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character in Operand 2. 16 microsec per program step when signs of Operands 1 and 2 are not alike. Speeds for representative additions and subtractions are as follows:

Number of Operand 2 Digits	Time (Microsec)
8	160
10	192
20	352

See below for multiplication timing formula. Representative times are as follows:

Multiplier Dig.	Number of Multiplicand Dig.	Number of Product Dig.	Aver. Time (Millisec)
3	3	6	2.51
3	5	8	3.12
6	6	12	7.26
10	10	20	17.18

Multiplier digits are assumed to be 5's.

See below for division timing formula. Representative times are as follows:

Number of Dividend Dig	Number of Divisor Dig	Number of Quotient Dig	Aver. Time (Millisec)
6	3	3	3.36
10	5	4	5.70
12	6	5	7.92

Described below are two formulas for computing the average time required to perform multiplication and division. These formulas are based on the new, improved addition and subtraction speeds.

Multiplication

Average time in microsec = $16(2N^2 + 26N + 6NY + Y + 4)$

where N = number of digits in multiplier

Y = number of digits in multiplicand

This formula assumes all fives in the multiplier and is based on steps 3 and 4 of the multiplication routine illustrated in the programming reference manual. The steps used to position the factors are not included in the formula. These steps can vary depending on the requirements of the individual program.

Example: 3 digit multiplier by 5 digit multiplicand
Using the formula we find:

$$\begin{aligned}
 \text{Average time} &= 16(2(3)^2 + 26(3) + 6(3 \times 5) + 5 + 4) \\
 &= 16(18 + 78 + 90 + 5 + 4) \\
 &= 16(195) \\
 &= 3,120 \text{ microsec or } 3.120 \text{ millisec}
 \end{aligned}$$

Division

Average Time in microsec = $16(7RQ + 40Q + DQ + Q^2)$

where D = no. of digits in the dividend

R = no. of digits in the divisor

Q = no. of digits in the quotient

In this formula the Quotient digits are assumed to be all fives and formula is based on steps 5, 6 and 7 of the division routine in the programming reference manual. The set-up and decimal alignment steps have not been included since these steps may vary in accordance with the requirements of the individual program.

Example: 6 dividend digits by 3 divisor digits
giving a quotient of 3 digits
Using the formula we find:

$$\begin{aligned} \text{Average time} &= 16 (7 (3 \times 3) + x+0(3) + (6 \times 3) + (3^2)) \\ &= 16 (63 + 120 + 18 + 9) \\ &= 16 (210) \\ &= 3,360 \text{ microsec or } 3.360 \text{ millisecc} \end{aligned}$$

Construction (Arithmetic unit only)

Transistors and magnetic cores

Arithmetic mode Serial



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[BRL 1964, UNIVAC 1004 80/90, starting page 0274](#)

Processor is asynchronous; system is asynchronous
Operation

Processor is sequential; however, step sequence may be modified by plugboard wiring.

System is concurrent to the following degree:

Card Punch and Processor may operate simultaneously.

Card Reader, Printers and Punch may operate simultaneously.

STORAGE

	No. of Words	No. of Alphanum Char	Access Microsec
Magnetic Core	Variable	961	8

The system is not word oriented.

INPUT

80-Column Data Processor

Medium Speed

Punch Card Reader 300 - 400 cards/min

Read speed depends on number of columns read and amount of processing time required per card.

For example, assume a maximum of 35 millisecc of process time required per card read. Also, all 80 columns are being read. Under these conditions, a 300 card/min rate may be maintained.

When only 40 columns are being read and up to a maximum of 35 millisecc of process time is necessary, a rate of 400 cards/min may be maintained.

90-Column Data Processor
 Medium Speed
 Punch Card Reader 300 - 400 cards/min

Read speed depends on the number of frames and amount of processing necessary per card. (A frame is made up of an upper column and the corresponding lower column of a 90 column card).

When reading 45 frames (90-columns) and using up to 35 millisc of process time, a card feeding speed of 300 cards/min may be maintained.

In the above example if the frames are reduced to 23 (46 columns), a card feeding speed of 400 cards min can be maintained.

OUTPUT

80-Column Data Processor
 Medium Speed
 Printer (Alphanum Data) 300 lines/min
 Printer (Numeric Data) 400 lines/min
 Punch (Model No. 2009-00) Up to 200 cards/min
 (Optional)

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OUTPUT

90-Column Data Processor
 Medium Speed
 Printer (Alphanum Data) 300 lines/min
 Printer (Numeric Data) 400 lines/min
 Punch (Model No. 2011-00) Up to 200 cards/min
 (Optional)

The print drum of the printer rotates at a constant speed of 400 rev/min or 150 millisc/rev. During each revolution of the print drum, one of the 63 different characters passes the printing position every 2.38 millisc.

Each character actually appears on the print drum in two horizontal rows, known as the ODD and EVEN Rows. The characters which print in the odd printing positions are located in the odd rows, while the characters which print in the even printing positions are located in the even rows in the following manner:

Odd "A" Row A A A A Prints in ODD position
 Even "A" Row A A A A Prints in EVEN position
 Odd "B" Row B B B B Prints in ODD position
 Even "B" Row B B B B Prints in EVEN position

Each odd or even row time is one half the 2.38 millisc character time, or 1.19 millisc.

The fact that the characters are arranged in odd and even rows has no special significance in computing printing speeds.

When printing is initiated by a Print-Execute instruction, the processor is interlocked until all characters in print storage have been printed and cleared. As the rotation of the print drum causes a given character to move into printing position, print storage is scanned for the presence of that character. If a coincidence between the drum character in position to be printed and any of the characters stored in memory is detected, the characters in memory are printed and their print storage locations are cleared to spaces. After all the data in print storage has been printed and cleared, an interval of 1.19 millisc is required to detect that print storage is in a cleared condition and to release the processor interlock.

Therefore, print-interlock time in milleseconds, i.e., the time required to complete a printing operation, is equal to $2.38N + 1.19$ where N is equal to the number of characters that must pass the print position to completely print a line.