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TUNITY

### MOD3.16

MILESTONE 4 DESIGN SPECIFICATION

UTILITY ROUTINES 'TMERGE ROUTINE BK3

21 December 1979

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#### FOREWORD

This docuemnt is the MOD3.16 Milestone 4 Design Specification for 'TMERGE, a routine within the Utility Routines of the 'TUNITY System. It contains the engineering analysis and logical design for this routine. It is also a guide to the routine listing and should be used with the appropriate version of this listing.

'TMERGE is written in the JOVIAL J4 language and is designed to be run on the CDC 3800 with a two-bank core, using the SCF System IIB software executive monitor (SYMON).

'TMERGE was generated as <u>part of the 'TUNITY</u> software development responsibilities under Contract

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### 1. INTRODUCTION

### 1.1 IDENTIFICATION

Name: Author: 'TMERGE J. B. Rininger A. A. Laferriere

Date Documented: 31 July 1970

1.2 PURPOSE

'TMERGE provides all routines in the 'TUNITY software system with the capability to sort and merge long strings of data. Since 'TMERGE is a utility routine, an interface diagram is not appropriate.

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#### 2. DESCRIPTION

'TMERGE has three entrances: the initialization entrance ('TMERGE), the data input entrance ('TMIN), and the operation completion/output entrance ('TMOUT).

For each data string the using routine wishes to sort, a single call to the initialization entrance 'TMERGE must be made. The calling sequence of this entrance provides the program with the following data: type of sort (BCI, numeric, or logical), number of sort keys per entry, number of words per entry, address of input area, address of output area, address of sort/merge buffer, number of words in sort/merge buffer, and the number of words in the I/O record. This information initializes 'TMERGE and allows the user to begin processing data.

The data input entrance ('TMIN) must be called once for each data entry. When a call is made, the entry to be input is transferred from the input buffer to the next empty position in the sort buffer. When the sort buffer is filled, the data is sorted and written as one file on the disc. The sort buffer can then accept more input data, as before.

This input process continues as long as the user makes repeated calls to 'TMIN. When the user has input all of his data, he signals 'TMERGE that the input process is completed by calling the operation completion entrance 'TMOUT. This call tells 'TMERGE that no more data will be input to the sort buffer, causes the data remaining in the buffer to be sorted and written as the last file on disc, and signals 'TMERGE to perform any merge passes that may be necessary.

To output the sorted data, the user must make repeated calls to 'TMOUT. Each call causes one record to be output. When all data has been output, 'TMOUT transmits an end-of-data flag to the user to signal that processing is completed.

The 'TMERGE overview flow diagram is shown in Figure 4-1.

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#### 3. USAGE

### 3.1 INPUT/OUTPUT

### 3.1.1 Calling Sequence

The calling sequences for the three entrances are as follows:

### **Initialization**

'TMERGE (TYPE, NKEYS, NWORDS, INBUF, OUTBUF, SORTBUF, BUFSIZ, RECSIZ) \$ Data Input

'TMIN (= ERRFLG) \$

### Data Output

'TMOUT (= EOFLG) \$

where:

BUFSIZ	= Number of words in sort/merge buffer
EOFLG	= End of file flag:
	0 = More data to be retrieved
	1 = All data has been retrieved
ERRFLG	= Input error flag:
	0 = No error

1 = Error - no further input allowed

- INBUF = Address of input buffer
- NKEYS = Number of sort key words per entry
- NWORDS = Number of words per entry
- OUTBUF = Address of output buffer

RECSIZ = Number of words in disc I/O record

SORTBUF = Address of sort/merge buffer

TYPE = Type of sort:

```
0 = BCI \text{ sort}
```

1 = Numeric sort

2 = Logical sort

### 3.1.2 Input/Output Parameters

'TMERGE inputs and outputs are listed in Table 4-1.

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### 3.2 INTERNAL VARIABLES

The internal variables used in 'TMERGE are listed in Table 4-2.

### 3.3 INTERFACES

'TMERGE interfaces are described in Table 4-3.

3.4 ERROR MESSAGES AND RECOVERY PROCEDURES

Error messages and recovery procedures governing this routine are listed in Table 4-4. These error messages are output via 'TERR.

