62)* in this chapter.

Enter 2 to indicate that the program specifies the output data set exchange type. Then, see *Specifying the Output Data Set (Prompt 30-32)* in this chapter. If you choose option 2, the merge program references input 1 when assigning an exchange type to the output data set. Input 1 and input 2 can have different data exchange types.

### SELECT DATA EXCHANGE TYPE (PROMPT 30-62)

When you indicate you want to specify the output data set exchange type, the following prompt is displayed:

```
Select exchange type for output data set.  
Options are  
1. BASIC          3. I  
2. H  
Select option:  _ Press ENTER
```

30-62

The three data set types are discussed under *Data Exchange Type* in Chapter 1. The exchange type selected is used in assigning the output data set. Enter your selection and press the Enter key to continue.

## SPECIFYING THE OUTPUT DATA SET (PROMPT 30-32)

The diskette storage for the output data set is unassigned because merge allocates the storage. You must, however, specify the output data set name and device.

The following prompt is displayed:

```
Insert OUTPUT diskette and enter  
Data set name:  -----  
Device address:  ----
```

Press ENTER

30-32

Enter the output data set name and device address for the output data set diskette. Be sure a diskette is inserted in the specified diskette drive.

Press Enter to continue.

This data set may be multivolume. (See *Specifying Multivolume Data Sets* in Chapter 3 for more detail.) When a volume other than the final volume is completed, you are prompted for the next volume.

The output data set consists of full records identical to those in the input data sets.

## SPECIFYING THE MERGE RECORD KEY (PROMPT 30-63)

Once you have identified your output data set, you must specify the data to be extracted from the input record to form the record key. This key indicates how you want the records merged and determines the sequence of the output. The following prompt is displayed:

```
Enter the following for each field to be compared.  
Sequence(1=Ascend,2=Descend)/Data type(1=Char,2=Num)/Position/Length:  
- / - / ----- / --   - / - / ----- / --   - / - / ----- / --  
- / - / ----- / --   - / - / ----- / --   - / - / ----- / --  
Press ENTER
```

30-63

You must specify all four parameters for each field:

Sequence / Data type / Position / Length

A maximum of six fields of data can be entered in the display format.

See *Record Key* in Chapter 1 for details on the explanation and restrictions for each field.

## SPECIFYING AN ALTERNATE COLLATING SEQUENCE (PROMPT 30-64)

After you respond to the record key prompt, you can alter the collating sequence. The following prompt is displayed:

Enter original/new HEX values for each change to collating sequence:

```
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --  
-- / --      -- / --      -- / --      -- / --      -- / --      -- / --
```

Press ENTER to continue

30-64

Either press the Enter key to continue, or enter the original collating (hex) value and the new collating (hex) value for each change. Remember, both characters in the hex value must be entered before the graphic character appears on the prompt. An entry in the last pair of entry spaces causes the prompt to repeat. Appendix C shows the collating values. For more detail, see *Changing the Collating Sequence* in Chapter 1.

### PERFORMING MERGE (PROMPT 30-67)

When you create a command data set and the program is ready to perform the merge, you must indicate whether or not you want it to do so. The following prompt is displayed:

```
Command data set created. Do you want to perform merge?  
Options are  
1. Yes  
2. No  
Select option:  _ Press ENTER
```

30-67

Option 1 indicates the merge should be performed. When you have created a command data set, you might want to choose this option to ensure the merge you have designed completes successfully. If you choose option 1, the next prompt will be SYSMERGE in process (Prompt 30-36), which is discussed next in this chapter.

Option 2 indicates that you only want to create a command data set and not actually perform the merge. If you choose option 2, the next prompt is merge completed (prompt 30-78).

### MERGE IN PROCESS (PROMPT 30-36)

The following display will be visible until another volume is requested or an entry is made through the keyboard.

```
SYSMERGE in process.
```

30-36

The display is for your information only and no response is possible.

## SPECIFYING MULTIVOLUME DATA SETS

### End of Input Volume (Prompt 30-33)

When a volume of an input data set (other than the final volume) is completed, the following prompt is displayed:

```
End of volume, merge input data set      X.  
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN  Volume: SS  
Options are  
  1. Insert diskette for next volume in device  XXXX.  
  2. Terminate input for data set.  
Select option:  _  Press ENTER
```

30-33

Option 1 indicates that you will continue with another volume to the specified input. Insert the next volume of that input into the specified drive and press the Enter key to continue.

Option 2 indicates that no more volumes are to be merged for this data set.

### End of Output Volume (Prompt 30-34)

Merge assigns space to the output data set from the space following the last allocated data set on a specified diskette. Once the allocated space is used and more space is needed, merge displays the following prompt:

```
End of volume; merge output data set _____ Volume: SS
Do NOT remove diskette until next screen is displayed.
Do you want multivolume support?
    1. Yes          2. No
Select option:    _ Press ENTER
```

30-34

Option 1 indicates you will provide another volume and continue merge. When you select this option (multivolume support), prompt 30-35 is displayed. Remember, DO NOT remove the diskette until prompt 30-35 is displayed.

Option 2 discontinues merge. If you select this option an incomplete data set error occurs. Previous volumes might exist coded as continued. You can use the diskette label maintenance utility to correct this. (See the *IBM 5280 Utilities Reference/Operation Manual*, SC21-7788 for details.)

After you press the Reset key, the merge terminated prompt 30-79 is displayed.

### Next Output Volume (Prompt 30-35)

When you select to continue merge output on another volume, the following prompt is displayed:

```
Insert diskette for next volume in device    XXXX.

Press ENTER
```

30-35

Insert the diskette into the specified device and press the Enter key to continue.

## MERGE COMPLETED (PROMPT 30-78)

If the merge is successful, or if you indicated not to perform merge when creating a command data set (option 2 of prompt 30-67), the following prompt is displayed:

```
X          SYSMERGE
Merge completed.
Options are
  1. Restart
  2. Exit
Select option:  _  Press ENTER
```

30-78

Option 1 allows you to run merge again. Refer to *Restarting Merge* in this chapter. When your program is loaded in a foreground partition, option 2 displays the program load prompt, allowing you to load a different program. When your program is in a background partition and choose option 2, the program exits from the partition.

## RESTARTING MERGE

You must insert the sort/merge diskette to restart the merge program if one of the following conditions occurs:

1. Merge terminates after you respond to the command data set prompt (30-65) when running from an existing command data set, or
2. Merge terminates after you have responded to the last alternate collating sequence prompt (30-64).

Make sure the sort/merge diskette is inserted into the specified drive and press the Enter key to continue. If the diskette is not in the proper drive, the load prompt will be displayed. For more detail see *Restarting Sort/Merge* in Chapter 1.

## Chapter 4. Command Data Set Display Operation

The sort/merge command data set display program allows you to review the command data set parameters you specified. When the load prompt is displayed, insert the sort/merge diskette in the appropriate diskette drive.

```
X XXXX XXX  
Program name: _____  
Device address: _____  
Partition number: ...
```

Press ENTER

05-00

Enter SYSCMDSP to identify the display program. The following prompt is displayed:

```
SYSCMDSP - SORT/MERGE COMMAND DATA SET DISPLAY.  
Insert command data set diskette and enter  
Data set name: _____  
Device address: _____
```

Press ENTER

30-50

Then enter the command data set name and the device address where the diskette is located.

Press the Enter key to continue.

