Assignment 6

Due November 29, 11:59am

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 **NOON**.

1. [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
```

2. [10 points] Solve Problem **12.7** from the textbook. **Hint:** The shared counter variable can be declared as "**volatile int thread_id_counter**". It should be initialized to 0 in **main()** and then checked by each thread as follows: "**while (thread_id_counter != my_id);**". Note that each thread must increment **thread_id_counter** after updating global **dot_product**.

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

4. [10 points] Show **decimal** number **–128.625** in the 32-bit IEEE-754 floating-point format. Also, consider two 32-bit IEEE-754 floating-point numbers:

X = **1100 0001 1001 0100 1111 0000 0000 0000**,
Y = **0011 1110 0100 0000 0000 0000 0000 0000**.

Compute **Z = X–Y** and convert it to the decimal format.