In addition, 'DERROR is called after each disc read and write to handle error procedures.

3.5 INFORMATIONAL MESSAGES

None.

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	2	Table 4-1.	'TMERGE Input/Output	
Element	Table Block	Routine Set/Use	Special Comments	

There are no formal inputs or outputs for this routine. All I/O is transferred through the calling sequence.

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Table 4-2. Internal Variables

JOVIAL Symbol	Engr. Symbol	Internal Units	Description
BLOCKBUF	- ·	n.d.	Equivalent to SORTBUF
BUFSIZ	-	ń.d.	Number of entries in sort/merge buffer to be sorted
COMPARE	· _	n.d.	Table of sort key words
ENTRIES	-	n.d.	Number of entries in sort/merge buffer to be sorted
EOFILE	-	n.d.	End-of-data indicator
EOFLG	-	n.d.	End of file flag:
	·		0 = more data to be retrieved 1 = all data has been retrieved
ERRFLG	-	n.d.	Error flag:
	-		0 = no error has occurred 1 = no further input allowed
FILE		n.d.	File number (item in FILETAB)
FILETAB	-	n.d.	File directory
IMAX	-	n.d.	Number of words per entry
IMAX1	-	n.d.	IMAX - 1
INBUF	-	n.d.	Address of input area where data to be sorted is placed
JJ	-	n.d.	Entry counter for sort/merge buffer
JJJ	-	n.d.	Entry counter for blocking buffer
JMAXM	-	n.d.	Number of entries per record
JMAXM1	-	n.d.	JMAXM - 1
JMAXS	-	n.d.	Number of entries that can be contained in sort/merge buffer
ККК	-	n.d.	File counter for file directory
KMAX	-	n.d.	Number of files that can be processed per pass
KMAX1	-	n.d.	KMAX - 1
KMAXM	-	n.d.	Number of records that can be contained in sort/merge buffer
KMAXMI	-	n.d.	KMAXM - 1
LOCB	-	n.d.	Sort/merge buffer location
LOCM	-	• n.d.	Location of merge set up table (MERGSET)
LOCBLK	-	n.d.	Location of blocking buffer
LOCBUF	-	n.d.	Location of sort/merge buffer
MAXWDS		n.d.	Maximum available disc space in words
MERGBUFF	-	n.d.	Equivalent to SORTBUF
NKEYS	-	n.d.	Number of sort keys per entry
NULLF	<b>-</b> '	n.d.	Empty file counter
NWORDS	-	n.d.	Number of words per entry
OUTBUE	÷	n.d.	Address of output area where sorted data is to be

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Table 4-2. Internal Variables (Continued)

JOVIAL Symbol	Engr. Symbol	Internal Units	Description
OUTREC	-	n.d.	Output record counter
PASSFLG	•	n.d.	Merge pass flag
			0 = intermediate merge 1 = final merge 2 = initialize final merge
RECORDS	-	n.d.	Number of records per file (item in FILETAB)
RECS	-	n.d.	Number of records per file
RECSIZ	-	n.d.	Number of words in disc I/O record
RECSIZM	· -	n.d.	Integral multiple of disc track size
SORTBUF	-	n.d.	Address of sort/merge buffer
STATUS	-	n.d.	Status flag:
• . . • •		: 	V(INIT) = initialization V(INTSORT) = internal sort V(INTMERG) = internal merge V(EXTSORT) = external sort V(EXTMERGE) = external merge V(EOF) = end-of-file
TCODE	, <del>-</del>	n.d.	Sort type:
•			l = numeric sort 2 = BCI or logical sort
TEM1	-	n.d. }	
TEM2	-	n.d.	
TEM3	-	n.d. (	Temporary Cells
TEM4		n.d.	
TOTWDS	-	n.d.	Cumulative words written on disc
TRAKSIZ	<b>-</b> .	n.d.	Disc track size
TYPE	÷.	n.d.	Type of sort:
			0 = BCI sort 1 = numeric sort 2 = logical sort

