

SYSTEM TIMINGS

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OPERATION	OP CODE	FORMULA
Key to abbreviations used in formulas		
L _A = Length of the A-field		
L _B = Length of the B-field		
L _C = Length of Multifield field		
L _I = Length of Instruction		
L _M = Length of Multiplier field		
L _Q = Length of Quotient field		
L _R = Length of Divisor field		
L _S = Number of significant digits in Divisor (Excludes high-order 0's and blanks)		
L _r = Length of A- or B-field, whichever is shorter		
L _x = Number of characters to be cleared		
L _y = Number of characters back to right-most "0" in control field		
L _z = Number of 0's inserted in a field		
I/O = Timing for Input or Output cycle		
F _m = Forms movement times. Allow 20 ms for first space, plus 5 ms for each additional space		
T _m = Tape movement times		
Σ = Number of fields included in an operation		
Add (no recomplement)	A	.0115 (L _I + 3 + L _A + L _B)
Add (recomplement)	B	.0115 (L _I + 3 + L _A + 4 L _B)
Branch	W	.0115 (L _I + 1)
Branch if Bit Equal*	B	.0115 (L _I + 2)
Branch if Character Equal	B	.0115 (L _I + 2)
Branch if Indicator On	B	.0115 (L _I + 1)
Branch if Word Mark and/or Zone	V	.0115 (L _I + 2)
Clear Storage	/	.0115 (L _I + 1 + L _x)
Clear Word Mark	□	.0115 (L _I + 3)
Compare	C	.0115 (L _I + 1 + L _A + L _B)
Control Carriage	F	.0115 (L _I + 1) + F _m
Control Unit	U	.0115 (L _I + 1) + T _m
Divide (over-)*	%	.0115 (L _I + 2 + 7 L _R L _Q + 8 L _Q)
Half	•	.0115 (L _I + 1)
Load Characters to A Word Mark	L	.0115 (L _I + 1 + 2 L _A)
Modify Address*	#	.0115 (L _I + 9)
Move Characters to A or B Word Mark	M	.0115 (L _I + 1 + 2 L _w)
Move Characters and Edit or Word Mark*	E	.0115 (L _I + 1 + L _A + L _B + L _y)
Move Characters to Record or Word Mark*	P	.0115 (L _I + 1 + 2 L _A)
Suppress Zeros	Z	.0115 (L _I + 1 + 3 L _A)
Move and Insert Zeros*	X	.0115 (L _I + 1 + 2 Σ L _A + Σ L _Z)
Move Numerical	D	.0115 (L _I + 3)
Move Zone	Y	.0115 (L _I + 3)
Multiply (over-)*	@	.0115 (L _I + 3 + 2 L _C + 5 L _C L _w + 7 L _w)
No Operation	N	.0115 (L _I + 1)

OPERATION	OP CODE	FORMULA
Punch a Card	4	.0115 (L _I + 1) + I/O
Read a Card	1	.0115 (L _I + 1) + I/O
Read and Punch	5	.0115 (L _I + 1) + I/O
Select Stacker	K	.0115 (L _I + 1)
Set Word Mark	9	.0115 (L _I + 2)
Start Punch Feed*	9	.0115 (L _I + 2)
Start Read Feed*	8	.0115 (L _I + 1)
Store A-address Register*	Q	.0115 (L _I + 5)
Store B-address Register*	H	.0115 (L _I + 4)
Subtract (no recomplement)	S	.0115 (L _I + 3 + L _A + L _B)
Subtract (recomplement)	5	.0115 (L _I + 3 + L _A + 4 L _B)
Write a Line	2	.0115 (L _I + 1) + I/O
Write and Punch	6	.0115 (L _I + 1) + I/O
Write and Read	3	.0115 (L _I + 1) + I/O
Write, Read and Punch	7	.0115 (L _I + 1) + I/O
Zero and Add	+ 0	.0115 (L _I + 1 + L _A + L _B)
Zero and Subtract	0	.0115 (L _I + 1 + L _A + L _B)

TAPE OPERATIONS

T_m—Tape movement can be determined from the following

N = Number of Characters

C = Character Rate

729 II at 200 cpi = .067 ms

at 556 cpi = .024 ms

729 IV at 200 cpi = .044 ms

at 556 cpi = .016 ms

Write, Read Tape

729 Model II = 10.8 + CN ms

729 Model IV = 7.3 + CN ms

Rewind

729 Model II = 1.2 minutes/reef

729 Model IV = .9 minutes/reef

Skip and Blank Tape

(add to subsequent write time) Note 1

729 Model II = 108 ms

729 Model IV = 72 ms

Backspace (after Read)

729 Model II = 46 + CN ms

729 Model IV = 33 + CN ms

Backspace (after Write)

729 Model II = 52 + CN ms

729 Model IV = 37 + CN ms

Note 1—leave about 8 inches between records

* Special Feature

INSTRUCTION FORMAT

IBM 1401 Data Processing System Reference Card

The IBM 1401 Data Processing System uses a variable word-length concept; the length of an instruction can vary from one to eight characters.

OP CODE A- or I-ADDRESS B-ADDRESS D-CHARACTER

X XXX X

Op Code: This is always a single character which defines the basic operation being performed. A word mark is always associated with the operation code position of an instruction.

A-Address: This always consists of three characters. It can identify the units position of the A-field, or it can be used to select a special unit or feature (tape unit, 1210 Reader-Sorter, Column binary feature, etc.).

I-Address: Instructions that can cause program branches, use the I-address to specify the location of the next instruction to be executed if a branch occurs.

B-Address: This is a three-character storage address associated with the B-field. It usually addresses the units position of the B-field, but in some operations, such as tape read and write, it specifies the high-order position of a record storage area.

d-Character: The d-character is used to modify an operation code. It is a single alphabetic, numerical, or special character, positioned as the last character of an instruction. It can be used with instructions of any length.

BINARY-CODED-DECIMAL

The internal code used in the IBM 1401 Data Processing System is called binary-coded-decimal. All data and instructions are translated into this code as they are stored. The coding system has a total of 8 magnetic bits which are used in an odd-number-of-bits configuration to represent a character. The possible bits are represented as C B A 8 4 2 1. The C is a check bit that is added to all even-bit configurations to give them an odd number of bits.

DIGIT	BCD CODE	DIGIT	BCD CODE
12 zone	C-B-A	6	C-4-2
11 zone	B	7	4-2-1
10 zone	A	8	8
1	1	9	C-8-1
2	2	0 (zero)	C-8-2
3	C-2-1	A	B-A-1
4	4	J	C-B-1
5	C-4-1	S	C-A-2

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