

LOGIC AND USE OF THE DIVISION WORKSHEET

Use of the division worksheet enables the programmer to write rapidly and with little effort the set of instructions that are required to execute a division. When the worksheet is used, all divisions are performed in the same field, the high order digit of which is labeled BFIELD. The instructions required in the division process address certain digits in this field, the specific addresses being determined by the character adjustments which are easily calculated on the worksheet.

Correct execution of a division requires that the dividend be inserted in the proper location in the division field (BFIELD); that, if necessary, zeros be inserted in a sufficient number of digits following the dividend to develop a quotient to the specified number of decimal places, including extra digits required for rounding the quotient; that the low order digit of the field thus established be signed, and that this sign be negative if the dividend is negative; that, if the dividend in the above field is signed, the sign be removed; that the divide instruction address the high order digit of the dividend in the above field; that 5 be added to the correct digit of the quotient in rounding; that, if the quotient is negative, this 5 be added to the absolute value of the quotient rather than to the negative number; and that, particularly if the quotient is negative, the sign of the quotient developed in the division process be moved to the low order digit of the quotient after rounding. The seven instructions in the middle of the worksheet provide for all of these contingencies, and this set of instructions is therefore used when the sign of the dividend and quotient are unknown or known to be negative. Obviously, some of these instructions are unnecessary if the programmer has other knowledge of the signs; the instructions needed in these common special cases are listed at the bottom of the worksheet.

The locations of the digits to be addressed by the instructions are determined by five factors: the number of digits in the dividend and divisor fields and the number of decimal places in the dividend, divisor, and quotient. On the worksheet, these values are called A, B, C, D, and E, respectively, and the programmer writes these known values into the blanks provided. He then uses the simple formulas listed on the worksheet to compute the necessary character adjustments, which are called F through N, and he then enters these values into the blanks provided in the A- and B-Addresses of the set of instructions to be used. He also writes the label or location of the dividend and divisor in the specified blanks. These instructions are then copied onto the proper location in the coding sheet for the program. The letters J through N and the words "Dividend" and "Divisor" are, of course, not copied onto the coding sheet.

Suggested practice is that the block diagram for the program contain one block representing the set of instructions used in the entire division process, and that this block be identified to refer to the related division worksheet, which should be attached to the block diagram.

DIVISION WORKSHEET

Program _____
Routine _____

Date _____

Name of Field	Length of Field	Decimal Places
Dividend _____	A = _____	C = _____
Divisor _____	B = _____	D = _____
Quotient _____	P = _____	E = _____

Enter greatest possible number of digits in quotient, if known.

Computation of Character Adjustments

$G = D + E - C =$ _____
 $H =$ _____ (If $G > 0$, enter G . If not, enter 0.)
 $S = A + H - P =$ _____

Use this column if S is not greater than 0 or if P is not known

Use this column if S is greater than 0

$F = A + B =$ _____	$F = A + B - S =$ _____
$J = F + H + 2 =$ _____	$J = F + H - S + 2 =$ _____
$K = B + 1 =$ _____	$K = B - S + 1 =$ _____
$L = A + G =$ _____	$L = A + G - S =$ _____
$M = A + H + 1 =$ _____	$M = A + H - S + 1 =$ _____
$N = L - 1 =$ _____	$N = L - S - 1 =$ _____

Required Constants

Count	Label	OP Code	Contents	
1	BFIELD	DCW *	Count must be at least as great as J.	
1	ZERO	DC *		0
1	FIVE	DCW *		5

Instructions

Number	OP Code	A-Address	B-Address
1	ZA	ZERO	BFIELD + _____ (J)
2	ZA	(Dividend)	BFIELD + _____ (F)
3	MZ	BFIELD + _____ (F)	BFIELD + _____ (J)
4	MZ	ZERO	BFIELD + _____ (F)
5	D	(Divisor)	BFIELD + _____ (K)
6	A	FIVE	BFIELD + _____ (L)
7	MZ	BFIELD + _____ (M)	BFIELD + _____ (N)

The Quotient is located at BFIELD + N, is signed, and in L digits in length.

Special Cases

- If the Dividend is known to be unsigned, use MCW for OP code of Instruction (2) and omit Instructions (3) and (4).
- If the Dividend is known to be signed and positive, omit Instruction (3).
- If the Quotient is known to be positive, omit Instruction (7), and reduce each character adjustment by 1. The Quotient will always be unsigned.

Instructions for the common combination of special cases (1) and (3):

ZA	ZERO	BFIELD + _____	(J-1)
MCW	(Dividend)	BFIELD + _____	(F-1)
D	(Divisor)	BFIELD + _____	(K-1)
A	FIVE	BFIELD + _____	(L-1)

The Quotient is located at BFIELD + N, is unsigned, and is L digits in length.