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Table 4-3. Interfaces

Routine	1	Purpose	Referenc
'TMERG	E CALLS THE FOLLOWING ROUTINES	5:	
DERROR	Checks disc operations		2
SDAHA	Performs disc operations	• · · ·	. 1
SORT	Sorts strings of data		1
'TERR	Handles error messages		· 1
RELDIS	To release disc space		1
SABORT	Redundant call to 'SABOF	RT	1

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Table 4-4. Error Messages

• •	Message No	Message Category	Respo Yes	nse No	Error Message		•	. <b></b>	Description
···.	00	5	-	-	'TMOUT called but no data input			(a)	Explanation: This message indicates that 'TMOUT has been called before 'TMIN; i.e., the entrances have been called in the wrong order.
								(b)	Effect: This error is unrecoverable and will immediately terminate processing via 'TERR.
8	~							(c)	Test Performed: If JJ EQ 0.
		·						(d)	Reference: Figure 4-2, Sheet 6.
	•			•				(e)	Error Cause: The error probably caused by incorrect coding of 'TMERGE entrances in using routine
			·			-		(f)	<u>Corrective Action</u> : Check use of 'TMERGE in using routine.
B	01	5	- '	-	Invalid call to 'TMIN			(a)	Explanation: This message indicates that initialization for the input process either did not occur or was done incorrectly.
							· ·	(ь)	Effect: This error is unrecoverable and will immediately terminate processing via 'TERR.
								(c)	Test Performed: If STATUS NQ V(INTSORT) or V(EXTSORT).
		•						(d)	Reference: Figure 4-2, Sheet 3.
	. ·							(ė)	Error Cause: This error probably caused by improper call to initialization entrance ('TMERGE).

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Table 4-4. Error Messages (Continued)

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Message No.	Message Category	Response Yes No	Error Message		Description
		•		(f)	<u>Corrective Action</u> : Check initialization call in using routine.
02	5		Invalid call to 'TMOUT	(a)	Explanation: This message indicates that initialization for the output process either did not occur or was done incorrectly.
	. `			(b)	Effect: This error is unrecoverable and will immediately terminate processing via 'TERR.
				(c)	Test Performed: If STATUS EQ V(INIT).
				(b)	Reference: Figure 4-2, Sheet 5.
	· .			(e)	Error Cause: This error probably caused by improper call to initialization entrance.
	· .			(f)	<u>Corrective Action</u> : Check initialization call in using routine.
03	5 ',	<b></b>	Invalid input to 'TMERGE	(a)	Explanation: This message indicates that one or more 'TMERGE input parameters had invalid values (see Section 4.1)
				(b)	Effect: This error is unrecoverable and will immediately terminate processing via 'TERR.
	• •			(c)	Test Performed: All input parameters are tested against corresponding limits.

Table 4-4. Error Messages (Continued)

	Message No.	Message Category	Respo Yes	nse No	Err	or Message		Description
							(d)	Reference: Figure 4-2, Sheet 1.
							(ė)	Error Cause: This error probably caused by improper coding of initialization call in using routine.
~							(f)	<u>Corrective Action</u> : Check initialization call in using routine.
	· · ·	· .			· ·			
								· · · · · · · · · · · · · · · · · · ·
5		•		•				
	.,							

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#### 4. LIMITATIONS

### 4.1 USAGE LIMITATIONS

The following constraints are placed on the calling sequence parameters of 'TMERGE:

- a. The sort type indicator must be between 0 and 2 inclusive. (0 < TYPE < 2)
- b. The number of sort keys specified must be either 1 or 2. (1<NKEYS<2)
- c. The number of words in the sort/merge buffer must be an integer multiple of the number of words in the I/O record. (BUFSIZ = n\*RECSIZ where n is an integer such that  $3 \le 40$ . The lower limit on n is set to 3 because the buffer must be at Teast large enough to allow the combining of two records into a (third) merged record. The upper limit is set to 40 because, due to space and timing limitations, this number of records is the estimated maximum practical capacity of 'TMERGE.)
- d. The number of words in the I/O record must be an integer multiple of the number of words per entry. (RECSIZ = m\*NWORDS where m is an integer such that  $m \ge 1$ )
- e. Only one type of sort (TYPE) can be made for a single initialization.

