CMPU-224 Lab3 Practice
Spring 2025

1. You are given the following 6-bit two's-complement number.

   `100110`

   (a) What is the decimal value of this number?

   -32 16 8 4 2 1
   1 0 0 1 1 0
   -32+6 = -26

   OR Take the Two's comp. To get magnitude
   011001
   + 1
   011010
   16+8+2 = 26

   -26

   (b) What is representation of that number as a 10-bit two's-complement number? Give your answer as in hexadecimal.

   SIGN Extend To 10 Bits
   1111100110

   0x 3C6

2. You are given the following 6-bit two's-complement number.

   `001100`

   (a) What is the decimal value of this number?

   12

   (b) What is representation of that number as a 10-bit two's-complement number? Give your answer as in hexadecimal.

   Zero extend To 10-bits
   0000001100

   0x 00C

3. For this question, assume all the numbers are internally represented as 6-bit two's complement binary numbers.

   (a) What is the decimal value of $30 + 12$?

   42 ⇒ -32 16 8 4 2 1
   101010
   -32 + 10 = -22

   -22

   (b) What is the decimal value of $-22 + -22$?

   ⇒ -44 ⇒ -64 32 16 8 4 2 1
   1 0 1 0 1 0 0
   ↑ DISCARD
   ⇒ 010100

   20

   (c) What is the decimal value of $-20 >> 3$?

   $\frac{-20}{8}$ ⇒ -2.5 (Round Down)

   OR

   -20 ⇒ -32 16 8 4 2 1
   1 0 1 0 1 0
   ⇒ Shift 3 ⇒ 111101 ⇒ -3

   -3

4. Consider a 10-bit floating point representation called "Tiny Float".
The bits are arranged as follows:
Bit 9: Sign bit (S)
Bits 8–5: Exponent (E) Bias = $2^{4-1}-1 = 7$
Bits 4–0: Fraction (F)

Convert the decimal number -13.5 into the 10-bit Tiny Float representation.

(a) Convert the number to fixed-point binary.

13.5 = 1101.1

(b) Normalize the binary number (show the value in scientific notation like $1.xxxx \times 2^y$).

1.1011×2^3

(c) Determine the values for the Sign bit, Exponent bits, and Significand bits.

S = 1
Exp = 10 (3+7) ⇒ 1010
frac = 10110 (5-bits)

(d) Write the final 10-bit binary representation.

Sign	Exponent	Significand
1	1010	10110

5. Consider the following Tiny Float represented in binary:

0 0101 10100

(a) Identify the sign, the biased exponent value (in decimal), and the stored fractional part.

s = 0
exp = 0101
frac = 10100

(b) Calculate the actual exponent (unbiased) in decimal.

5 - 7 = -2

(c) Write the number in binary scientific notation (restoring the implicit leading 1).

$1.10100 \times 2^{-2} \Rightarrow .01101$

(d) Convert the result to a standard decimal number.

.5 .25 .125 .0625 .03125
0 1 1 0 1

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  1
 .25
 .125
 .03125
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 0.40625
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