

## Assignment 6

### Due December 3, 12:59pm

**NOTE:** Late submissions will **NOT** be accepted. Please put your solutions in the CENG 355 **drop-box** (ELW, second floor) – they will be collected at **13:00**.

**1.** [10 points]

- (a) Show **decimal** number **-25.25** in the 32-bit IEEE-754 floating-point format.
- (b) Show 32-bit **IEEE-754** number **0 00000000 110000000000000000000000** in the decimal format.
- (c) Show 32-bit **IEEE-754** number **0 01111111 000000000000000000000000** in the decimal format.
- (d) Given two 32-bit IEEE-754 floating-point numbers **X** and **Y** below, calculate (in the binary format) **Z = X - Y**, and then convert **Z** to the decimal format:  
**X = 1100 0001 1001 0100 1111 0000 0000 0000,**  
**Y = 0011 1110 0100 0000 0000 0000 0000 0000.**

**2.** [3 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    R4, R0, R2           // R2 = R0 + R4
MOV    R4, (R0)             // MEMORY[R0] = R4
MOV    (R2), R0             // R0 = MEMORY[R2]
MOV    R0, (R4)             // MEMORY[R4] = R0
MOV    R4, (R1)             // MEMORY[R1] = R4
MOV    R2, (R0)             // MEMORY[R0] = R2
ADD    #4, R0, R0           // R0 = R0 + 4
ADD    #4, R1, R1           // R1 = R1 + 4
ADD    #4, R2, R2           // R2 = R2 + 4
ADD    R0, R4, R4           // R4 = R4 + R0

```

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

**4.** [10 points] Solve Problem **12.7** from the textbook. **Hint:** Declare the shared counter variable as `"volatile int thread_id_counter"`, initialize it to 0 in `main()`, and check it by each thread as follows: `"while (thread_id_counter != my_id);"`. Each thread must increment `thread_id_counter` after updating global `dot_product`.