#### 4.2 DATA LIMITATIONS

The amount of data that can be sorted using 'TMERGE is limited only by the amount of scratch disc space available.

4.3 ACCURACY LIMITATIONS

Not applicable.

4.4 TIMING LIMITATIONS

See Section 4.5

#### 4.5 SPACE REQUIREMENTS

'TMERGE will require 1,015 words of core storage and enough scratch disc storage to handle the input/output and work area requirements of the program.

The work area required is directly related to the number of physical records from the disc which can be stored at one time in the assigned buffer space. This number is defined by

> Number of Records = Number of words in sort buffer Number of words per record .

If the total number of files on the disc is such that

Number of Records  $\geq$  Number of Files on disc,

then only one pass will be required to merge all of the data. If, however, the number of files on disc is greater than the number of records in the buffer, the number of passes 'TMOUT must make to merge the data will be greater than one.

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In the case of a single-pass merge, the number of words of disc required will be equal to the number of words in the data list. In the multiple-pass case, additional disc space will be required for intermediate merges. Thus, it is recommended that the using routine should attempt to make the ratio of the size of the sort buffer to the size of the I/O record such that the merge can be achieved in a single pass. This single pass condition is achieved by setting the size of the sort/merge buffer such that:

> Size of sort/merge buffer (words) Size of I/O record (words)

Total number of words to be sorted/merged Size of sort/merge buffer (words)

This will minimize the disc space required and, in addition, reduce the running time.

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5. METHOD AND FLOW DIAGRAM

#### 5.1 INITIALIZATION

To begin a sort or merge of long data strings, the using routine must first call the initialization entrance 'TMERGE.

When this call is made, 'TMERGE checks the input parameters to make certain they have valid values. (See Section 4.1). If one or more parameters are invalid, 'TMERGE calls 'TERR to print error message 03, and processing is terminated. If all parameters are valid, 'TMERGE checks the size of the input record. If the input record is larger than the record size on disc (some integer multiple of the track size), the disc record is increased in size until it is at least as large as the input record. 'TMERGE then sets the status flag to indicate an internal sort.

'TMERGE next sets the sort-type and end-of-file flags. If the sort to be performed is a BCI sort, the sort-type flag, TCODE, is set to 2. If the sort is not BCI, the sort-type flag is set to the value specified by the TYPE parameter in the 'TMERGE calling sequence. If the sort-type is numeric, the end-of-file flag is set to a large numeric value [0(3777...7)]. If the sort is not numeric, the end of the file flag is set to 0(777...7).

After the flags have been set, 'TMERGE initializes the parameters used to maintair the file directory, FILETAB. (FILETAB is a 100-entry table, two items per entry, containing the file number and number of records per file for each file.) The NENT of the file directory is set equal to the maximum number of records that may be in the sort/ merge buffer, the variable JMAXS is set equal to the maximum number of entries per buffer, JMAXM is set to the maximum number of entries per I/O record, and KMAXM is set equal to the maximum number of files that can be processed per merge pass.

Once the file directory parameters have been initialized, 'TMERGE saves the buffer locations. The location of the sort/merge buffer is stored in the variable LOCBUF, and the location of the blocking buffer is stored in LOCBLK. Finally, 'SDAHA is called to declare the files needed for the merging process, and control is returned to the calling routine.

### 5.2 DATA INPUT

To begin processing data, the using routine must enter the data into the sort buffer by making repeated calls to the data input entrance ('TMIN). When a call to 'TMIN is made, the program checks to make certain that the status flag, STATUS, is set to indicate either an internal or external sort. If the status flag is not set to one of these modes, 'TERR is called to print error message 01, and processing is terminated.

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If the status flag has been set correctly, 'TMIN checks to see if the sort buffer is filled. If the buffer is not filled, 'TMIN transfers an entry from the input buffer to the sort buffer. If a BCI sort is indicated, (TYPE = 0), JOVIAL function BCI2SCD is called to convert the BCI sort keys to sortable code. After the call to BCI2SCD, or if that call was not necessary, the sort buffer entry counter JJ is incremented by 1, and control returns to the calling routine.

