# CS-UY 2214 — Recitation 8

## Introduction

Complete the following exercises. Unless otherwise specified, put your answers in a plain text file named `recitation8.txt`. Number your solution to each question. When you finish, submit your file on Gradescope. Then, in order to receive credit, you must ask your TA to check your work. Your work should be completed and checked during the recitation session.

You may consult the E20 manual, which is available on Brightspace.

## Problems

1. Consider the multicycle E20 processor, as described in the E20 manual. Name all of the micro-operation registers.

2. Consider the multicycle E20 processor, as described in the E20 manual.

   Which control signals would you set to achieve each of the following microcode instructions?

   For each microcode instruction, give all relevant control signals and their values. Each instruction is to be taken independently.

   (a) `pc <- pc + 1`

   (b) `R[7] <- MDR`

   (c) `M[pc] <- B`

3. Consider the multicycle E20 processor. Consult the circuit diagram in the E20 manual. Using only that diagram and the instruction reference, determine which E20 instruction will be performed with the following control line settings for each of the stages:

```
IF stage:
    WEir = 1
    WEram = 0
    WEreg = 0
    WEpc = 0
    WEa = 0
    WEb = 0
    WEalu = 0
    MUXaddr = 1
ID stage:
    WEa = 1
    WEb = 1
    MUXr1 = 4
    MUXb = 0
EXEC stage:
    aluOp = 0
```

```
    WEalu = 1
    MUXalu = 1
MEM stage:
    MUXaddr = 0
    WEram = 0
WB stage:
    WEpc = 1
    MUXpc = 0
```

4. Is it possible for an E20 program to perform a memory read (`lw`) using the pointer value 8193? If so, write a program that will do so, and describe what will happen when the program is run. If not, describe why not.

   Consult the E20 manual.

5. Consider the following E20 program:

   ```
   .fill 8321
   .fill 8450
   .fill 8579
   .fill 16387
   ```

   What is the final value of registers `$1`, `$2`, and `$3` after execution of this program?