You can either display the command data set parameters on the display screen or print them out on a printer. The following prompt gives you the options:

Which output device will be used?

Options are

1. Display
2. Printer

Select option: \_ Press ENTER

30-51

If a printer is not installed with your 5280 system, prompt 30-51 will not be displayed. The command data set information is automatically displayed.

Enter a 1 to display the parameters only on the display screen. Enter a 2 for a printed copy of the parameters from the printer.

If you indicate option 2 (printer) on prompt 30-51, the following prompt instructs you to make sure the printer is ready.

Align paper to top of page.

Enter printer device address: \_\_\_\_\_

Press ENTER

30-52

First, align the printer paper, then enter the printer device address.

**Note:** When using the print option, the record length is a maximum of 80 characters. Ensure the paper is the proper width.

Press the Enter key to continue.

Once printing begins, the following prompt is displayed:

```
SYSCMDSP in process.
```

30-53

This prompt is for your information only; no response is required.

Alternate collating sequence changes may affect a constant when it contains character data. These changes may appear when the command data set is displayed or printed. For example, assume you specified three select record conditions with character type constants of Anderson, Baker, and Anton. Assume you also indicated C1/C2 as a collating sequence change (all As collated as Bs). The constants in the command data set will be displayed or printed as Bnderson, Bbker, and Bnton.

If the character constant contains a nondefined character (no graphics representation on the EBCDIC chart), the character will be printed as a dash.

When the command data set display is successfully completed, the following prompt is displayed:

```
Utility completed.
```

```
Options are
```

```
1. Restart
```

```
2. Exit
```

```
Select option:  _ Press ENTER
```

30-78

Enter a 1 to restart the display program. Enter a 2 to exit the program.

The following are printed examples of command data sets.

### EXAMPLE 1

```
SORT  Command data set name:  EXAMPLE

      Name          Device
Input data set:  INDATA      4000
Output data set: OUTDATA      4400
Work data set:  SYSUT001     D3
Output exchange type:  I

Sort type:  RECORD SUBSET

Record key (Sequence / Data type / Position / Length):
ASCENDING / CHARACTER / 0027/ 002          ASCENDING / NUMERIC / 0048/ 006

Collating sequence changes (Original hex value / New hex value):
40/E9 5B/C8 C1/C2 C2/C1 C8/C9 C9/CA

Record subset output format (Position/Length):
0001/ 0004  0035/ 0012  0048/ 0010

Select records conditions
(Condition number / Option / Field 1 position / Data type / Field length /
 Compare / Field 2 position / Constant / Logical):
01 / OMIT          / 0048/ NUMERIC / 003/ GE /          / +500          / AND
02 / OMIT          / 0058/ CHARACTER / 002/ GT /          / 30          / OR
03 / INCLUDE ALL
```

### EXAMPLE 2

```
MERGE Command data set name:  EXAMPLE

      Name          Device
Input1 data set:  INDATA1     4000
Input2 data set:  INDATA2     4800
Output data set:  OUTDATA      4400
Output exchange type:  H

Record key (Sequence / Data type / Position / Length):
ASCENDING / CHARACTER / 0010/ 012

Collating sequence changes: NONE
```

## Appendix A. Performance Considerations

The time it takes a program to run can vary greatly and is dependent on the following factors:

- Number of records to be included
- Record key size
- Sort type
- Record selection used
- Alternate collating sequence used
- System environment
- Partition size
- Order of data

### *Number of Records to be Included*

The more records you want to sort or merge, the longer the job will take. For the most efficient job, therefore, use the record select option of the sort utility to include only the necessary records.

### *Record Key Size*

The larger the record keys, the longer it will take to run the job. Use the shortest key possible in your record key for the job.

### *Sort Type*

To reduce the run time on a sort job, use the sort type that is most efficient for your job. (Address out will be the fastest since the output contains only a 4-byte relative record number.)

### *Record Selection*

The more conditions and constants you specify, the less main storage space available for records. You should consider using record selection to exclude records you don't want to sort. The result might be a shorter program run than if you don't use record selection.

### ***Alternate Collating Sequence***

Using an alternate collating sequence increases the time it takes to run a job.

### ***System Environment***

Identical jobs (number of records) with equal partition size might have different run times. Jobs that must compete for system resources in a multiprogramming environment usually require more run time than the same job executing alone on the system.

### ***Partition Size***

The larger the partition available for a program, the faster the run time for that job.

### ***Order of Data***

Suppose two data sets contain identical information; however, many of the first data set's records are already in the sequence you want. Using the same sequence specifications to sort each data set would make the program run time faster for the first data set.

## Appendix B. Things to Remember

Under some circumstances, you use the include or omit option with the same results. For instance, the results are the same whether you include all records less than 100 or omit all records greater than 99.

Sort/merge automatically allocates the output data sets for each program after an output data set name and device address is provided.

The record keys of input 1 and input 2 must be identical for merge. Both input 1 and input 2 must be in sequenced order according to the data chosen for the record key. Both merge input data sets must have the same record length.

When using an IBM-supplied diskette for the first time, you must clear the large empty data set that has been preallocated on the diskette. See the *IBM 5280 Utilities Reference/Operation Manual*, SC21-7788 for details on the diskette clear utility and diskette label maintenance utility.

Whenever possible it is good practice to provide a work data set to avoid program termination which occurs when a work data set is needed and not provided. The work data set is cleared from the diskette automatically after sort completion. To ensure that enough storage is available on the work data set diskette, it is best to provide an empty diskette. If possible, keep a scratch diskette on hand to use as a work data set diskette.

Data set size is important when you are using one drive. If partition storage is not large enough to provide enough work area, the input, the output, and the work data sets are all located on the same diskette. This limits the size of the data set that can be handled.

Data exchange type I is the most efficient exchange type, supported by many systems, and can be exchanged with systems other than 5280.

Specifying only omit conditions on the record select prompt leaves nothing in the work area to sort. At least one include statement must be specified, either include or include all, to have records in the sort.

The amount of work data set storage space depends on your data station. If you have one drive, the work data set is allocated after the last data set on your diskette. If you have two available drives, you should specify the diskette with the most diskette space available after the output data set is allocated. If you have three available drives, you can dedicate a drive and diskette to the work data set for maximum work data set storage.



