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1. 80 COLUMN PROGRAMMING RULES - R.A. Smith, E.E. Kidsgrove.

The 80 column manual is now available. It covers the subject in great detail and contains all the rules, programming details, operating instructions etc. However the following basic rules may be of interest to the casual user as a reference or serve as an introduction to the subject. Some of the rules quoted here, whilst more restrictive than absolutely necessary, give assurance of correct operation in all circumstances.

The 80 column input-output machine reads and punches cards in the 64 column mode i.e. as on a Mark I DEUCE, or in the 80 column mode i.e. reads or punches all 80 columns of alphanumeric cards according to the IBM 4-zone code.

1.1 Reader and Punch Speeds.

The punch runs at 100 cards per minute. The reader normally runs at 200 c.p.m. but can be run at 100 c.p.m. by moving a switch. It also runs at 100 c.p.m. if punching is proceeding simultaneously. Any program or data which can be read on a Mark I (i.e. 64 column) machine can be read on an 80 column reader, at 100 c.p.m. if not at 200 c.p.m.

1.2 12-24,1.

An instruction 12-24,1, obeyed from m.c.m with a wait number W, causes one card only to be read and the columns to be stored as 6-bit characters in 16 consecutive m.c.'s of DL12, starting with the m.c. specified by W, namely m + W + 2. It is usual and convenient to have m + W + 2 = 0.

1.3 10-24,1.

An instruction 10-24,1, obeyed from m.c.m with a wait number W, causes one card only to be punched, the columns containing the 6-bit characters from 16 consecutive m.c.'s of DL12, starting with m.c. m + W + 18 (not m + W + 2).

1.4 9-24,s.

Unlike 64 col. operations, 80 col. operations do not require this instruction to terminate them. If 9-24 is used it will terminate all 64 and 80 col. input/output operations immediately whether completed or not.

1.5 Storage in DL12.

The 6-bit characters read into or punched from DL12 are stored 10 per word-pair, the first word-pair containing columns 80, 79,....71, the next word-pair columns 70,69,....61 and so on, the characters running continuously from the least significant end of the word-pair. e.g. 2_{10} N, 12-24,1,20,T would store the columns of the card thus:

	P_{1-6}	P_{7-12}	P_{13-18}	P_{19-24}	P_{25-30}	P_{31-2} P_{1-4}	P_{5-10}	P_{11-16}	P_{17-22}	P_{23-28}	P_{29-32}	
12_0	80	79	78	77	76	75	74	73	72	71	-	12_1
12_2	70	69	68	67	66	65	64	63	62	61	-	12_3
12_4	60	59	58	57	56	55	54	53	52	51	-	12_5
12_6	50	49	48	47	46	45	44	43	42	41	-	12_7
12_8	40	39	38	37	36	35	34	33	32	31	-	12_9
12_{10}	30	29	28	27	26	25	24	23	22	21	-	12_{11}
12_{12}	20	19	18	17	16	15	14	13	12	11	-	12_{13}
12_{14}	10	9	8	7	6	5	4	3	2	1	-	12_{15}

The 4-bits at the end of each word pair are in fact zero after reading but are ignored and unaltered on punching and therefore immaterial.

1.6 80 Column TIL.

It is normally necessary to follow every 12-24,1 (or 10-24,1) by a 2-24 (NZ) instruction. This discrims, on "80 column TIL" which starts immediately an 80 column operation is initiated and remains on until it is completed. Further input-output operations and references to DL12 should not normally be attempted in the interval between 12-24,1 (or 10-24,1) and 2-24 (NZ). The size of this interval (which is often used for processing cards already read or to be punched later) is immaterial except that if it is too great missed cycles may occur (see specification in 1.12).

It is common practice to put the 2-24 instruction immediately preceding the next 12-24,1 or 10-24,1 rather than after the current one. If this is done care must be taken to see that the last operation is still covered by a 2-24.

1.7 Missed Cycles.

The cycle time of the machine is 300 m.s. at 200 c.p.m. and 600 m.s. at 100 c.p.m.

It is not normally possible to call another input-output operation until at least 2 m.s. after the completion of the previous operation, as indicated by the end of 80 col. TIL or 9-24 or a CR (col. 1 punching in a card being read in the 64 col. mode). However if the calling of the next operation is delayed too long a missed cycle will occur i.e. approx. 300 m.s. or 600 m.s. will be wasted. (There will however be no other effect i.e. no lost cards etc.).

