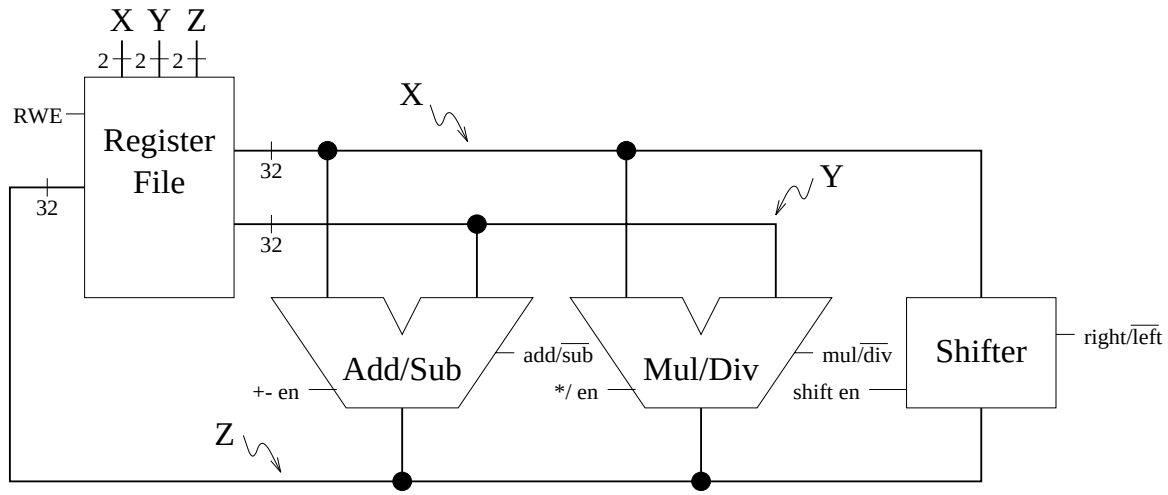
ECE2030h HW-6 Due 11-20-01

Name: _____

Microcode Programming

The datapath below incorporates an adder/subtractor, multiply/divider, and a one bit shifter. An arithmetic operation is specified by the $add/\overline{sub}$ and $mul/\overline{div}$ control lines. Subtraction is $(X - Y)$; division is (X/Y). The shift direction is controlled by the $right/\overline{left}$ control line. The enable signals determine which functional unit drives the Z bus. The datapath also contains a register file with four registers.



Write microcode for this datapath to compute the function below. The initial values of the registers should be used in the equation. Any register may be modified once its initial value has been used for the last time. Express all signals in octal notation (i.e., to select register two on the X bus, put a "2" in the X column).

$$R_0 = \frac{3R_0R_1 + 9R_2}{R_0 - R_3}$$

cycle	X	Y	Z	RWE	$add/\overline{sub}$	$+-\ en$	$mul/\overline{div}$	*/ en	$right/\overline{left}$	$shift\,en$
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Answer on Next Page

Please write equation in left margin:
e.g., R3 = R0-R3

HW-6 Answer

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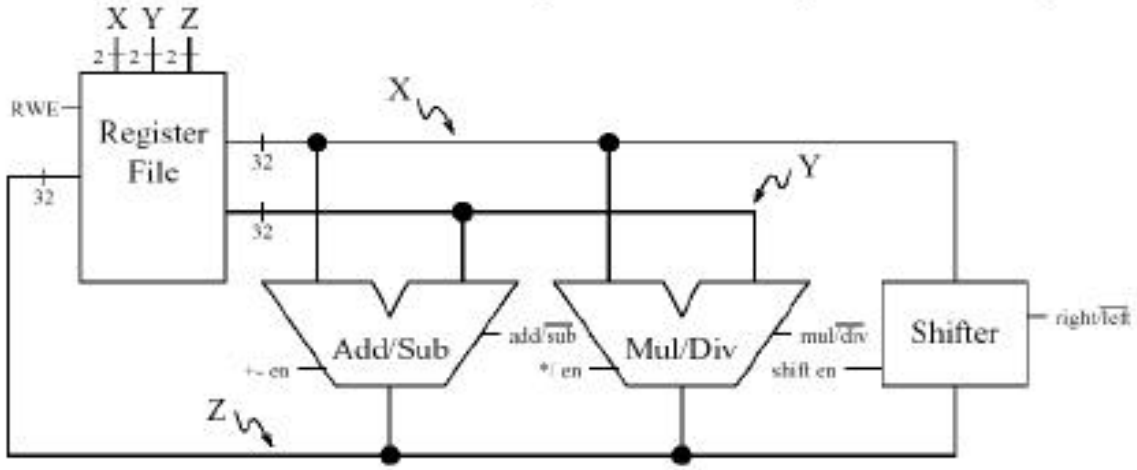

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cycle	X	Y	Z	RWE	add/sub'	+ - en	mult/div'	*/en	right/left'	shift en	Comment
1	0	3	3	1	0	1	X	0	X	0	$3 = $0 - $3 = R0 - R3
2	0	1	1	1	X	0	1	1	X	0	$1 = $0 * $1 = R0 R1
3	2	X	0	1	X	0	X	0	0	1	$0 = $2<<1 = 2 R2
4	2	0	2	1	1	0	X	0	X	1	$2 = $2 + $0 = 3 R2
5	1	2	0	1	1	0	X	0	X	1	$0 = $1+$2 = R0 R1+3R2
6	0	X	1	1	X	0	X	0	0	1	$1 = $0 <<1 =2R0 R1+6R2
7	0	1	0	1	1	1	X	0	X	0	$0 = $0+$1 = 3R0 R1+9R2
8	0	3	0	1	X	0	0	1	X	0	$0 = $0 / $3 = ANSWER