If the sort buffer is filled, 'TMIN sets the variable RECS to equal the number of records in the sort/merge buffer, the variable ENTRIES equal to the number of entries in the sort/merge buffer, and then calls procedure GENFILE. GENFILE sorts the data in the buffer and writes the sorted data into a single file on disc.

After the call to GENFILE, 'TMIN sets the status flag to indicate an external sort and interrogates the file counter to see if the number of files on disc is less than the maximum. If the number of files on disc is not less than the maximum, the parameters necessary to merge the files on disc are initialized and procedure ONEPASS is called to perform the merge. After the merge, the disc file counter is cleared.

Once the files on disc have been merged, (or if the number of files on disc is less than the maximum), 'TMIN checks to make certain that the cumulative number of words written on disc does not exceed the maximum space available. If the maximum has been exceeded, the error flag (ERRFLG) is set to 1 and control is returned to the calling routine. If the maximum has not been exceeded, the program branches back to transfer an entry from the input buffer to the sort buffer, after which control is returned to the calling routine.

'TMIN is called and executed in this manner until all input data has been entered into the sort buffer. To begin output procedures, a call to the output entrance ('TMOUT) must be made.

5.3 DATA OUTPUT

When 'TMOUT is called, a branch is made according to the value of the status flag (STATUS). If the status flag indicates an initialization operation (STATUS = V(INIT)), the call to 'TMOUT has been made at the wrong time, creating an error condition. 'TERR is called to output error message 02 and to terminate processing.

If the value of the status flag indicates an internal sort (STATUS = V(INTSORT)), 'TMOUT checks to see if the number of entries in the sort buffer is zero. If the number of entries is zero, error message 00 is printed using 'TERR and processing is terminated. If the number of entries is not zero, the parameter ENTRIES is set to equal the number of entries in the buffer, and procedure SORTEM is called to sort the entries. After the call to SORTEM, the status flag is set to indicate an internal merge (STATUS = V(INTMERG)), and the sort buffer entry counter (JJ) is set to zero.

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If the status flag indicates an internal merge (or if the sort operation in the last paragraph has been completed), 'TMOUT checks to see if all the sorted entries have been transferred to the output buffer. If all entries have been transferred, the endof-data flag (EOFILE) is set to 1, and control is returned to the calling routine. If all sorted entries have not been transferred to the output buffer, 'TMOUT transfers a sorted entry to the buffer. If a BCI sort/merge is being performed (TYPE = 0), JOVIAL function BCI2SCD is called to convert the sort keys from sortable code back into their original BCI form. After the necessary conversion has been performed, the sort buffer entry counter JJ is incremented by 1, and control is returned to the calling routine.

If the status flag indicates an external sort (STATUS = V(EXTSORT)), 'TMOUT initializes for a call to GENFILE by setting the parameter ENTRIES equal to the number of entries in the sort buffer and by setting RECS equal to the number of records in the sort buffer. GENFILE is then called to sort the data in the sort buffer and write the sorted data in one file on the disc. The status flag is then set to indicate an externa merge (STATUS = V(EXTMERG)) and the parameters needed to initialize procedure ONEPASS are set. ONEPASS is then called to merge the remaining files on disc into one file. Procedure MERGA is next called to perform the final merge pass. Control is then returned to the calling routine.

If the status flag has a value which indicates an external merge, procedure MERGB is called to perform the merge, after which control is returned to the calling routine.

Finally, if the status flag was previously set equal to V(EOF) by MERGB, the endof-data flag EOFLG is set and control is returned to the calling routine.

A detailed flow diagram of 'TMERGE is shown in Figure 4-2.

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Figure 4-2.

'TMERGE Detailed Flow Diagram (Sheet 2 of 9)

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Figure 4-2. 'TMERGE Detailed Flow Diagram (Sheet 4 of 9)

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Figure 4-2. 'TMERGE Detailed Flow Diagram (Sheet 5 of 9)

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Figure 4-2. 'TMERGE Detailed Flow Diagram (Sheet 6 of 9)

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'TMOUT

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7A FOR I=0,1,IMAX1 Calculate Index TEM1 = JMAXS\*I + JJTransfer one sorted entry to output buffer OUTBUF(\$I\$) = SORTBUF(\$TEM1\$) END I Is a BCI operation NO being performed? IS TYPE = 0?YES FOR I=0,1,NKEYS-1 CALCULATE INDEX TEMT = I \* JMAXS + JJ BCI2SCD Convert sort key to BCI: OUTBUF(\$TEM1\$) = BCI2SCD(1,OUTBUF(\$I\$)) \$ END 1 Add 1 to sort buffer entry counter JJ = JJ+1RETURN



'TMOUT

Figure 4-2.

