

**The University of Alabama in Huntsville**  
**ECE Department**  
**CPE 431 01/01R, CPE 531 01/91 Fall**  
**2022**

**Due September 13, 2022 – You must show your work to get full credit. Use online calculators to check your answers.**

**1.0 (5), 2.0 (5), 3.0 (10), 4.0 (10), 5.0 (10), 6.0 (10)**

- 1.0**     **<3.2>** Assume 12 and 155 are unsigned 8-bit decimal integers. Calculate  $12 - 155$  in binary. Is there overflow, why or why not?

$$12 - 155 = -143$$

1\_0111\_0001

**Answer:** Yes because at 8 bits signed you only get 113

- 2.0**     **<3.5>** What decimal number does the bit pattern 0xCB9A\_0A89 represent if it is a two's complement integer? An unsigned integer?

1100\_1011\_1001\_1010\_0000\_1010\_1000\_1001

31,30,27,25,24,23,20,19,17,11,9,7,3,0

**Unsigned Decimal: 3,415, 870, 089**

**Two's Comp Decimal: -1,268,386,441**

- 3.0**     **<3.5>** What decimal number does the bit pattern 0x6DB8\_0000 represent if it is a floating point number? Use the IEEE 754 standard and express in decimal scientific representation.

32 bit (single precision)

Binary: 0|110\_1101\_1|011\_1000-0000\_0000\_0000\_0000

23\_4-----

1101\_1011 (219)

1000\_0001 (bias)

0101\_1100 (92) = exp

$$2^{-2}, 2^{-3}, 2^{-4} = 0.4375 \text{ (fraction)}$$

**Answer:  $1.4375 * 2^{92} = 7.1182 \text{ E}27$**

- 4.0**     **<3.5>** Write down the hexadecimal representation of the decimal number 57812.59375 assuming the IEEE 754 single precision format.

Binary: 1110\_0001\_1101\_0100.10011

Scientific Notation:  $1.1100_0011_1010_1001_0011 * 2^{15}$

Calculate Exp:

0000\_1111 (15)

0111\_1111 (127)

1000\_1110 (142) – exp

Put it together: 0|100\_0111\_0|110\_0001\_1101\_0100\_1001\_1000

0100\_0111\_0110\_0001\_1101\_0100\_1001\_1000

**Answer: 0x4761\_D498**

**5.0 <3.5>** Write down the hexadecimal representation of the decimal number -5932.515625 assuming the IEEE 754 double precision format.

Ignore sign when changing to binary bc

Binary: 1\_0111\_0010\_1100.100001

Scientific:  $1.011100101100100001 \times 2^{12}$  (sign bit = 1)

Calculate Exp: 000\_0000\_1100 (12)

111\_1111\_1111 ( 1023)

100\_0000\_1011 (1035)

Put it together: 1|100\_0000\_1011|011100101100100001

1100\_0000\_1011\_0111\_0010\_1100\_1000\_0100\_0000\_0000\_0000\_0000\_0000\_0000\_0000\_0000

**Answer: C0B7\_2C84\_0000\_0000**

**6.0 <3.5>** Write down the hexadecimal representation of the decimal number -1947.75 assuming it was stored using the single precision IBM format (base 16, instead of base 2, with 7 bits of exponent, bias = 64, no implicit numbers)

Sign = 1

Hex: 79B.C

Scientific Notation:  $0.79BC \times 16^3$

Calculate Exp:  $3 + 40$  (bias: 64) = 43 ( 67 decimal)

Put it together: 1100\_0011 (43 and the sign bit in binary) = C3

Add the rest....

**Answer: 0xC379\_BC00**