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CSCI 240: Computer Organization and Assembly Language

Extra Credit

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$$1. \overset{M}{(-6)} \times \overset{Q}{(+14)} = -84$$

$$\begin{array}{ll} 6 \rightarrow 110 & 14 \rightarrow 1110 \\ +6 \rightarrow 0110 & +14 \rightarrow 01110 \\ -6 \rightarrow 1010 & -14 \rightarrow 10010 \end{array}$$

	A	Q	Q-1	
	0000	01110	0	
Shift	+0000	00111	0	0
A-M	0110			
	0110	00111	0	
Shift	0011	00011	1	0
Shift	0001	10001	1	1
Shift	0000	11000	1	1
A+M	+1010			
	1010	11000	1	
Shift	1101	01100	0	1

↓ Negate to check

$$0010 \quad 10100 = +84 \checkmark$$

Answer: 110101100 = -84

$$2. -53.125 \rightarrow 8 = 1$$

$$\text{Consider unsigned} \rightarrow 53.125 = 110101.001$$

$$110101.001 \times 2^0 = 1.10101001 \times 2^{+5}$$

$$\text{Bias for Single Precision} = 2^{8-1} - 1 = 127$$

$$\text{Biased exponent} = 5 + 127 = 132 = 128 + 4 = 10000100$$

S	Biased Exp	Fraction
1	10000100	10101001000...0
1	8	23

1100 0010 0101 0100 1000 0000 0000 0000

3. 1001 1110 0101 0000 0000

↓

$$32 + 16 + 8 + 4 = 60$$

$$\text{Unbiased exponent} = 60 - 127 = -67$$

$$\text{Fraction} \rightarrow .10100 = 2^{-1} + 2^{-3} = .5 + .125 = .625$$

$$\begin{aligned} \text{Number} &= (-1)^1 \cdot (1 + .625) \cdot 2^{-67} \\ &= -1.625 \times 2^{-67} \end{aligned}$$