## Appendix C. EBCDIC Collating Sequence

U.S./Canada EBCDIC Chart

Entry	Graphic								
00		34		68		9C		D0	}
01		35		69		9D		D1	J
02		36		6A	!	9E		D2	K
03		37		6B	,	9F		D3	L
04		38		6C	%	A0		D4	M
05		39		6D	-	A1	-	D5	N
06		3A		6E	>	A2	s	D6	O
07		3B		6F	?	A3	t	D7	P
08		3C		70		A4	u	D8	Q
09		3D		71		A5	v	D9	R
0A		3E		72		A6	w	DA	
0B		3F		73		A7	x	DB	
0C		40	blank	74		A8	y	DC	
0D		41		75		A9	z	DD	
0E		42		76		AA		DE	
0F		43		77		AB		DF	
10		44		78		AC		E0	\
11		45		79	.	AD		E1	
12		46		7A	:	AE		E2	S
13		47		7B	#	AF		E3	T
14		48		7C	@	B0		E4	U
15		49		7D	'	B1		E5	V
16		4A	¢	7E	=	B2		E6	W
17		4B	.	7F	"	B3		E7	X
18		4C	<	80		B4		E8	Y
19		4D	(	81	a	B5		E9	Z
1A		4E	+	82	b	B6		EA	
1B		4F		83	c	B7		EB	
1C		50	&	84	d	B8		EC	
1D		51		85	e	B9		ED	
1E		52		86	f	BA		EE	
1F		53		87	g	BB		EF	
20		54		88	h	BC		E0	0
21		55		89	i	BD		F1	1
22		56		8A		BE		F2	2
23		57		8B		BF		F3	3
24		58		8C		C0	(	F4	4
25		59		8D		C1	A	F5	5
26		5A	!	8E		C2	B	F6	6
27		5B	\$	8F		C3	C	F7	7
28		5C	*	90		C4	D	F8	8
29		5D	)	91	j	C5	E	F9	9
2A		5E	;	92	k	C6	F	FA	
2B		5F	~	93	l	C7	G	FB	
2C		60	-	94	m	C8	H	FC	
2D		61	/	95	n	C9	I	FD	
2E		62		96	o	CA		FE	
2F		63		97	p	CB		FF	
30		64		98	q	CC			
31		65		99	r	CD			
32		66		9A		CE			
33		67		9B		CF			

**Note:** The EBCDIC graphics are shown in this chart. See the *System Concepts* manual for the graphics displayed for other national character sets. Graphics are assigned to all blank positions (except hex 40) for maintenance purposes. These graphics are incompatible with other systems and cannot be used for exchange purposes.



**addrout data set:** A record address diskette data set produced by the sort program. An address out (addrout) data set contains the binary relative record numbers of records in a diskette data set, and can be used to process the data set designated as the input data set to the sort program.

**addrout sort:** A type of sort where the output consists of 4-byte, binary, relative record numbers that indicate the relative positions of records in a data set.

**allocation:** Assigning a resource, such as an output data set or a work data set, for use in performing a specific task.

**alternate collating sequence:** A specific user-defined alternative to the the standard EBCDIC collating sequence.

**basic data exchange:** A diskette data exchange that uses 128-byte sectors. The basic data exchange formats allow you to exchange data between 5280 and other systems that use the basic data exchange format.

**byte:** A sequence of 8 binary digits that could represent a character and can be operated upon as a unit.

**binary:** Pertaining to a numeric code that uses exactly two distinct characters, usually 0 and 1.

**character:** A letter, digit, or other symbol used to represent data.

**collating sequence:** The order each character holds in relation to other characters in a set, such as the letters of an alphabet.

**command data set:** A data set that contains the parameters that are necessary to perform a particular sort or merge.

**data exchange:** The exchange of diskettes and the data recorded on them with a system or device different from the one recording the data.

**data set:** On a diskette, an organized collection of related data records treated as a unit.

**data set name:** The name associated with a data set. The first character must be alphabetic, and the remaining characters can be any combination of alphabetic or numeric characters. Blanks cannot appear between characters in a name.

**device address:** EBCDIC characters used to identify a 5280 device such as a diskette drive or printer. (See logical device, physical device.)

**diskette drive:** The mechanism used to read information from and write information to a diskette.

**EBCDIC (extended binary-coded decimal interchange code):** A character set containing 256 eight-bit characters.

**field:** One or more bytes of related information in a record.

**field length:** The number of positions allowed for a given field, determined by the maximum length of information that will be entered in the field.

**full record:** A type of sort where the output contains records identical to the input records.

**hex:** Hexadecimal. A number system using 16 symbols: 0-9, A-F each representing 4 bits (one-half byte).

**H-type data exchange:** A diskette data exchange format that uses 256-byte sectors. The H-type exchange allows you to exchange data between 5280 and other systems that use the H-type data exchange format.

**IPL:** See initial program load.

**I-type data exchange:** An exchange type that has records in blocked and spanned format. This allows the use of any available standard physical record size.

**index/key:** The field within a record that identifies that record. See index/key sort.

**index/key sort:** A type of sort in which the output data set contains an index/key and a relative record number. The index/key is an input record field specified by the user.

**initial program load:** The initialization procedure that causes an operating system to start operation.

**input data set:** A set of records a program uses as source information.

**input record:** A data record that is transferred from an input data set to computer storage for processing.

**logical:** A symbol that represents the logical connection or action to be performed between the terms in an expression. The connection between conditions in a sort record selection.

**merge program:** A program product used to combine two sequential sets of records into one.

**multivolume:** A data set that requires more than one volume to physically store all the records in the data set.

**open:** To prepare a data set for processing.

**parameter:** A variable that is given a value for a specified application.

**partition:** A specified area of 5280's storage in which a program can execute.

**prompt:** A message issued by a program; the prompt requests either information or an operator action to continue processing.

**record:** A collection of related data, treated as a unit.

**record key:** Collectively, fields of data specified to be examined during a sort or merge operation to determine the sequence of the output data set. Used by sort or merge to generate output.

**record subset:** A type of sort in which fields from the input record are combined to form the output of the sort.

**relative record number:** A number that specifies the location of a record in relation to the beginning of the file.

**signed numeric:** A numeral with an associated algebraic sign denoting a positive or negative value.

**sort program:** A program product used to arrange records into a desired sequence, according to data contained in one or more specific fields within the records.

**sort sequence specifications:** User-specified information indicating the various sort key fields in ascending or descending order. This information is used by the sort/merge programs in generating the output data set.

**status line:** For the 5280, the first line on a display screen. This line provides operational information.

**volume:** A data carrier that is mounted and demounted as a unit.

**work data set:** An area on diskette that is reserved for temporary storage of data being processed.

- addr out sort 3
  - allocation 9
  - alternate collating sequence 19
  - alternate collating sequence (30-64) 19, 44, 58
  - ASCII diskettes 7
    - limitations 7
  - automatic output data set allocation 9
  - automatic work data set allocation 18
- 
- BASIC data exchange 11
  - byte 3
- 
- calculating output data set 9
  - calculating work data set 18
  - close/release data 9
    - input/output 9
    - work 18
  - collating sequence 19, 44, 58
  - command data set 7
  - command data set - existing (30-65) 36, 52
  - command data set created (30-67) 46
  - command data set diskette (30-65) 35, 51
  - command data set display 5, 63
  - command data set display - which device (30-51) 64
  - command data set 7
  - command display in process (30-53) 65
  - command data set information (30-68) 37, 53
  - completion 30
  - constant 25
  - control information (command data set) 7, 37, 53
  - correcting errors 31
  - creating a command data set (30-65) 35, 51
- 
- data exchange 11, 12
  - data security (see security) 8
  - data set allocation 9
  - dedicated drive 10
  - device address 7
  - display command data set 63
  - drives 1
- 
- EBCDIC 19
  - end of volume (merge output 30-34) 61
  - end of volume - (merge input 30-33) 60
  - entry method (30-60) 34, 50
  - errors 31
  - exchange types 11
    - specify (30-61) 39
  - exchange types - select (30-62) 39
- 
- format of records 11
  - full record sort 2
- 
- graphic characters 19, 71
  - guide to using include/omit 22
- 
- H type data exchange 11
  - hex 19
- 
- I type data exchange 11
  - include all (record select) 23
  - include/omit 22
  - index key sort 4
  - indexing 4
  - input data set ID (30-01) 38
  - input 1 (merge 30-30) 54
  - input 2 (merge 30-31) 54
  - IPL 6
- 
- key 4, 13
  - key field 4, 13

