Alan Palayil Homework 3 Due Date: 9/30/2022

Q.1 Representing 6FD4 in signed 16-bit number

bits 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

S (1) ← 15 bits magnitude →

Sign bit (S) = 1 if the number is negative.

Represent 6FD4 and 273B in binary notation.

+ 6	F	D	4		2	7	3	B	
0110	1111	1101	0100	-(I)	0010	0111	0011	1011	-(II)

The signed 2's complement of 273B to generate (-273B) and add the result to 6FD4

The signed 1's complement of 273B is 1101 1000 1100 0100

Add (1) 1

1101 1000 1100 0101

Signed hexadecimal notation of (-273B): D 8 C 5 -(1)

Adding eq(1) to eq(I) ∴

0110 1111 1101 0100

\+ 1101 1000 1100 0101

Carry → 1 0100 1000 1001 1001

4 8 9 9

∴ 6FD4 - 273B = 4899 //

Q.2 Converting 174 into 8-bit binary

174 : 10101110 and since left most bit is 1, so the number is negative number.

Thus, 174 = 01011110

= 10100001 ← 1's complement

= 10100010 ← 2's complement

= 82

So, 174 ⇒ (-82)

85 : 01010101 and since left most bit is 0, so the number is positive number.

Thus, 174 + 85 ⇒ -82 + 85

= 3

Since the number is in the range of 8-bit signed integers. So, this isn't overflow nor underflow.

Q3.3

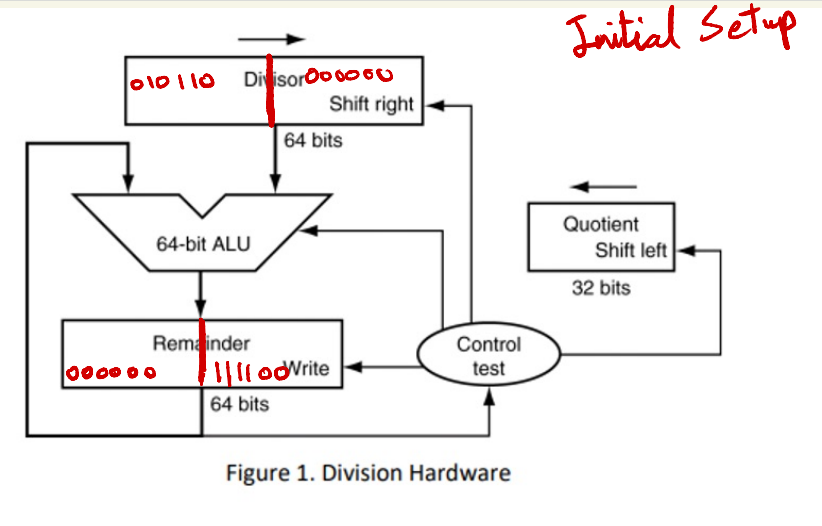

Figure 1. Division Hardware

Iteration	Step	Quotient	Divisor	Remainder
0	Initially	000000	010110 000000	000000 111100
1	Rem = Rem - Div	000000	010110 000000	110101 000100
	Q<0 -> Rem = Rem + Div, Q <<1	000000	010110 000000	000000 111100
	Div >>1	000000	001011 000000	000000 111100
2	Rem = Rem - Div	000000	001011 000000	101010 000100
	Q<0 -> Rem = Rem + Div, Q <<1	000000	001011 000000	000000 111100
	Div >>1	000000	000101 100000	000000 111100
3	Rem = Rem - Div	000000	000101 100000	100100 100100
	Q<0 -> Rem = Rem + Div, Q <<1	000000	000101 100000	000000 111100
	Div >>1	000000	000010 110000	000000 111100
4	Rem = Rem - Div	000000	000010 110000	100001 110100
	Q<0 -> Rem = Rem + Div, Q <<1	000000	000010 110000	000000 111100
	Div >>1	000000	000001 011000	000000 111100
5	Rem = Rem - Div	000000	000001 011000	100000 011100
	Q<0 -> Rem = Rem + Div, Q <<1	000000	000001 011000	000000 111100
	Div >>1	000000	000000 101100	000000 111100
6	Rem = Rem - Div	000000	000000 101100	000000 010000
	Q<0 -> Q <<1, Q += 0001	000001	000000 101100	000000 010000
	Div >>1	000001	000000 010110	000000 010000
7	Rem = Rem - Div	000001	000000 010110	100000 000110
	Q<0 -> Rem = Rem + Div, Q <<1	000010	000000 010110	000000 010000
	Div >>1	000010	000000 001011	000000 010000

Q.4 Convert 56 in binary is 111000 and 0.93 is .1110 1110 0000
So, the binary for 56.93 = 111000.1110 1110 0000
The leftmost number is sign bit and it will be 0 since the number is positive.
The mantesa = 1100 0111 0111 0000 1010 010
Exponent = 5x127 = 132
132 in binary is 10000100
So, 56.93 in IEEE 754 standard is
0 10000100 1100 0111 0111 0000 1010 010 //

Q.5 -1.585×10^{-1}
For 5 bit exponent bias = $2^{5-1} - 1 = 15$
Since, the given value is negative, the sign bit is 1.
$1.585 \times 10^{-1} = 0.1585$ and converting it to binary:
0.1585 = .0010 1000 100
$1.\underbrace{01000100}_{\text{mantesa}} \times 2^{-3}$ (E = E' + B)
exponent = −3 + bias = −3 + 15
= 12 = 01100
∴ 1 01100 0100 0100 00 //