

CMPU-224 Lab10 Quiz

Spring 2026

Name: _____

This is a closed book, closed notes quiz. No electronic devices are allowed. You have until 3:30pm to complete the quiz. There are a total of 4 questions and 10 points.

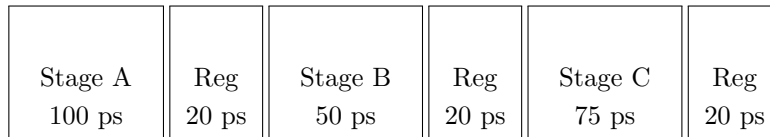
There should be enough space on the quiz for your answers. If you need more space to work out a problem, blank paper will be available, just ask.

If you finish with time remaining, raise your hand and I will come and collect your quiz. You may then work on the lab assignment.

Good Luck!

1. (2 points) In the RISC-V 5-stage pipeline, in which stage or stages are used or can be used to compute the address of the next instruction?

2. (2 points) Consider the following three-stage pipeline. The propagation delay of each stage is shown in the diagram below. Each pipeline register takes 20 ps to latch its value.



What is the shortest possible clock cycle period (in ps) for this pipeline? Be sure to count the propagation delay and the time to latch the data into the register.

Minimum clock period: _____ ps

What is the total latency of this pipeline assuming the shortest possible clock cycle? I.e., what is the total time for a single instruction to pass through all three stages and be latched into the final pipeline register?

Total latency: _____ ps

3. For each of the following RISC-V code fragments, determine the **total number of clock cycles** the fragment takes to complete on the 5-stage pipeline with forwarding and predict-not-taken branching. When there are no more instructions left to execute, assume the processor stops after the last instruction finishes the writeback stage.

(a) (1 point)

```

1   addi  t0, x0, 5
2   add   t1, t0, t0

```

Total cycles: _____

(b) (1 point)

```

1   lw    t0, 0(t1)
2   add   t2, t0, t3

```

Total cycles: _____

(c) (1 point)

```

1   beq   x0, x0, target
2   addi  t0, x0, 1
3 target:
4   addi  t1, x0, 2

```

Total cycles: _____

(d) (1 point)

```

1   bne   x0, x0, target
2   addi  t0, x0, 1
3 target:
4   addi  t1, x0, 2

```

Total cycles: _____

4. (2 points) When the hazard unit detects a **load/use hazard**, which of the following correctly describes the control actions applied to the pipeline stages on the next clock cycle? **Circle one.**

- A. IF: normal, ID: normal, EX: bubble, MEM: normal, WB: normal
- B. IF: stall, ID: stall, EX: bubble, MEM: normal, WB: normal
- C. IF: normal, ID: bubble, EX: bubble, MEM: normal, WB: normal
- D. IF: stall, ID: bubble, EX: stall, MEM: normal, WB: normal