load prompt (05-00) 6, 33, 49, 63  
 loading command data set display (05-00) 63  
 loading merge (05-00) 49  
 loading sort (05-00) 33  
 loading sort/merge 6  
 logical device address 7  
 logical operator 25

merge 5, 49  
 merge completed (30-78) 62  
 merge in process (30-36) 59  
 merge input 1 (30-30) 54  
 merge input 2 (30-31) 54  
 merge record key (30-63) 57  
 merge terminated (30-79) 30  
 multivolume  
   end of volume (30-33, 30-34) 60, 61  
 multivolume support 5, 8, 10

next output volume (30-35) 61  
 number of records  
   affects on sort time 67  
 number of sequence specifications  
   affect on sort/merge 67

omit (record select) 22  
 open data sets 1  
 order of sequence specifications 29  
 organization of manual 1  
 output data set (calculating size) 9  
 output data set 9  
 output data set exchange type (30-61) 39, 55  
 output data set ID merge (30-32) 56  
 output data set ID sort (30-03) 42  
 output device (30-51) 64  
 output exchange type (30-61) 39, 55  
 owner identifier (ID) 8

parameters 7  
 partition 6  
 perform merge (30-67) 59  
 perform sort (30-67) 46  
 performance considerations 67  
 physical device address 7  
 print command data set 63  
 printer device address (30-52) 64

prompts 5  
   align paper (30-52) 64  
   alternate collating sequence (30-64) 19, 44, 58  
   command data set display (30-50) 63  
   command data set diskette (30-65) 36, 52  
   command data set information (30-68) 37, 53  
   end of input volume (30-33) 60  
   end of output volume (30-34) 61  
   load (05-00) 33, 49, 63  
   merge completed (30-78) 62  
   merge in process (30-36) 59  
   merge input 1 (30-30) 54  
   merge input 2 (30-31) 54  
   next output volume (30-35) 61  
   output data set exchange type? (30-61) 39, 55  
   performing merge (30-67) 59  
   performing sort (30-67) 46  
   record key (30-63) 41, 57  
   record selection (30-05) 22, 45  
   record subset (30-02) 40  
   select exchange type (30-62) 39, 55  
   select entry method (30-60) 34, 50  
   select exchange type (30-62) 39, 55  
   select sort type (30-00) 38  
   sort completed (30-78) 47  
   sort in process (30-06) 47  
   specify input data set (30-01) 38  
   specify output data set (30-03) 42  
   specify output data set (30-32) 56  
   specify work data set (30-04) 43  
   SYSCMDSP completed (30-78) 65  
   termination (30-79) 30  
   volume protection (05-01) 8  
   which output device (30-51) 64

record format 2, 11  
 record key 13  
 record key (30-63) 41, 57  
 record selection (30-05) 22, 45  
 record size (length) 3  
 record subset (30-02) 40  
 record subset sort 3, 16  
 records (quantity of)  
   affect on sort/merge 67  
 reference number (prompts) 5  
 relative record number 3  
   address out 3  
 restarting sort/merge 32, 48, 62  
 running time 67

security (data) 8  
 select entry method (30-60) 34, 50  
 select exchange type (30-62) 39, 55  
 select records (30-05) 22, 45  
 select sort type (30-00) 38

sequence (collating)  
   changing standard collating sequence 19  
 size of records 3  
   affect on sort/merge run time 67  
 size of work data set 18  
   calculating size of work data set 67  
 sort 2, 33  
   sort completed (30-78) 47  
   sort in process (30-06) 47  
   sort input diskette (30-01) 38  
   sort record key (30-63) 41  
   sort terminated (30-79) 30  
   sort time affected 67  
   sort types 2  
   specify record key (30-63) 13, 41  
   standard collating sequence 19  
   subset sort 3  
   SYSCMDSP (30-50) 63  
   SYSCMDSP in process (30-53) 65  
   SYSCMDSP completed (30-28) 65  
  
 termination 30  
 time required to sort/merge 67  
 types of sort 2

using an existing command data set (30-65) 36

volume protect 8

work data set 18  
 work data set ID (30-04) 43

05-00 load 33, 49, 63  
 05-01 volume protection 8

30-00 select sort type 38  
 30-01 specify input data set 38  
 30-02 record subset 40  
 30-03 specify output data set 42  
 30-04 specify work data set 43  
 30-05 record selection 22, 45  
 30-06 sort in process 47

30-30 merge input 1 54  
 30-31 merge input 2 54  
 30-32 specify output data set 56  
 30-33 end of input volume 60  
 30-34 end of output volume 61  
 30-35 next output volume 61  
 30-36 merge in process 59

30-50 command data set display 63  
 30-51 which output device 64  
 30-52 align paper 64  
 30-53 SYSCMDSP in process 65

30-60 select entry method 34, 50  
 30-61 output data set exchange type 39, 55  
 30-62 select exchange type 39, 55  
 30-63 record key 41, 57  
 30-64 alternate collating sequence 19, 44, 58  
 30-65 command data set diskette 36, 52  
 30-67 performing sort/merge 46, 59  
 30-68 command data set information 37, 53  
 30-78 utility completed 47, 62, 65  
 30-79 termination 30



**Please use this form only to identify publication errors or request changes to publications.** Technical questions about IBM systems, changes in IBM programming support, requests for additional publications, etc, should be directed to your IBM representative or to the IBM branch office nearest your location.

**Error in publication** (typographical, illustration, and so on). **No reply.**

*Page Number    Error*

**Inaccurate or misleading information in this publication.** Please tell us about it by using this postage-paid form. We will correct or clarify the publication, or tell you why a change is not being made, provided you include your name and address.

*Page Number    Comment*

IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

● No postage necessary if mailed in the U.S.A.

Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Cut Along Line

Fold and tape

Please do not staple

Fold and tape



NO POSTAGE  
NECESSARY IF  
MAILED IN THE  
UNITED STATES

**BUSINESS REPLY MAIL**  
FIRST CLASS      PERMIT NO. 40      ARMONK, N. Y.



POSTAGE WILL BE PAID BY ADDRESSEE

IBM CORPORATION  
Product Information Development  
Department 997  
11400 Burnet Road  
Austin, Texas 78758

Fold and tape

Please do not staple

Fold and tape



International Business Machines Corporation

General Systems Division  
4111 Northside Parkway N.W.  
P.O. Box 2150  
Atlanta, Georgia 30301  
(U.S.A. only)

General Business Group/International  
44 South Broadway  
White Plains, New York 10601  
U.S.A.  
(International)





**International Business Machines Corporation**

**General Systems Division  
4111 Northside Parkway N.W.  
P.O. Box 2150  
Atlanta, Georgia 30301  
(U.S.A. only)**

**General Business Group/International  
44 South Broadway  
White Plains, New York 10601  
U.S.A.  
(International)**

IBM 5280 Sort/Merge Reference/Operation Manual (File No. S5280-33) Printed in U.S.A. SC21-7789-0



# Technical Newsletter

This Newsletter No. SN21-8197

Date 14 November 1980

Base Publication No. SC21-7789-0

File No. S5280-33

Previous Newsletters None

## IBM 5280 Sort/Merge Reference/Operation Manual

© IBM Corp. 1980

This technical newsletter applies to release 2, modification 0 of IBM 5280 Sort/Merge (Program 5708-SM1) and provides replacement pages for the subject publication. These replacement pages remain in effect for subsequent releases and modifications unless specifically altered. Pages to be inserted and/or removed are:

Title page, Preface  
iii, iv  
1 through 4  
13, 14  
17 through 20  
37, 38  
43, 44  
57, 58  
69, 70

Changes to text and illustrations are indicated by a vertical line at the left of the change.