1.8 Dual Operations.

The reader and punch can be operated simultaneously in either the 64 or 80 col. mode or any combination of the two. The calling instructions (12-24 s or 12-24 1 and 10-24 s or 10-24 1) either of which may be obeyed first, must be separated (m.c.'s specified by the wait numbers) by not more than 1 m.s. If both sections are called in the 80 column mode the first calling instruction specifies which half of DL12 it will use (according to the rule in 1.2 or 1.3) the other half automatically being used by the other, whatever its wait number (usually

put = 0) Only one 2-24 (NZ) is necessary to cover both the 12-24 1 and 10-24 1.

During dual operations a 9-24 instruction will stop both reader and punch immediately. If either is in the 80 col. mode the automatic decall when TIL ends will stop both and 9-24 is unnecessary.

1.9 Simultaneous 80 and 64 col. Working.

Any 80 col. operation causes the normal row single shots to appear which enables 12-24 1 to initiate reading in the 64 and 80 col. modes simultaneously provided the rules for 64 col. reading are followed. A 12-24 s instruction is unnecessary.

It is not possible to punch simultaneously in both modes and destination 29 should not be used after an 80 col. punch until at least 18 m.s. after the end of TIL.

1.10 Change of Mode.

As a rule care must be exercised in changing from one mode or combination of modes to another. Before the change it is essential to ensure that all previous operations have been completed, either by using 9-24 or examining 80 col. TIL. In particular after reading in the 64 column mode (e.g. in reading in the program) it is not permissible to obey 12-24,1 or 10-24,1 until a 9-24 instruction has been obeyed (and at least 2 m.s. after it).

1.11 Character Code.

Cards read or punched are in the IBM 4 zone code and the character representations are as follows:

BINARY	CHAR-ACTER	CARD ROWS	BINARY	CHAR-ACTER	CARD ROWS	BINARY	CHAR-ACTER	CARD ROWS	BINARY	CHAR-ACTER	CARD ROWS
0	0	0	16	+	Y	32	-	X	48	zero	0
1	1	1	17	A	Y,1	33	J	X,1	49	.	0,1
2	2	2	18	B	Y,2	34	K	X,2	50	S	0,2
3	3	3	19	C	Y,3	35	L	X,3	51	T	0,3
4	4	4	20	D	Y,4	36	M	X,4	52	U	0,4
5	5	5	21	E	Y,5	37	N	X,5	53	V	0,5
6	6	6	22	F	Y,6	38	O	X,6	54	W	0,6
7	7	7	23	G	Y,7	39	P	X,7	55	X	0,7
8	8	8	24	H	Y,8	40	Q	X,8	56	Y	0,8
9	9	9	25	I	Y,9	41	R	X,9	57	Z	0,9
10	10	8,2	26	Free	Y,8,2	42	Free	X,8,2	58	Free	0,8,2
11	11	3,3	27	Free	Y,8,3	43	Free	X,8,3	59	Free	●,8,3
12	12	8,4	28	Free	Y,8,4	44	Free	X,8,4	60	Free	0,8,4
13	13	8,5	29	Free	Y,8,5	45	Free	X,8,5	61	Free	0,8,5
14	Free	8,6	30	Free	Y,8,6	46	Free	X,8,6	62	Free	0,8,6
15	Space	None	31	Free	Y,8,7	47	Free	X,8,7	63	Ignore	0,8,7

Binary value 48 will be punched as zero and is never produced on reading; 15 is produced by a blank column; 63 produces a blank column.

1.12 Timing Specifications.

This table is not complete but gives timings which if obeyed will exclude missed cycles, lost cards and other troubles, whether the operations are 64 column, 80 column or dual and irrespective of whether they are being performed on a Mark I or Mark II machine.

The times are measured from the m.c.'s specified by the wait numbers of the appropriate instructions and are in major cycles.

64 Column Operations:	Times in m.s.	
	200 c.p.m.	100 c.p.m.
Max. time between rows	13	37
Max time between cards (any 9-row to Y-row of next card).	57	116
Max. time from 12-24 or 10-24 (machine at rest) to 1st row.	30	50
Max. time from 9-row to 9-24 to avoid missed card	15	20
Max. time from S.S. to 64 col. TIL discrim 2-24	8	23
Max. time from S.S. and still read row	2	7
Max. time from S.S. and still punch row	-	4
Min. time from 9-24 to next reference to I.D. (source 0)	13	13
Min. time from 9-24 to next display on O.S. (destination 29)	-	20
80 Column Operations:		
Min. time from end of 80 col. TIL to next 12-24,1 or 10-24,1	2	2
Max time from end of 80 col. TIL to next 12-24,1 or 10-24,1 to avoid missed cycles	11	26
Max. time from 12-24,1 or 10-24,1 to 2-24 to avoid missed cycles in continuous operation	270	540
Min. time from end of 80 col. TIL to next reference to I.D. (source 0)	11	11
Min. time from end of 80 col. TIL to next display on O.S. (destination 29)	-	18
Max. time between 12-24,1 or 12-24 s and 10-24 1 or 10-24 s in a dual operation	1	1

