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IBM 1410/7010 OPERATING SYSTEM
SYSTEM GENERATION; PRELIMINARY SPECIFICATIONS

This newsletter contains replacement pages reflecting an expansion of the specifications described in the publication, IBM 1410/7010 Operating System; System Generation: Preliminary Specifications, Form # C28-0320.

Changes in text are indicated by a vertical bar to the left of the text. Changes in figures are indicated by a (•) to the left of the figure number.

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Appendixes

Appendix A — Operating System Machine Requirements

System Generation

The machine requirements for the generation of the SCF from the Master File are described in the Introduction of this publication.

Data Processing

UNIT-RECORD REQUIREMENTS

All configurations of the Operating System require:

1 IBM 1402 Card Read Punch, Model 2 for use as the Standard Input Unit and/or the Standard Punch Unit.

1 IBM 1403 Printer, Model 2 for use as Standard Print Unit.

NOTES:

1. Tape units may be substituted for each of the functions of card reading, card punching, and printing.

2. At the option of the user, punch and printer output may be intermixed on one tape unit for subsequent off-line punching and printing on an IBM 1401 Data Processing System.

3. At the option of the user, the standard print and/or punch capability may be eliminated from the Resident Monitor. If this option is selected, none of the compilers may be used and no diagnostics are provided by the Linkage Loader.

TAPE-ORIENTED SYSTEMS

In addition to the unit-record requirements, tape-oriented systems require:

1 tape unit for a System Operating File

1 tape unit for a Job File

1 tape unit for a System Library File if this file is not on the same reel of tape as the SOF.

NOTES:

1. If a Core-Image File (MDM) is desired, an additional tape unit must be provided. This unit is not available for any other use.

2. The tape unit assigned to the Job File is available as a work file if the program is loaded from the SOF.

Compiler Requirements. The three compilers (COBOL, FORTRAN, and Autocoder) share work files. The user may include any or all three compilers in his system.

In addition to the requirements listed for a tape-oriented system, the compilers require:

3 tape units used as work files by the AUTOCODER, COBOL, and FORTRAN compilers.

1 additional tape unit if the compile-and-go capability is used.

NOTE: The tape designated as the Job File may be used as a work file during compilation.

1301 DISK-ORIENTED SYSTEMS

In addition to the unit-record requirements, disk-oriented systems require a series of contiguous cylinders formatted in the LOAD Mode, consisting of:

1. Six cylinders for basic programs in the SOF and for the Job File.

2. Additional cylinders to accommodate:
   Storage of compilers in the SOF as follows:
   COBOL — 4 cylinders
   FORTRAN — 4 cylinders
   Autocoder — 5 cylinders
   Storage of user-supplied programs in the SOF. Each cylinder can effectively store 60,000 positions of core storage.
   Expansion of the Job File beyond an effective 240,000 positions of core storage. Each additional cylinder can effectively store 60,000 positions of core storage.
   40 cylinders for working storage used by the compilers.

3. Five additional cylinders if the compile-and-go capability is used. These five cylinders can accommodate 4,400 subprogram card-image records that are the output from the compilers. (To increase this capacity, additional cylinders may be provided. Each additional cylinder can effectively store 880 card-image records.)

4. Additional cylinders to accommodate the System Library File of relocatable programs, as follows:
   One cylinder for COBOL subprograms if the COBOL compiler is included.
   Five cylinders for FORTRAN subprograms if the FORTRAN compiler is included.
   Additional cylinders for user-supplied subprograms. (Each cylinder can effectively store 880 card image records.)

GENERALIZED TAPE SORTING PROGRAM REQUIREMENTS

In addition to the requirements listed for tape- and disk-oriented systems, the Generalized Tape Sorting Program requires a minimum of four tape units. For

a tape-oriented system, these may be the same units used as work files by the compilers. Additional tape units may be used to increase the program's efficiency. (See the publication, *The Generalized Tape Sorting Program.*)

NOTE: The tape unit designated as the Job File for the tape-oriented system may be used as one of the four units for the sorting program.

TELE-PROCESSING SYSTEM REQUIREMENTS

Tape-Oriented TELE-PROCESSING *Supervisor.*
1 tape unit for storage of the TP Library File.
1301 Disk-Oriented TELE-PROCESSING *Supervisor.*
1 cylinder of disk storage, formatted in the LOAD Mode, for storage of the TELE-PROCESSING Supervisor.

Additional cylinders of disk storage, formatted in the LOAD Mode, for storage of TP Programs. The effective capacity of each cylinder is dependent upon the format used (i.e., relocatable or absolute) and the average size of the TP Programs.

To unload and reload the main-line program, the user must provide a tape unit for the Temporary Storage File (MDT). This unit is not available for any other use.

