Computer Science 304 Computer Organization Spring 2025 Assignment 5

Due: beginning of class, Tuesday, 3/25/2025

Answer the following questions and submit solutions by the due date. Show your work for full credit. All submissions must be completely your own work.

- 1. [12 points] Show how the following binary fractional values would be rounded to the nearest fourth (2 bits to the right of the binary point), according to the round-to-even rule. For each value, show the (i) the true decimal value before rounding, (ii) the binary value (to the nearest fourth) after rounding to the nearest even, and (iii) the decimal value of the binary in (ii).
 - a. 1.01101
 - b. 10.1001
 - c. 110.101
 - d. 1111.1110
- 2. [8 points] Assuming an 8-bit IEEE binary string for floating point representation, with 1 bit for the sign, 3 bits for the exponent, and 4 bits for the significand (somewhat similar to Slide 28 in the Chapter 2 Floating Point notes), apply operations to the following two numbers. Show (i) the exact unnormalized binary result and (ii) the binary result in the 8-bit IEEE format after fixing.

 $\begin{array}{c} 0 \ 010 \ 0100 \\ 0 \ 100 \ 1110 \end{array}$

- a. Find the sum of the two IEEE binary values above.
- b. Find the product of the two IEEE binary values above.
- 3. [10 points] Given the following C declarations, state whether each of the comparisons is always true (True) or not always true (False). Provide a short explanation for each answer. Note: for this problem, assume a **long** (int) of 8 bytes, and that neither **d** nor **f** is **NaN**.

```
int i;
long g;
float f;
double d;
a. i == (int) (long) i;
b. g == (long) (double) g;
c. d == (double) (long) d;
d. g * g >= 0
e. i == (i + g) - g
```

(continued)

- 4. [20 points] Consider the following C code. Assume that variables are stored in memory starting at location 2000, in order and with no gaps between variables. Assume all int's and pointers consume 4 bytes each.
 - a. [4 points] Show the memory layout and values for the variables at position A.
 - b. [5 points] Show the memory layout and values for the variables at position B.
 - c. [5 points] Show the memory layout and values for the variables at position C.
 - d. [6 points] What is printed by the program?

```
#include <stdio.h>
int main ()
{
    int x = 5, y = 2;
    int *p = \&x;
    int *q = &y;
    int a[3] = \{-1, 3, 4\};
    // ## A ##
    *p += 1;
    p++;
    *p += 3;
    // ## B ##
    q = \&a[1];
    *q = 0;
    p = q - -;
    ++(*p);
    *q = 8;
    // ## C ##
    printf ("%d %d %d\n", &p, p, *p);
    printf ("%d %d %d\n", &q, q, *q);
}
```