COSC 121   Spring 2019   Assignment 6
Due March 25, 2019

The purpose of this assignment is to improve familiarity with the datapath and control **block diagram** in the textbook by Patterson & Hennessy [PH]. This will make it easier to understand the discussion of pipelining, the next topic to be discussed in the course.

I used slide 8 in the set at https://www.utdallas.edu/~dodge/EE2310/lec19.pdf for the discussion related to this. Understanding the block diagram on slide 8 above should suffice to complete this assignment.

BACKGROUND INFORMATION

Consider the single cycle datapath in the textbook [PH]. It includes four multiplexers (MUX), as follows:

- Multiplexer #1 determines the Rd input to the Register Block.
- Multiplexer #2 provides one of the inputs to the ALU.
- Multiplexer #3 whose output is stored in the PC.
- Multiplexer #4 whose output goes to the Write Data input of the Register Block.

For each of these multiplexers, assume the following:

- The output of a MUX equals its upper input if the control of the MUX is 0.
- The output of a MUX equals its lower input if the control of the MUX is 0.

QUESTIONS

1. In the datapath, observe that one adder computes PC+4, whereas another adder computes the target address for certain branch operations. Which of these adders should be able to complete its computation first when an instruction is being executed? Briefly explain your answer.

For the instruction specified in each of questions 2 and 3, specify the value that the control inputs for the four multiplexers (recall that each of these control inputs should be 0 or 1).

2. An R-type instruction, particularly add $\$1$, $\$2$, $\$3$, which adds contents of source registers 1 and 2 and stores the result in destination register 3.

3. A *conditional branch* that is taken (i.e., the next instruction is executed from the branch's target address).

A conditional branch compares the contents of two registers. The branch is taken only if the desired condition is true. This question asks you to assumes that the condition is, in fact, true. Recall that the condition is evaluated using the ALU.

SUGGESTED EXERCISE: Answer Question 2 for some of the other instructions as well, such as an unconditional branch, load and store.