Appendix B — Operating System Core-Storage Requirements

The estimated core storage requirements for an Operating System are determined by the following:

Resident Monitor	CORE STORAGE LOCATIONS REQUIRED: WITHOUT TELE-PROCESSING	WITH TELE-PROCESSING
Basic Resident Monitor (Notes 1 and 4)		
Tape-Oriented	8575	14975
Disk-Oriented (Note 3)	14175	20575
Optional System Functions		
Standard Print Unit	450	450
Standard Punch Unit	350	350
Alternate Input Unit	200	200
Optional IOCS Routines		
Unit Record	300	450
Tape Label		
1. 80-Character Labels	1425	1425
2. 120-Character Labels	1425	1425
3. Both Lengths	1900	1900
Tape Error Statistics	350	450
Exit to user-supplied interrupt routines	350	150
1301 Disk (Note 3)	950	1100
Random Processing Scheduler	4600	4600
Additional Tele-Processing Capabilities Required		
For device indicated:		
a. Programmed Transmission Control	—	4000/channel
b. 1414, Model IV or V with:	—	100/channel
1009 Data Transmission Unit	—	2500/adapter
1014 Remote Inquiry Unit	—	1700/adapter
Telegraph Terminal Unit	—	1700/adapter
One of the following:		
a. Absolute Tape Loader	—	1700
b. Absolute 1301 Disk Loader	—	4300
c. Relocatable Tape Loader	—	6800
d. Relocatable 1301 Disk Loader	—	6800
Optional		
Routine for temporary storage of main-line program	—	1000

Additional Requirements

TAPE-ORIENTED COMPILERS (NOTE 2)	29000	29000
1301 DISK-ORIENTED COMPILERS (NOTES 2 AND 3)	39000	39000

NOTES:
1. These figures include all index registers (and floating-point areas for the 7010).
2. The Resident Monitor must include the Standard Print Unit and the Standard Punch Unit Options.
3. The Disk-Oriented Resident Monitor must include the 1301 Disk IOCS routines.

Appendix C — Operating System Timing Estimates

IOCS Timing Estimates

SCHEDULING FUNCTIONS (NOTE 1)	TIMING IN MICROSECONDS: 1410	7010
1. Blocking/unblocking of GET or PUT, time per record (NOTE 2):		
a) GET or PUT, Form 2 Data Records	370	130
b) GET, Form 4 Data Records	370	130
c) PUT, Form 4 Data Records	595	210
2. GET FILE:		
a) one IORW is sent to a read/write list; file consists of unblocked records; not preceded by a GET FILE, DEFER.	2110	705
b) GET FILE following a GET FILE, DEFER; file consists of unblocked records.	690	245
c) *Additional* time for a GET FILE if file consists of blocked records.	480	160
3. GET FILE, DEFER	2080	670

INPUT/OUTPUT FUNCTIONS	TIMING IN MICROSECONDS: 1410	7010
1. Service an interrupt due to the completion of an overlapped operation: No error conditions: another IORW is added to a file list (Note 3).	1610	515
2. Start a pending operation and return to an interrupted instruction (Note 3).	1290	420

INPUT/OUTPUT FUNCTIONS	TIMING IN MICROSECONDS	
3. Attempt twice to assign an access mechanism to a SEEK request, issue a SEEK operation, transmit an IORW to a read/write list, release the access mechanism.	1975	865
4. To start SEEK operation, nonsequential	1470 50M	560 16M
5. Additional time to start SEEK operation, full-track sequential.	890	300
6. To start I/O operation after detecting SEEK complete interrupt	1450 50M 50n	555 16M 16n
7. Additional time to start I/O operation if another module, having a higher priority, has a SEEK pending.	820 50p	350 16p

where:
M – Total number of modules on same channel.
n – Placement of object module in module table as determined by the DSKDF macro-instruction (module 00 is always lowest; n – 1).
p – Placement of module with SEEK pending in module table as determined by the DSKDF macro-instruction.

NOTES:

1. The times listed for the Scheduling Functions are generally overlapped with respect to all channels.

2. If a GET or PUT must move a data record, add the time required for the move to the times listed.

3. These times are not overlapped with respect to the channel being serviced except for SEEK operations in process.

Autocoder Compiler Timing Estimates

BASIC TIMING ESTIMATES

The speed of the Autocoder compiler is dependent upon the characteristics of the source program and the input/output devices used for compiling. The following table provides a method of estimating the approximate time required.

INPUT/OUTPUT MACHINE CONFIGURATION	TIMING IN MINUTES PER 1000 SOURCE STATEMENTS 1410	7010
1. Tape input and tape output	3.4	2.1
2. Unit record input and tape output	4.3	3.0
3. Tape input and unit record output	5.5	4.7
4. Unit record input and output	6.4	5.6

NOTES:

1. A minimum time of approximately one minute is incurred regardless of the number of source statements.

2. The above timings are not representative for an exceptional mixture of source statement types (e.g., 90 percent declarative statements).

3. Source program does not contain DTF, IOCS, or user-supplied macros.

4. Tape Units are IBM 729 II.

5. Unit record equipment is an IBM 1402 Card Read Punch, Model 2, and an IBM 1403 Printer, Model 2.

6. No allowance is made for the time required to find the compiler phases.

ADDITIONAL TIMING ESTIMATES

Symbol Table Overflow: The number of symbols used in a source program may cause overflow of tables in certain compiler phases. Table sizes are a function of the size of core storage and the size of the Resident Monitor. For timing estimates, tables may be assumed to have a capacity of 500 symbols. (This is the capacity for a 40,000 position system.) For each overflow of the symbol table, add the following times to the preceding table:

(a) For the 1410, add 1.0 minutes per 1000 source statements

(b) For the 7010, add 0.7 minutes per 1000 source statements.

