

Assignment 6

Due December 4, 23:59

NOTE: Late submissions will not be accepted. Please submit a single PDF file with your answers via the **ECE 355 Brightspace** webpage.

1. [10 points]

- (a) Show 32-bit IEEE-754 number **1 11111111 000000000000000000000000** in the decimal format.
- (b) Show 32-bit IEEE-754 number **0 00000000 110000000000000000000000** in the decimal format.
- (c) Show decimal number **-0.625** in the 32-bit IEEE-754 representation.
- (d) Given two 32-bit IEEE-754 numbers **X** and **Y** below, calculate (in the binary format) **Z = X - Y**. Then, convert your IEEE-754 result **Z** to the decimal format:

X = 0 01111011 100000000000000000000000,
Y = 1 01111110 110100000000000000000000.

2. [5 points] Consider a pipelined datapath consisting of five stages:

- F** - fetch the instruction from the memory,
- D** - decode the instruction and read the source register(s),
- C** - execute the ALU operation specified by the instruction,
- M** - execute the memory operation specified by the instruction,
- W** - write the result in the destination register.

Identify data hazards in the code below and insert NOP instructions where necessary.

```

ADD    #4, R0, R0    // R0 = R0 + 4
ADD    #4, R2, R2    // R2 = R2 + 4
MOV     (R0), R1      // R1 = MEMORY[R0]
MOV     (R2), R3      // R3 = MEMORY[R2]
SUB     R2, R0, R4     // R4 = R2 - R0
SUB     R3, R1, R5     // R5 = R3 - R1
MOV     R4, (R2)      // MEMORY[R2] = R4
MOV     R5, (R0)      // MEMORY[R0] = R5
ADD     #4, R0, R0     // R0 = R0 + 4
ADD     #4, R2, R2     // R2 = R2 + 4

```

3. [2 points] Solve Problem **12.8** from the textbook.

4. [8 points] Solve Problem **12.7** from the textbook. **Hint:** Declare a shared counter variable, e.g., `"volatile int thread_id_counter"`, initialize it to 0 in `main()`, and poll it by each thread as follows: `"while (thread_id_counter != my_id);"`. Each thread must increment `thread_id_counter` after updating global `dot_product`.