'TMERGE Detailed Flow Diagram (Sheet 7 of 9)





Figure 4-2.

'TMERGE Detailed Flow Diagram (Sheet 9 of 9)

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### 7. CLOSED SUBROUTINES

This section describes in detail the procedures, closes and JOVIAL functions employed by 'TMERGE. They are presented in alphabetical order.

7.1 BCI2SCD

7.1.1 Identification

Name :	JOVIAL Function BCI2SCD
Author:	J.B. Rininger
Date Documented:	31 July 1970

7.1.2 Purpose

This JOVIAL function is used to convert BCI data to sortable code, or to convert sortable code to BCI data.

7.1.3 <u>Usage</u>

JOVIAL function BCI2SCD is called from 'TMIN, 'TMOUT, and procedure MERGB. The calling sequence is as follows:

#### BCI2SCD(FLAG, WORD) \$

where

FLAG = conversion type indicator 0 = BCI to sortable code

1 = sortable code to BCI

WORD = the single word to be converted

### 7.1.3.1 Input/Output

The input to BCI2SCD consists of the conversion type code and the word to be converted. (All input to BCI2SCD comes from the calling sequence.)

The output of BCI2SCD consists of the input word converted according to the value of the conversion type code.

### 7.1.3.2 Internal Variables

The internal variables used in BCI2SCD are as follows:

JOVIAL Symbol	Internal Units	Description
BCI2SCD	n.d.	Converted data
FLAG	n.d.	Conversion flag
TEMP	n.d.	Temporary cell, used to hold each byte of the input word as it is being processed
WORD	n.d.	Input data

7.1.3.3 Error Messages and Recovery Procedures

None.

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### 7.1.4 Method and Flow Chart

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When a call to BCI2SCD is made, if FLAG is equal to O (indicating BCI to sortable code conversion), a l is added to each BCI character except "blank" or "60," which is changed to "00."

If FLAG is equal to 1 (indicating a sortable code to BCI conversion), 1 is subtracted from each byte unless the byte contains "00," which is changed to "60."

A detailed flow diagram of BCI2SCD is shown in Figure 4-3.

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### 7.2 GENFILE

7.2.1 Identification

Name: Author: Procedure GENFILE

J. B. Rininger A. A. Laferriere

Date Documented: 31 July 1970

#### 7.2.2 Purpose

This procedure is used to generate a file of sorted data on the disc.

7.2.3 Usage

Procedure GENFILE is called from 'TMIN and 'TMOUT. The calling sequence is as follows:

#### GENFILE \$

#### 7.2.3.1 Input/Output

The input to GENFILE consists of the array of data to be sorted and filed, and the number of entries in the array.

The output of GENFILE is a table specifying file number and number of records in the new file.

7.2.3.2 Internal Variables

None

7.2.3.3 Error Messages and Recovery Procedures

None

### 7.2.4 Method and Flow Chart

A call to GENFILE first causes the specifications for the new file to be written to be entered into the file table (FILETAB). Procedure SORTEM is then called to sort the entries in the sort/merge buffer. The sorted entries are then transferred to the blocking buffer (BLOKBUF), which is in turn written into the new file on disc. If the sort buffer is empty (i.e., if all sorted entries fit into the blocking buffer), contro returns to the calling routine. If the sort buffer still contains data, GENFILE begins the transfer to the blocking buffer again, and writes another file on disc. This procedure continues until the sort buffer is empty.

A detailed flow diagram of GENFILE is shown in Figure 4-4.

