

CMSC216 Week10Lab2 (Lab Work)

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Complete the following tasks and submit your work to GradeScope

A. Decimal and Binary conversion

- Represent 123 in a 16-bit binary number and give the corresponding hex value (give the prefix for hex)

$$123 \text{ (decimal)} = 64 + 32 + 16 + 8 + 2 + 1$$

$$123 \text{ (16-bit binary)} = (0000)(0000)(0111)(1011)$$

$$123 \text{ (16-bit binary)} = 0000000001111011$$

$$123 \text{ (hex)} = 0x007b$$

- Represent -123 in a 16-bit binary number and give the corresponding hex value (give the prefix)

$$\begin{aligned} -123 \text{ (16-bit binary)} &= 2\text{'s complement of } 0000000001111011 \\ &= 1111111110000101 \end{aligned}$$

$$-123 \text{ (16-bit binary)} = (1111)(1111)(1000)(0101)$$

$$-123 \text{ (hex)} = 0xff85$$

B. Convert 0xABCD to binary and also to octal.

$$0xABCD \text{ (16-bit binary)} = (1010)(1011)(1100)(1101) = 1010101111001101$$

$$0xABCD \text{ (16-bit binary)} = (1)(010)(101)(111)(001)(101)$$

$$0xABCD \text{ (octal)} = 0125715$$

C. Write binary expression for -123.5625 in IEEE 754 single-precision format and also give the corresponding hex value for the binary representation.

$$-123.5625 \text{ (decimal)} = -1 * (123 + 0.5625)$$

$$123 \text{ (binary)} = 1111011$$

$$0.5625 \text{ (decimal)} = 1*0.5 + 0*0.25 + 0*0.125 + 1*0.0625$$

$$0.5625 \text{ (binary)} = 0.1001$$

$$123.5625 \text{ (binary)} = 1111011.1001 = 1.1110111001 * 2^{(6 + 127 \text{ bias})}$$

$$-123.5625 \text{ (binary)} = -1^1 * 1.1110111001 * 2^{133}$$

$$\text{sign} = 1$$

$$\text{exponent} = 133 \text{ (dec)} = 128 + 4 + 1 = 10000101 \text{ (binary)}$$

$$\text{mantissa (first half)} = 1110111001$$

$$\text{mantissa (second half)} = 00000000000000$$

$$-123.5625 \text{ (IEEE 754 single precision)} = (1)(10000101)(111011100100000000000000)$$

$$-123.5625 = 11000010111101110010000000000000$$