### Summary of Amendments

- Volume sequence number is included as the first byte of the relative record number for *address out* and *index/key* sorts.
- Ascending and descending collating sequences are explained.
- The status line is displayed for the alternate collating sequence prompt.

**Note:** Please file this cover letter at the back of the manual to provide a record of changes.

IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901

© IBM Corp. 1980

Printed in U.S.A.

•



SC21-7789-0  
S5280-33

# **IBM 5280 Distributed Data System**

**Sort/Merge Reference/Operation Manual**

Program Number 5708-SM1

## Preface

This manual is intended for users of the 5280 Sort/Merge Program Product. It is designed to be a user's manual and reference guide for operators and programmers. This manual assumes the reader has a basic knowledge of the 5280 system operation and its functions.

The first chapter explains the general content of the manual and introduces the sort/merge programs. This chapter also explains some of the concepts of sort and merge. Chapter two and three discuss each program individually.

### Related Publications

- *IBM 5280 General Information*, GA21-9350
- *IBM 5280 System Concepts*, GA21-9352
- *IBM 5280 Utilities Reference/Operation Manual*, SC21-7788
- *IBM 5280 Message Manual* (to be available at a later date)

### First Edition (January 1980)

This edition applies to release 2, modification 0 of the IBM Sort/Merge Program (Program Product 5708-SM1) and to all subsequent versions and modifications until otherwise indicated in new editions or technical newsletters.

Changes are periodically made to the information herein; changes will be reported in technical newsletters or in new editions of this publication.

This publication contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious, and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental. It is possible that this material may contain reference to, or information about, IBM products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that IBM intends to announce such IBM products, programming, or services in your country.

Use this publication only for the purposes stated in the *Preface*.

Publications are not stocked at the address below. Requests for copies of IBM publications and for technical information about the system should be made to your IBM representative or to the branch office serving your locality.

This publication could contain technical inaccuracies or typographical errors.

Use the Reader's Comment Form at the back of this publication to make comments about this publication. If the form has been removed, address your comments to IBM Corporation, Product Information Development, Department 997, 11400 Burnet Road, Austin, Texas 78758.

IBM may use and distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

## Contents

<b>CHAPTER 1. AN OVERVIEW OF SORT/MERGE . . . . .</b>	<b>1</b>	<b>CHAPTER 3. MERGE OPERATION . . . . .</b>	<b>49</b>
The Sort Program . . . . .	2	Loading the Merge Program . . . . .	49
The Merge Program . . . . .	5	Specifying the Entry Method (Prompt 30-60) . . . . .	50
Command Data Set Display . . . . .	5	Creating a Command Data Set (Prompt 30-65) . . . . .	51
Prompts . . . . .	5	Using a Command Data Set (Prompt 30-65) . . . . .	52
Loading the Sort/Merge Programs . . . . .	6	Command Data Set Information (Prompt 30-68) . . . . .	53
Command Data Set Information . . . . .	7	Specifying the Input Data Sets (Prompts 30-30 and 30-31) . . . . .	54
Diskette Security . . . . .	8	Merge Input 1 (Prompt 30-30) . . . . .	54
Input Data Set . . . . .	8	Merge Input 2 (Prompt 30-31) . . . . .	54
Output Data Set . . . . .	9	Specifying the Output Data Set Exchange Type (Prompt 30-61) . . . . .	55
Merging Multivolume Data Sets . . . . .	10	Select Data Exchange Type (Prompt 30-62) . . . . .	55
Data Exchange Type . . . . .	11	Specifying the Output Data Set (Prompt 30-32) . . . . .	56
Exchange Limitations . . . . .	12	Specifying the Merge Record Key (Prompt 30-63) . . . . .	57
Record Key . . . . .	13	Specifying an Alternate Collating Sequence (Prompt 30-64) . . . . .	58
Sort Record Key . . . . .	15	Performing Merge (Prompt 30-67) . . . . .	59
Record Subset Sort . . . . .	16	Merge In Process (Prompt 30-36) . . . . .	59
Merge Record Key . . . . .	17	Specifying Multivolume Data Sets . . . . .	60
Work Data Sets (Sort Only) . . . . .	18	End of Input Volume (Prompt 30-33) . . . . .	60
Changing the Collating Sequence . . . . .	19	End of Output Volume (Prompt 30-34) . . . . .	61
Record Selection (Sort Only) . . . . .	22	Next Output Volume (Prompt 30-35) . . . . .	61
Completion/Termination . . . . .	30	Merge Completed (Prompt 30-78) . . . . .	62
Utility Terminated (Prompt 30-79) . . . . .	30	Restarting Merge . . . . .	62
Error Recovery . . . . .	31	<b>CHAPTER 4. COMMAND DATA SET DISPLAY OPERATION . . . . .</b>	<b>63</b>
Errors During Data Entry . . . . .	31	<b>APPENDIX A. PERFORMANCE CONSIDERATIONS . . . . .</b>	<b>67</b>
Errors During Processing . . . . .	31	<b>APPENDIX B. THINGS TO REMEMBER . . . . .</b>	<b>69</b>
Restarting Sort/Merge . . . . .	32	<b>APPENDIX C. THE EBCDIC COLLATING SEQUENCE . . . . .</b>	<b>71</b>
<b>CHAPTER 2. SORT OPERATION . . . . .</b>	<b>33</b>	<b>GLOSSARY . . . . .</b>	<b>73</b>
Loading the Sort Program (Prompt 05-00) . . . . .	33	<b>INDEX . . . . .</b>	<b>75</b>
Specifying the Entry Method (Prompt 30-60) . . . . .	34		
Creating a Command Data Set (Prompt 30-65) . . . . .	35		
Using a Command Data Set (Prompt 30-65) . . . . .	36		
Command Data Set Information (Prompt 30-68) . . . . .	37		
Selecting the Sort Type (Prompt 30-00) . . . . .	38		
Specifying the Input Data Set (Prompt 30-01) . . . . .	38		
Specifying the Output Data Set Exchange Type (Prompt 30-61) . . . . .	39		
Select Data Set Exchange Type (Prompt 30-62) . . . . .	39		
Specifying the Record Subset (Prompt 30-02) . . . . .	40		
Specifying the Sort Record Key (Prompt 30-63) . . . . .	41		
Specifying the Output Data Set (Prompt 30-03) . . . . .	42		
Specifying the Work Data Sets (Prompt 30-04) . . . . .	43		
Specifying an Alternate Collating Sequence (Prompt 30-64) . . . . .	44		
Selecting the Records to be Sorted (Prompt 30-05) . . . . .	45		
Performing Sort (Prompt 30-67) . . . . .	46		
Sort In Process (Prompt 30-06) . . . . .	47		
Sort Completed (Prompt 30-78) . . . . .	47		
Restarting Sort . . . . .	48		



## Chapter 1. An Overview of Sort/Merge

This chapter discusses the sort and merge programs, how to load and use them, and your interaction with the system. Material is arranged to provide a step-by-step explanation of the operation of each utility. For this reason, it is important to read the material in sequence.