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GENFILE



Figure 4-4. GENFILE Detailed Flow Diagram (Sheet 1 of 3)

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GENFILE



Figure 4-4. GENFILE Detailed Flow Diagram (Sheet 2 of 3)

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GENFILE



Figure 4-4. GENFILE Detailed Flow Diagram (Sheet 3 of 3)

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### 7.3 MERGA

7.3.1 Identification

Name: Procedure MERGA Author: J.B. Rininger Date Documented: 31 July 1970

### 7.3.2 Purpose

This procedure sets up the logic necessary for a multiple pass merge. A multiple pass merge is necessary when the number of files on disc is greater than the number of records that will fit in the buffer area.

7.3.3 Usage

Procedure MERGA is called from 'TMOUT. The calling sequence is as follows:

MERGA \$

#### 7.3.3.1 Input/Output

The input to MERGA consists of the file directory table generated in GENFILE.

The output of MERGA is the merge setup table (MERGSET), the merge pass mode flag (PASSFLG), the number of entries in the merge setup table (KMAX), and the new file number for the merged data (KKK).

### 7.3.3.2 Internal Variables

The internal variables used in MERGA are as follows:

JOVIAL Symbol	Internal Units	Description
ງງ ເ	n.d.	Entry counter for each record array
K	n.d.	File counter for merge setup table
FILE	n.d.	Number of records per file
MERGSET	n.d.	Table of files to be merged
RECORDS	n.d.	Number of records per file (table item)
RECS	n.d.	Number of records in file currently being processed (array)
Т	n.d.	Directory file counter

#### 7.3.3.3 Error Messages and Recovery Procedures

The disc error check routine 'DERROR is called after each disc write ('SDAHA call) to handle error procedures.

7.3.4 Method and Flow Chart

When a call to MERGA is made, the file directory FILETAB is searched for unmerged files. Unmerged files are transferred from FILETAB to the merge setup table MERGSET.

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## SECRET/Hx

The one-pass merge procedure ONEPASS is then called to merge the files in MERGSET. The new file created by ONEPASS is added to the file directory. This search-merge sequence is continued until all files specified in the directory have been merged.

A detailed flow diagram of MERGA is shown in Figure 4-5.

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MERGA

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Figure 4-5. MERGA Detailed Flow Diagram (Sheet 1 of 2)





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Figure 4-5. MERGA Detailed Flow Diagram (Sheet 2 of 2)

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7.4 MERGB

7.4.1 Identification

Name: Author: Procedure MERGB J. B. Rininger A. A. Laferriere

Date Documented: 31 July 1970

7.4.2 Purpose

This procedure merges a prescribed number of sorted files from the disc. The merged data can either be stored in a single file on the disc or transmitted, one entry per call, to an output buffer.

7.4.3 <u>Usage</u>

Procedure MERGB is called from 'TMOUT and ONEPASS. The calling sequence is as follows:

MERGB(LOCM)

where

LOCM = address of the merge setup table MERGSET.

### 7.4.3.1 Input/Output

The input to MERGB consists of the merge pass mode flag (PASSFLG), the table listing the order and the number of files to be merged in one pass (MERGSET), the number of files listed in MERGSET (KMAX), and the number of the new file for merged data (KKK). In addition, the address of the merge setup table is passed through the MERGB calling sequence.

When the merge pass mode flag is equal to 0, the output of MERGB is one file on disc consisting of the merge of all files listed in the merge setup table. When the merge pass mode flag is equal to 1, the output is one sorted entry per call to MERGB.

#### 7.4.3.2 Internal Variables

The internal variables used in MERGB are as follows:

JOVIAL Symbol	Internal Units	Description	
COMPARE	n.d.	Table of temporary cells for sort keys	
DUMMY1 DUMMY2	n.d.	Temporary cells, used to hold sort key words	
MERGSET	n.d.	Table of files to be merged	
REC	n.d.	Record counter for each file array	
XXX1 XXX2 YYY1 YYY2	n.d.	Items overlayed on DUMMY1 and DUMMY2	

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#### 7.4.3.3 Error Messages and Recovery Procedures

The disc error check routine 'DERROR is called after each disc I/O operation ('SDAHA call) to handle error procedures.