2. MAGNETIC TAPE LABELLING. - A.G. Henry, E.E. Kidsgrove.

The essential provisions of any tape labelling scheme are to ensure that the correct file is read and to preclude a file being overwritten while it should still be retained. Two concepts are available to achieve these requirements. One is the concept of date, whereby the day on which the processing takes place is compared with the day on which the file was originally written and with the day after which the file can safely be overwritten. The other is the file sequence concept whereby each time a file is written it is given the next number in a sequence for that file, irrespective of the programme used, and the checks are made on these file sequence numbers; this necessitates a file always being rewritten on an old version of the same file or on a spare reel, but this is usually no hardship.

In general the file sequence concept seems preferable as being less susceptible to human error although the date concept is used in COBOL. The main drawbacks of the date concept are that allowance either by the programme (at the expense of storage space) or by hand input, has to be made for days when the program is not run (weekends, bank holidays etc.) before the allocation of the "free date" when a file can be overwritten. Furthermore no built-in protection can be given to cover the contingency of the computer being out of service and necessitating a daily run having to be done a day or more in arrears, in such a case the automatic protection against premature overwriting of the file breaks down.

Details are given of one scheme that is now in operation in the hope that it will stimulate further ideas on the subject.

Tape Label Block.

This is a one word pair block, written three times to comprise one record. It contains:

(a) Spool Number (3 characters) - the unique reference number of a particular spool of tape.

(b) Division (1 character) - to distinguish between tapes belonging to the various divisions using the computer.

(c) File name (3 characters).

(d) File Sequence Number (2 characters) - increased by one every time a file is rewritten.

(e) Reel Number. The number of the reel within the particular file.

(f) Markers. (P_{29-32} of odd minor cycle) These ensure that the period programmes process the correct file from the daily sequences and that where necessary the period run has been carried out before the next daily run is done.

Input Parameter Cards.

(g) A Generation Card is input for each file being used by the program. This is computer produced every time a file is rewritten and contains the file sequence number corresponding to the file in question and a list of the spool numbers of the reels comprising that file ("father") and its previous two generations ("grandfather" and "greatgrandfather").

(h) A Date Parameter Card which carries today's date for output on failure cards and use, if required, in the programs and any other markers the particular program may require. This is hand punched.

Output Parameter Cards.

(i) A Generation Card for each file written. This is the same as the input one except that the file sequence number will be increased by one and the file will have a new set of spool numbers. Also the two previous generations will have been moved down one place (father → grandfather and grandfather → great-grandfather).

(j) Free Spools Card, for each file written contains the spool numbers that are now free (e.g. formerly "great-grandfather").

The Housekeeping Routines operate with data references as follows:

Input Files. Checks are made that the correct file is being processed (c), that its reels are processed in the correct order (e) and that the latest updated file is being used (a) and (d) and (g). The markers (f) are also checked to make sure that the program is being used in its correct place in the sequence of programs that operate on that file and that the file has not already been read by the programme in identical circumstances. To accommodate this last condition the label is then rewritten with the appropriate marker altered.

Without the ability to provide a permanent parameter store on tape or in the machine to contain the sequence number of the file next to be read by each programme there is no simple way of preventing a file being inadvertently processed twice, using in effect, "father" in the lineage the second time, if the out of date parameter card has not been destroyed. The marker guards against this but the necessity of altering the label precludes the removal of the "allow writing" steel ring on the spool. It is felt that the system used is the lesser of two evils.

Output Files. The file name (c) and its sequences number ((d) compared with (g) - the difference increment necessary is built into the program), are checked to ensure that it can be overwritten. A new label is generated appropriate to the new file being written.

Spare Reels. These will be required when a file expands in size and have a special file name (probably "CO●") so that no sequence number check is implemented.

Usage of Spools.

It was not felt that a count of the number of times that a reel had been used was necessary but this could be maintained manually or otherwise if required.