IOCS Macro Generation: Macro generation speed is a function of the sequence of macro statements in a source program. The following table may be used to estimate the additional time required for IOCS macro generation:

OUTPUT MACHINE CONFIGURATION	TIMING IN MINUTES PER STATEMENT 1410 DTF	1410 IOCS MACROS	7010 DTF	7010 IOCS MACROS
Tape output	0.25	0.06	0.20	0.04
Card output	0.30	0.07	0.20	0.05

NOTE: A minimum time of approximately 0.5 minutes is incurred regardless of the number of statements.

COBOL Compiler Timing Estimates

BASIC TIMING ESTIMATES

The speed of the COBOL compiler is dependent upon the characteristics of the source program and the input/output devices used for compiling. The following formula provides a method of estimating the approximate time required.

$$\text{TIME} = (I + E + D + P)(R + W) + 250(I + E) + 600D + 20P(50 + T/7) + .075P^2$$

Where:

TIME is in milliseconds (ms)

I = Number of cards in Identification Division

E = Number of cards in Environment Division

D = Number of cards in Data Division

P = Number of cards in Procedure Division

R = Standard Input Unit time per card-image record:
a) 75 ms for IBM 1402 Card Read Punch, Model 2.
b) 12.72 ms for IBM 729 II Tape Unit

W = Standard Print Unit time per card-image record
a) 100 ms for IBM 1403 Printer, Model 2
b) 14 ms for IBM 729 II Tape Unit

T = 20.4 ms if IBM 729 II Tape Units are used for work files while compiling. (Work file records are in 400 character blocks.)

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ASSUMPTIONS:

1. More than 380 cards in the Data Division will cause table overflow; the preceding formula will lose accuracy.

2. No allowance is made for the time required to find and load the compiler phases.

3. Procedure Division cards average seven COBOL words and/or operators per card.

ADDITIONAL TIMING ESTIMATE

Add 28P (2 + T/17) milliseconds to the basic time for the first usage of CORRESPONDING.

FORTRAN Compiler Timing Estimates

The speed of the FORTRAN compiler is dependent upon the characteristics of the source program and the input/output devices used for compiling. The following formula provides a method of estimating the approximate time required.

$$\text{TIME} = .07S + .6C + B + .003F + T\,(.04 + P) + N\,(.012 + .2T/100{,}000)$$

Where:

TIME is in seconds
B = The larger of .02T or .086C
C = Number of cards in source program
F = Total number of character positions in FORMAT Statements (including blank positions)
N = Number of names, statement numbers and literals in the source program. This figure includes the count for S (see below)
P = Standard Punch Unit time
  a) 0 for IBM 729 Model II Tape Unit
  b) .02 for IBM 1402 Card Read Punch, Model 2
S = Number of names in Specification Statements
T = Symbol count as computed below

ASSUMPTION: No allowance is made for the time required to find and load the compiler phases.

Symbol Count Computation. The symbol count T is computed from executable source statements in a FORTRAN program. Every executable statement has a symbol count of one for the end of the statement, an additional count of two if the statement has a statement number, and an additional count determined from the Arithmetic Expression and the Control and I/O Statement Symbol Count Tables, below. Symbol counts must also be computed for the nonexecutable statements, SUBROUTINE and FUNCTION, and for I/O lists. (See these entries in the Control and I/O Statement Symbol Counts Table, below.)

ARITHMETIC EXPRESSION SYMBOL COUNTS

ELEMENT	SYMBOL COUNT PER ELEMENT	EXAMPLE
1. Any real or integer variable	1	A or I
2. Any literal subscripted variable	3	D(1, 2, 3)
3. Any other type of subscripted variable (Note 2)	9	B (I) or C (1, 1, J) or E(2*I, 5*J+3, 7)
4. Any operator (Notes 1 and 2)	1	

NOTES:

1. The operators are

+	=	.GE.
−	(	.LT.
*	)	.LE.
/	,	.EQ.
**	.GT.	.NE.

2. Operators in subscripted variables are not counted. Thus, the arithmetic statement
10 E=(F(I,J,K) + G(1,2,3))
has a total symbol count of 20.

CONTROL AND I/O STATEMENT SYMBOL COUNTS

SOURCE STATEMENT	SYMBOL COUNT PER STATEMENT
BACKSPACE	2
CALL	4 + E
CONTINUE	1
DO	6
END	1
END FILE	2
FUNCTION	2 + M
GO TO	2
Computed GO TO	3 + M
Relational IF	5 + E
PAUSE	2
READ (i, n)	4 + I/O list
READ (i)	3 + I/O list
RETURN	1
REWIND	2
STOP	1
SUBROUTINE	2 + M
WRITE (i, n)	4 + I/O list
WRITE (i)	3 + I/O list
I/O List	E

NOTE: M is the number of parameters in the statement; E is the number of separate elements in the source statement (e.g., variable names, operators (as defined in Note 1 above), and literals).

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