### 7.4.4 Method and Flow Chart

When a call is made to procedure MERGB, a record from each file specified in the merge setup table MERGSET is read into the merge buffer. If the "final pass" mode is in effect (pass mode flag PASSFLG = 1), the entry from the merge buffer MERGBUF with the lowest index value is transferred to the output buffer OUTBUF each time the using routine calls 'TMOUT. (If TYPE is equal to 0, indicating a BCI operation is being performed, function BCI2SCD is called to convert the sort keys to BCI before the entry is output.) When a record for any file is depleted, a new record from that file is read into the merge buffer. This process is continued until all entries are output.

If the merge is in the "intermediate pass mode" (pass mode flag = 0), the files in the merge setup table are merged and written onto the disc in a single file via the blocking buffer BLOKBUF. The new file is then listed in the file directory FILETAB for the next pass.

A detailed flow diagram of MERGB is shown in Figure 4-6.

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Figure 4-6. MERGB Detailed Flow Diagram (Sheet 1 of 6)

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MERGB





Figure 4-6. MERGB Detailed Flow Diagram (Sheet 3 of 6)









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#### 7.5 ONEPASS

7.5.1 Identification

Name: Procedure ONEPASS

Author: J.B. Rininger Date Documented: 31 July 1970

7.5.2 Purpose

This procedure initializes and makes a call to the merge procedure MERGB.

7.5.3 Usage

Procedure ONEPASS is called from 'TMIN, 'TMOUT, and MERGA. This calling sequence is as follows:

ONEPASS \$

#### 7.5.3.1 Input/Output

The input to ONEPASS consists of the number of files to be merged (NENT(FILETAB)) and the file directory (FILETAB).

The output of ONEPASS is the updated file directory FILETAB.

7.5.3.2 Internal Variables

None

7.5.3.3 Error Messages and Recovery Procedures

After each call to 'SDAHA, ONEPASS calls the disc error check routine 'DERROR to handle error procedures.

7.5.4 Method and Flow Chart

When a call is made to ONEPASS, the parameters required by the merge procedure are set, and the NENT of the file directory is incremented by 1. 'SDAHA is then called to declare a new file, and finally MERGB is called.

A detailed flow diagram of ONEPASS is shown in Figure 4-7.

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PTF-GA-T300AH-79 PAGE 50 ONEPASS



U. AS



RETURN

Check status of 'SDAHA

Call merge procedure

MERGB (LOCM)

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### 7.6 SORTEM

#### 7.6.1 Identification

Name:	
Author:	

Procedure SORTEM J. B. Rininger A. A. Laferriere

### Date Documented: 31 July 1970

### 7.6.2 Purpose

This procedure sets up the logic necessary to perform a double sort on the data stored in the sort buffer.

7.6.3 <u>Usage</u>

Procedure SORTEM is called from 'TMOUT and GENFILE. The calling sequence is as follows:

#### SORTEM \$

#### 7.6.3.1 Input/Output

The input to SORTEM consists of the number of sort key words per entry, the array of data to be sorted, the number of entries in the array to be sorted, and the type of sort to be performed.

The output of SORTEM is the array of sorted data.

#### 7.6.3.2 Internal Variables

The significant internal variables used in SORTEM are as follows:

JOVIAL Symbol	Internal Units	Description
J1	n.d.	Key word index
J2	n.d.	Key word index
LOCTAB	n.d.	Pointer for parallel sort
PTAB	n.d.	Pointer table for parallel sort

7.6.3.3 Error Messages and Recovery Procedures

None.

#### 7.6.4 Method and Flow Chart.

When a call is made to SORTEM, the data in the sort merge buffer is sorted on the first key word of each entry. SORTEM next examines the parameter containing the number of sort keys (NKEYS). If NKEYS is equal to "1," the procedure is exited. If NKEYS is equal to "2," a minor sort is performed on the second key word of each entry.

A detailed flow diagram of SORTEM is shown in Figure 4-8.

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Figure 4-8. SORTEM Detailed Flow Diagram (Sheet 1 of 2)

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### 8. REFERENCES

- 1. See Reference 3.
- 2. See Reference 3.
- Model 13 Documentation for CDC 3800, TM-4164/001/03, December, 1971.

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