After using this manual, the reader should be able to:

- Understand the purpose of sort/merge.
- Perform the steps required to:
  - load the sort and merge programs from a diskette.
  - start the operation.
  - create and display a command data set
  - terminate the operation.
- Respond to the screen displays (prompts). Examples of prompts are provided sequentially as they would appear in an actual operation. Response choices are listed following each prompt.
- Recover from errors caused when sort or merge is being used. Error messages and the suggested responses to them are listed in the *Message Manual* to assist you with an error.

With both programs, the diskette data sets must be in the diskette drive when they are identified. The sort/merge program diskette may be removed after the program has been loaded.

The sort data sets are opened in the sequence: input, output, work. The merge data sets are opened in the sequence: input 1, input 2, output. If the proper data set diskettes are not inserted in the proper diskette drives, the status line blinks. The information on the status line indicates which of the data sets caused the error. To continue processing, press the Reset key, modify the prompt data as required and then press the Enter key. Be sure that data set diskettes are not removed from their drive until the program ends, because errors could occur. If the results of your sort or merge are not what you expected, reexamine the parameters you specified.

The merge program supports multivolume input and output (either or both), but two or more drives are required. A two-drive system provides you with multivolume output when necessary. For complete multivolume support you must be able to dedicate a drive to each multivolume data set. See *Merging Multivolume Data Sets* in this chapter.

## THE SORT PROGRAM

Sort allows you to change the order of your records. The records from the original data set are used to create a new data set with the records in the sorted order. The input data set is not altered. The input data set must be on a single diskette, and may be a volume of a multivolume data set.

The sort program offers four types of sorted output. These are:

- Full record sort
- Address out sort
- Record subset sort
- Index/key sort

The differences among the sort type options are in the format or contents of the output as follows:

**Note:** In the following examples names are sorted in ascending alphabetical order.

1. *Full record* writes the entire record to the output data set in sorted order.

Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Each full record is written to your output data set.

Dan	Jim	Pat	Tom
29	41	23	35
3524	1473	4826	4186

2. *Address out* writes 4-byte binary relative record numbers to the output data set. If the input data set is a volume of a multivolume data set, the first byte of the relative record number specifies the volume sequence number (hex 01 through 63) of the input data set; otherwise the first byte is hex 00. The remaining bytes of the relative record number correspond to the position of the record in the input data set. In effect, you have created an index for your data set. Using DE/RPG you can read the relative record numbers from your address out data set and directly access records from the input data set. (See the *IBM 5280 DE/RPG User's Guide*, SC21-7804 or the *IBM 5280 DE/RPG Reference Manual*, SC21-7787 for details.)

Because entire input records are not written, an address out sort is faster than the other sort types. (See *Performance Considerations* in Appendix A for more information.) The output of the sort also requires less diskette space since the address out data set contains only a 4-byte binary relative record number instead of the full record length.

Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Only a relative record number is written to your output data set to act as an index in referencing your records. In this example, the input data set is not multivolume, and the first relative record is number 2 (Dan). The binary relative record numbers are shown in hexadecimal.

X '00000002'	X '00000004'	X '00000003'	X '00000001'
--------------	--------------	--------------	--------------

3. *Record subset* combines specified fields from the input record to form the records written to the output data set. Records in the output data set contain only those fields you specified from each input record. Fields in the subset might be repeated, resulting in the possibility of a subset being longer than the input record length. The total length of all specified fields must not exceed 1,024 characters.

Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Dan	Jim	Pat	Tom
29	41	23	35

Your output contains a subset of data fields from your input data set. In this example, the name and age fields are used as the subset.

4. *Index/key* writes an index/key to the output data set. The index/key consists of a key field and a relative record number. The key is an input record field you select. Only one field can be selected for the key, and it must not be more than 28 bytes long.

The 4-byte binary relative record number indicates the volume and relative position of the record in the input data set. If the input data set is a volume of a multivolume data set, the first byte of the relative record number specifies the volume sequence number (hex 01 through 63) of the input data set; otherwise the first byte is hex 00. The remaining three bytes specify the relative position of the record in the input data set.

Tom	Dan	Pat	Jim
35	29	23	41
4186	3524	4826	1473

Your output contains a key field name plus a relative record number. In this example, the input data set is volume 2 of a multivolume data set. The binary relative record numbers are shown in hexadecimal.

Dan	Jim	Pat	Tom
X '02000002'	X '02000004'	X '02000003'	X '02000001'

For example, if you are using a diskette 2D that has been initialized with 256-byte sectors, your output must be H or I on a diskette 2D. Even though other diskette types have 256-byte sectors, H exchange type is only supported by diskette 2D.

With the 5280 system it is most efficient to create and assign exchange type I on your data sets for processing. Basic exchange type is efficient for exchange with other systems and is supported by many IBM systems. See *System Concepts* for more detail.

## RECORD KEY

How your records are sorted or merged (alphabetically by last names or numerically by account number, for example) is determined by the record key.

The record key consists of fields of data you specify to be examined. The data field specified first is examined first, and so on until all designated data fields are examined. Collectively the data in the specified fields is referred to as a record key.

A maximum of six fields of data can be read from the input data set to form the record key, and the total length of the key can be as long as 64 characters of data.

**Note:** In an index/key sort only one data field may be designated and cannot exceed a length of 28 bytes.

The system prompts you to designate four parameters (or characteristics) for each field of data you include in the record key. A sequence type, data type, record position, and field length must be entered in the display format for each field of data. The fields are processed in the order they appear on the display.

The following prompt is displayed:

```
Enter the following for each field to be compared.  
Sequence(1=Ascend,2=Descend)/Data type(1=Char,2=Num)/Position/Length:  
_ / _ / ____ / __   _ / _ / ____ / __   _ / _ / ____ / __  
_ / _ / ____ / __   _ / _ / ____ / __   _ / _ / ____ / __  
Press ENTER
```

30-63

Possible entries for each parameter are:

*Sequence*

You can enter 1 for ascending EBCDIC sequence (hex 00 through FF) or enter 2 for descending EBCDIC sequence (hex FF through 00) with respect to the collating sequence. Appendix C shows the US/Canada EBCDIC collating sequence.

*Data type*

You can enter 1 to indicate character or positive numeric data, or you can enter 2 to indicate positive or negative numeric data.

**Note:** A field that might contain a negative value (such as an account balance) must be designated a data type 2. All other data can be designated as a data type 1.

*Position*

This parameter is the starting position of the field within the input record. The value in this field cannot exceed the logical record length.

*Length*

This parameter is the number of characters in the data field.

- Data type 1 can be 1-64 characters long.
- Data type 2 can be 1-16 digits long.
- The length of this field cannot exceed 28 characters if an index/key sort has been specified.

**Note:** The total value of the position and length cannot be greater than the logical record length plus one.

**Sort Record Key**

Assume you specified the following records:

1	10	27	35	48	58
Customer Number	Customer Name	Region	Salesman	Balance	Overdue (days)
4961	National Foods	03	Thompson	300.00	
6446	Morgan Hardware	02	Mitchell	500.00	60
4429	Davis Paints	02	Mitchell	100.00	
2905	Office Supply	01	Norton	700.00	30
6881	Burton Drug	03	Thompson	485.00	45
5280	King's Drive-In	01	Norton	197.00	
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
14 5407	Mel's TV Repair	01	Norton	890.00	60

## Merge Record Key

In a merge program, records from either input data set must have the same field characteristics. Records from either input data set must also be the same record length.

