ECE 485/585 – Computer Organization and Design

HOMEWORK #3

Due date: Friday, September 30th 2022 11:59PM

Solve the following exercises from the textbook (Chapter 3)

1. What is 6FD4-273B when these values represent signed 16-bit hexadecimal numbers stored in sign-magnitude format? The result should be written in hexadecimal. You MUST show your work.

2. Assume 174 and 85 are signed 8-bit decimal integers stored in sign-magnitude format. Calculate 174+85. Is there overflow, underflow or neither? You MUST show your work.

3. Using a table similar to the below Table 1, calculate 60 divided by 22 by using the hardware described in Figure 1. You should show the contents of each register on each step. Assume both inputs are unsigned 6-bit integers, *NOT 32-bit integers*, and modify the division hardware shown in Figure 1. (Refer to Lecture Note #5 Page 12-14.)

Iteration	Step	Quotient	Divisor	Remainder
0	Initial values	0000	0010 0000	0000 0111
1	1: Rem = Rem – Div	0000	0010 0000	1110 0111
	2b: Rem < 0 ⟹ +Div, sll Q, Q0 = 0	0000	0010 0000	0000 0111
	3: Shift Div right	0000	0001 0000	0000 0111
2	1: Rem = Rem – Div	0000	0001 0000	1111 0111
	2b: Rem < 0 ⟹ +Div, sll Q, Q0 = 0	0000	0001 0000	0000 0111
	3: Shift Div right	0000	0000 1000	0000 0111
3	1: Rem = Rem – Div	0000	0000 1000	1111 1111
	2b: Rem < 0 ⟹ +Div, sll Q, Q0 = 0	0000	0000 1000	0000 0111
	3: Shift Div right	0000	0000 0100	0000 0111
4	1: Rem = Rem – Div	0000	0000 0100	0000 0011
	2a: Rem ≥ 0 ⟹ sll Q, Q0 = 1	0001	0000 0100	0000 0011
	3: Shift Div right	0001	0000 0010	0000 0011
5	1: Rem = Rem – Div	0001	0000 0010	0000 0001
	2a: Rem ≥ 0 ⟹ sll Q, Q0 = 1	0011	0000 0010	0000 0001
	3: Shift Div right	0011	0000 0001	0000 0001

Table 1. Division example (Figure 3.10 of textbook)

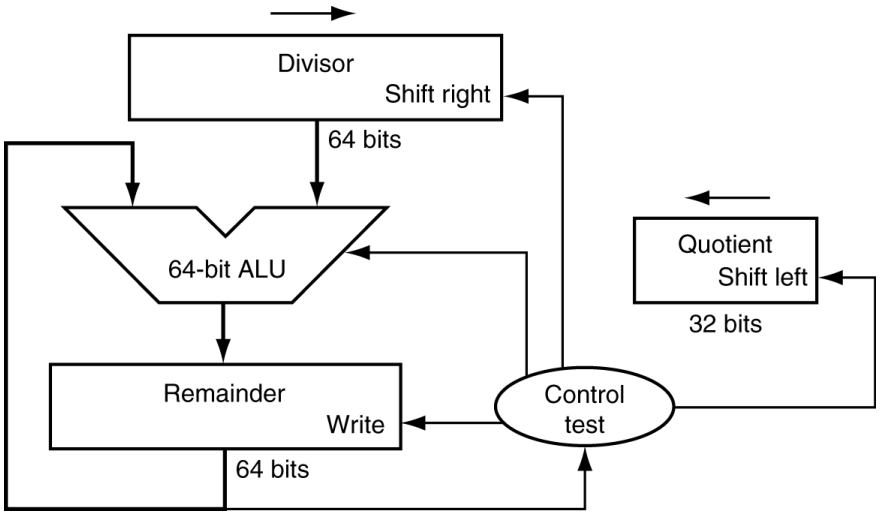

Figure 1. Division Hardware

4. Write down the binary representation of the decimal number 56.93 assuming the IEEE 754 double precision format.

5. IEEE 754-2008 standard contains a half precision that is only 16 bits wide. Leftmost bit, which is the most significant bit (MSB), is still the sign bit, the exponent is 5 bits wide and has a bias of 15, and the fraction is 10 bits long. A hidden 1 is assumed. Write down the bit pattern to represent -1.585×10^{-1} assuming a version of this format, which uses an excess-16 format (exponent bias = 15) to store the exponent. Comment on how the range and accuracy of this 16-bit floating point format compares to the single precision IEEE 754 standard.