

Lab 7: Division

Released: Friday 27 October 2017, 6:00am

Due: Monday 6 November 2017, 23:00pm

Each of you should submit your own solution. If you choose to work with a neighbor/partner, put your partner's name on your submitted copy of the lab. Late submissions will not be accepted.

To help you practice for an upcoming exam, consider working each problem in pen or pencil on a hard copy of this document. Then, **enter your answers into CourseWeb.**

1. Show the steps for dividing the dividend $1011\ 1011_b$ by the divisor $0000\ 1110_b$ (both **unsigned**) using **restoring division** for Hardware Design 3. Restoring division is described online, with an example, at <http://www.cs.pitt.edu/~childers/CS0447/lectures/division.pdf>.

Populate the cells of the following table. Within it, **show your work** for each addition/subtraction.

Iteration	Divisor (8 bits)	Restoring Division (Hardware Design 3)	Remainder Register (16 bits)															
		Step	Remainder (8 bits)								Dividend (8 bits)							
0	0000 1110	Initial values	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1
		Shift left	0	0	0	0	0	0	0	1	0	1	1	1	0	1	1	X
1	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0								
			1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	X
		R<0, restore, set Q 0, shift left	0	0	0	0	0	0	1	0	1	1	1	0	1	1	0	X
2	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0								
			1	1	1	1	0	1	0	0	1	1	1	0	1	1	0	X
		R<0, restore, set Q 0, shift left	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	X
3	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0								
			1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	X
		R<0, restore, set Q 0, shift left	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	X
4	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0								
			1	1	1	1	1	1	0	1	1	0	1	1	0	0	0	X
		R<0, restore, set Q 0, shift left	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0	X
5	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0								
			0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	X
		R>0, set Q 1, shift left	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	X

6	0000 1110	R = R-Divisor	1	1	1	1	0	0	1	0										
			0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	X		
7	0000 1110	R>0, set Q 1, shift left	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	X		
			1	1	1	1	0	0	1	0										
8	0000 1110	R<0, restore, set Q 0, shift left	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	X		
			1	1	1	1	0	0	1	0										
Done		R = R-Divisor	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	X		
		R>0, set Q 1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1		

FINAL RESULT: $1011\ 1011_b \div 0000\ 1110_b = \underline{0000\ 1101} \text{ rem } 0000\ 0101$