Assume you want to merge the records of several new customers into an alphabetic listing of all your customers. You specify the following merge record key:

1 / 1 / 0010 / 17  
Field 1

The listing of your present customers looks like this:

<b>Account Number</b>	<b>Customer Name</b>	<b>Region</b>	<b>Salesman</b>	<b>Account Balance</b>	<b>Overdue (days)</b>
6730	American News	01	Norton	890.00	60
6881	Burton Drug	03	Thompson	485.00	45
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Fixit	03	Thompson	525.00	45
4429	Davis Paints	02	Mitchell	100.00	
5280	King's Drive-In	01	Norton	197.00	
5407	Mel's TV Repair	01	Norton	225.00	30
6446	Morgan Hardware	02	Mitchell	500.00	60
4961	National Foods	03	Thompson	300.00	
2905	Office Supply	01	Norton	700.00	30

The listing of your new customers appears as follows. Remember, both data sets must already be in sequence or your merge will terminate.

<b>Account Number</b>	<b>Customer Name</b>	<b>Region</b>	<b>Salesman</b>	<b>Account Balance</b>	<b>Overdue (days)</b>
3490	Gene's Plumbing	01	Norton	150.00	
2382	Hammel Meats	03	Thompson	215.00	
6727	Nichol's Electric	03	Thompson	85.00	
4968	Porter Dairy	02	Mitchell	135.00	
5473	Vick's Delivery	03	Thompson	245.00	

After the two data sets are merged, the new listing of all your customers looks like this:

<b>Account Number</b>	<b>Customer Name</b>	<b>Region</b>	<b>Salesman</b>	<b>Account Balance</b>	<b>Overdue (days)</b>
6730	American News	01	Norton	890.00	60
6881	Burton Drug	03	Thompson	485.00	45
2784	Casper Books	02	Mitchell	650.00	60
6697	Dan's Flowers	03	Thompson	525.00	45
4429	Davis Paints	02	Mitchell	100.00	
3490	Gene's Plumbing	01	Norton	150.00	
2382	Hammel Meats	03	Thompson	215.00	
5280	King's Drive-In	01	Norton	197.00	
5407	Mel's TV Repair	01	Norton	225.00	30
6446	Morgan Hardware	02	Mitchell	500.00	60
4961	National Foods	03	Thompson	300.00	
6727	Nichol's Electric	03	Thompson	85.00	
2905	Office Supply	01	Norton	700.00	30
4968	Porter Dairy	02	Mitchell	135.00	
5473	Vick's Delivery	03	Thompson	245.00	

### WORK DATA SETS (Sort Only)

To allow for the difference in the needs of each sort, the sort program always requests a diskette for the creation of up to two work data sets. You might or might not specify work data sets available. However, if the partition storage is not large enough and no work data set is available, the sort program will terminate.

The work data sets must be contained on a single diskette. The work data sets are assigned space on a specified diskette following the last allocated data set on that diskette. When 2 work data sets are necessary, the output data set is assigned space prior to the work data sets being assigned space. When the output data set and work data sets are on the same diskette, the output data set is also assigned space physically ahead of the work data sets.

The diskette space used for the work data sets is freed upon completion of the sort.

The available storage in the partition being used is normally sufficient for an average simple sort. However, the amount of work area needed in the partition varies greatly depending on the complexity of the sort. Input record length, key length, number of records, partition size, and the number of options specified will affect the amount of work area needed.

To avoid program termination if work data sets are needed and not available, it is best to always have work data sets available. The maximum number of work data set records you would need is 2 1/2 times the number of records in the input data set. The length of a work data set record is equal to the length of the sort record key plus 3.

## CHANGING THE COLLATING SEQUENCE

If necessary, you can alter the standard EBCDIC collating sequence. (See Appendix C for the U.S./Canada chart of the EBCDIC collating sequence and hex value. See the *System Concepts* manual for all other available EBCDIC collating charts.) That is, you can specify that certain characters be treated as though they have a different value within the collating sequence. For example, instead of A B C D E F followed later by a b c d e f, you might want the sequence to be: A a B b C c D d E e F f.

This option allows you to treat a character as if it has a value in the sequence normally assigned to another character. Both the new and the original character will have the same apparent value in the sequence and will be considered equal. If the two characters are not to appear equal, you must also assign a new value to the original character.

When responding to prompt 30-64, you will notice that the graphic character will not appear on the display until after you have entered both characters in the hex value. For example, an A appears only after you enter both the C and 1 for the hex value C1. If you enter a nondefined character (one that has no graphic representation on the EBCDIC chart) a solid rectangular block (■) appears on the display. The hex value for the position above the cursor is displayed on the status line.

**Note:** The alternate collating sequence changes are applied only to record key fields specified with a character data type. The changes are also applied to character constants specified in the select records prompt (30-05).

You can specify a change when the following prompt is displayed:

The screenshot shows a terminal window with a rounded rectangular border. At the top left, there is a vertical line. The text inside the window is as follows:

```
0 0001      H 01 40  
Enter original/new HEX values for each change to collating sequence:  
_/_      _/_      _/_      _/_      _/_      _/_  
_/_      _/_      _/_      _/_      _/_      _/_  
_/_      _/_      _/_      _/_      _/_      _/_  
Press ENTER to continue
```

An arrow labeled "Cursor" points to the first underscore in the first row of underscores. In the bottom right corner of the window, the text "30-64" is displayed.

### EXAMPLE 1

Assume you want the blank treated the same as the Z. You enter:

40/E9

Whenever the program encounters a blank (hex 40), the system treats the blank the same as it does a Z (hex E9). All blanks then are collated in sequence as if they were Zs.

### EXAMPLE 2

If you want the program to sort B before A, enter:

C1/C2 C2/C1

The first entry (C1/C2) assigns the A (C1) the B (C2) value and the characters share that value. The B (C2) then receives the A (C1) value with the second entry (C2/C1). The characters A (C1) and B (C2) have exchanged collating values and the program sorts the B ahead of the A.

### EXAMPLE 3

If you want all dollar signs (5B on the EBCDIC chart) collated ahead of the letter H (C8) you could enter:

5B/C8 C8/C9 C9/CA

This tells the system to assign the 5B (\$) the C8 (H) value, the C8 (H) the C9 (I) value, and the C9 (I) the CA (unassigned) value. Each set of parameters has reassigned the next character one value down on the collating sequence. You normally reassign character values up or down until you reach an available blank space or a space occupied by a seldom used special character in the EBCDIC chart. This allows each character its own collating value rather than sharing a value with another character and the two appearing equal as in example 1.

If you specify collating values in the last entry spaces of the prompt, the prompt is displayed again after you press the Enter key. This allows you to enter any number of changes (18 on each prompt). Be aware that the last value you assign a hex character is the one that is effective. For example, if you specify C1/C3 and later specify C1/C4, the C1(A) is not sorted as C3(C), it is sorted as C4 (D).

**Note:** If you use an ASCII input diskette, sort/merge will translate it into EBCDIC. Therefore, any collating sequence changes you make affect the EBCDIC collating sequence.

