Assignment 6

Due December 1, 13:59

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 **14:00**.

1. [12 points]

(a) Show decimal number **−128.625** in the 32-bit IEEE-754 floating-point format.

(b) Show 32-bit IEEE-754 number **0 00000000 10000000000000000000000** in the decimal format.

(c) Show 32-bit IEEE-754 number **0 01111111 00000000000000000000000** 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**.

(e) Repeat part (d) assuming that **X**, **Y**, and **Z** are 2's complement numbers.

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.

```
MOV   R2, R0          // R0 = R2
ADD   #4, R4, R4      // R4 = R4 + 4
ADD   R0, R2, R1      // R1 = R0 + R2
MOV   R4, R2          // R2 = R4
MOV   (R4), R6        // R6 = MEMORY[R4]
MOV   R3, (R1)        // MEMORY[R1] = R3
ADD   R0, R2, R3      // R3 = R0 + R2
ADD   R4, R6, R5      // R5 = R4 + R6
ADD   R2, R4, R1      // R1 = R2 + R4
```

3. [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`.