## COMMAND DATA SET INFORMATION (PROMPT 30-68)

When you use a command data set, the parameters are read from the data set into the 5280 system. The data sets to be used are displayed on the following prompt:

```
Insert diskette(s) for the following.
```

```
          Data set name      Device
Input   -  XXXXXXXXXXXXXXXXX  XXXX
Output  -  XXXXXXXXXXXXXXXXX  XXXX
Work    -  XXXXXXXXXXXXXXXXX  XXXX
```

```
          Press ENTER
```

```
30-68
```

At this time you may remove the command data set diskette.

Insert the necessary diskettes for the input, output, and work data sets on the devices indicated. (If no device address is displayed for the work data set, no work data set is to be used.) Your sort is now ready to process.

Press the Enter key to continue.

Next, see *Sort In Process (Prompt 30-06)* in this chapter.

### SELECTING THE SORT TYPE (PROMPT 30-00)

When you choose to enter parameters from the keyboard, you first indicate your sort type.

The following prompt is displayed to allow you to select the sort type:

```
Select sort type.  
Options are  
  1. Full record    3. Record subset  
  2. Address out   4. Index/key  
Select option:    _ Press ENTER
```

30-00

Select one of the options and press the Enter key to continue. A detailed explanation of the sort types is given in Chapter 1 under *The Sort Program*.

### SPECIFYING THE INPUT DATA SET (PROMPT 30-01)

Once you designate the type of sort you want, you must identify your input data set. The following prompt is displayed:

```
Insert INPUT diskette and enter  
Data set name:  _____  
Device address:  _____  
  
Press ENTER
```

30-01

Enter the data set name and the device address for your input data set. Be sure the diskette containing the input data set is in the proper diskette drive.

Press the Enter key to continue.

The input must be on a single diskette; however, it may be a volume of a multivolume data set. Input data sets may not be removed during program operation.

## | SPECIFYING THE WORK DATA SETS (PROMPT 30-04)

Diskette work data sets are necessary if there is not enough partition storage available to sort all the records from the input data set. If needed, the work data sets are automatically assigned by sort, but only if you have specified a device address.

| **Note:** The sort program will not allocate the work data sets on an ASCII diskette.

The following is displayed:

```
Insert WORK diskette and enter  
Data set name:   SYSUT001  
Device address:  _____
```

Press ENTER

30-04

| If no work data sets are to be assigned or used, simply press the Enter key to continue. Remember, if work data sets are needed and not available, your program will terminate.

| When work data sets are to be used, enter the correct device address. Be sure that a diskette is inserted in the drive you specify. To avoid termination if work data sets are needed and not available, it is best to always have work data sets available. The maximum number of work data set records you would need is 2-1/2 times the number of records in the input data set. The length of a work data set record is equal to the length of the sort record key plus 3.

Press the Enter key to continue.

### SPECIFYING AN ALTERNATE COLLATING SEQUENCE (PROMPT 30-64)

After you finish responding to the work data set prompt (30-04), the following display gives you the option of altering the collating sequence for your job.

```
0 0001      H 01 40
Enter original/new HEX values for each change to collating sequence:
_/_      _/_      _/_      _/_      _/_      _/_
_/_      _/_      _/_      _/_      _/_      _/_
_/_      _/_      _/_      _/_      _/_      _/_
Press ENTER to continue
```

30-64

Either press the Enter key to continue or enter the original collating (hex) value and the new collating (hex) value for each change. Remember that both characters in the hex value must be entered before the graphic character appears on the prompt. The system status line is displayed for this prompt. If you want to review hex values you have entered, position the cursor under the field to be reviewed; the hex value for that field is displayed in positions 18 and 19 of the status line. An entry in the last pair of entry spaces causes the prompt to repeat. Appendix C shows the EBCDIC collating values. For more detail, see *Changing the Collating Sequence* in Chapter 1.

## SPECIFYING THE MERGE RECORD KEY (PROMPT 30-63)

Once you have identified your output data set, you must specify the data to be extracted from the input record to form the record key. This key indicates how you want the records merged and determines the sequence of the output. The following prompt is displayed:

```
Enter the following for each field to be compared.  
Sequence(1=Ascend,2=Descend)/Data type(1=Char,2=Num)/Position/Length:  
_ / _ / ____ / __   _ / _ / ____ / __   _ / _ / ____ / __  
_ / _ / ____ / __   _ / _ / ____ / __   _ / _ / ____ / __  
Press ENTER
```

30-63

You must specify all four parameters for each field:

Sequence / Data type / Position / Length

A maximum of six fields of data can be entered in the display format.

See *Record Key* in Chapter 1 for details on the explanation and restrictions for each field.

### SPECIFYING AN ALTERNATE COLLATING SEQUENCE (PROMPT 30-64)

After you respond to the record key prompt, you can alter the collating sequence. The following prompt is displayed:

```
0 0001      H 01 40
Enter original/new HEX values for each change to collating sequence:
_/_      _/_      _/_      _/_      _/_      _/_
_/_      _/_      _/_      _/_      _/_      _/_
_/_      _/_      _/_      _/_      _/_      _/_
Press ENTER to continue
```

30-64

Either press the Enter key to continue, or enter the original collating (hex) value and the new collating (hex) value for each change. Remember, both characters in the hex value must be entered before the graphic character appears on the prompt. The system status line is displayed for this prompt. If you want to review hex values you have entered, position the cursor under the field to be reviewed; the hex value for that field is displayed in positions 18 and 19 of the status line. An entry in the last pair of entry spaces causes the prompt to repeat. Appendix C shows the collating values. For more detail, see *Changing the Collating Sequence* in Chapter 1.

## Appendix B. Things to Remember

Under some circumstances, you use the include or omit option with the same results. For instance, the results are the same whether you include all records less than 100 or omit all records greater than 99.

Sort/merge automatically allocates the output data sets for each program after an output data set name and device address is provided.

The record keys of input 1 and input 2 must be identical for merge. Both input 1 and input 2 must be in sequenced order according to the data chosen for the record key. Both merge input data sets must have the same record length.

When using an IBM-supplied diskette for the first time, you must clear the large empty data set that has been preallocated on the diskette. See the *IBM 5280 Utilities Reference/Operation Manual*, SC21-7788 for details on the diskette clear utility and diskette label maintenance utility.

Whenever possible it is good practice to provide work data sets to avoid program termination which occurs when work data sets are needed and not provided. The work data sets are cleared from the diskette automatically after sort completion. To ensure that enough storage is available on the work data set diskette, it is best to provide an empty diskette. If possible, keep a scratch diskette on hand to use as a work data set diskette.

Data set size is important when you are using one drive. If partition storage is not large enough to provide enough work area, the input, the output, and the work data sets are all located on the same diskette. This limits the size of the data set that can be handled.

Data exchange type I is the most efficient exchange type, supported by many systems, and can be exchanged with systems other than 5280.

Specifying only omit conditions on the record select prompt leaves nothing in the work area to sort. At least one include statement must be specified, either include or include all, to have records in the sort.

The amount of work data set storage space depends on your data station. If you have one drive, the work data set is allocated after the last data set on your diskette. If you have two available drives, you should specify the diskette with the most diskette space available after the output data set is allocated. If you have three available drives, you can dedicate a drive and diskette to the work data set for maximum work data set storage.

The maximum number of work data set records you need is 2 1/2 times the number of records in the input data set. The length of a work data set record is equal to the length of the sort record key plus 3.

