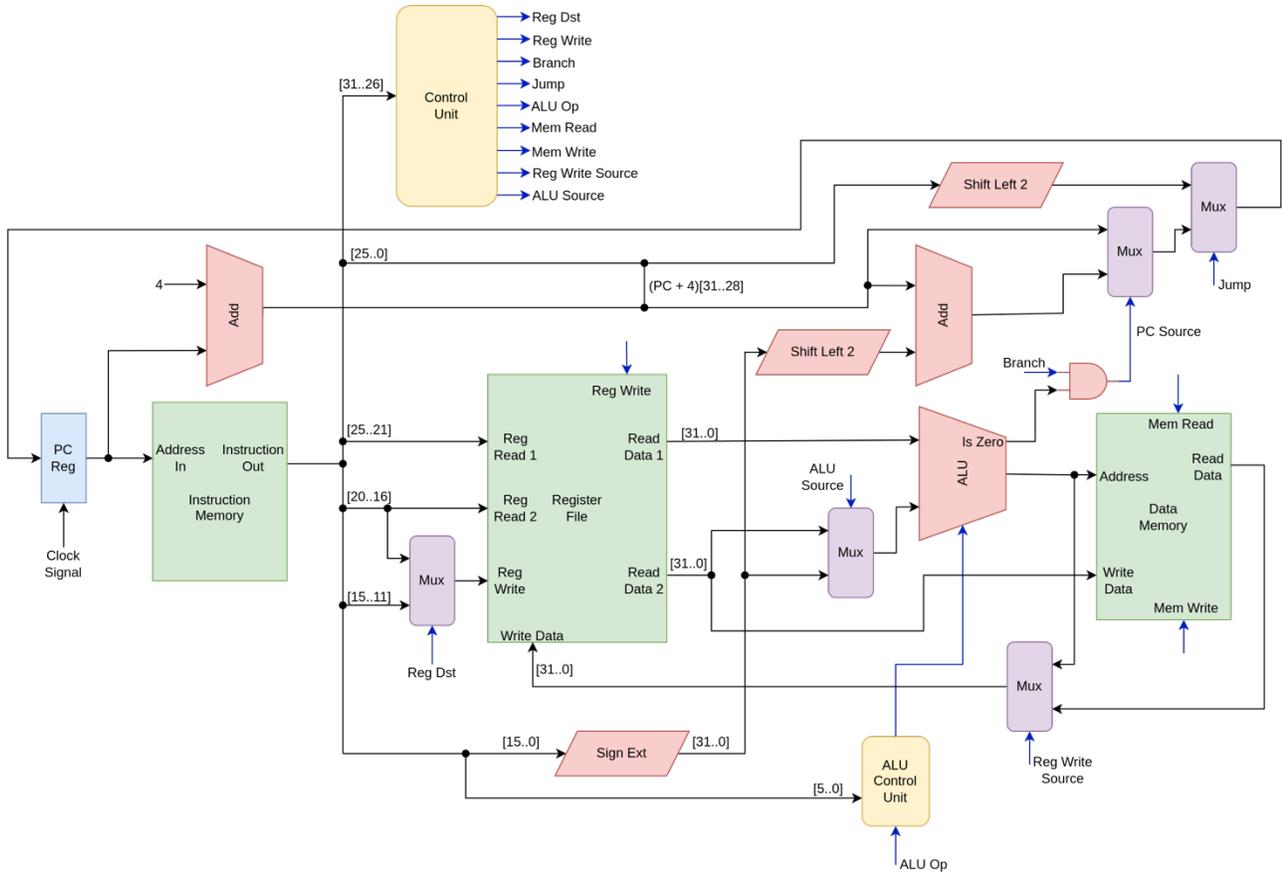


CSE490/590, Summer 2025, Homework 2

[Question 1]

Highlight the flow of data in the MIPS data path for the instructions:

- a. `add $s1, $s2, $s3`
- b. `lw $t3, 4($t4)`



CSE490/590, Summer 2025, Homework 2

[Question 3]

In the following instruction sequence for a MIPS 5-stage pipelined datapath, list the data hazards:

```
lw $s2, 0($s1)
```

```
lw $s1, 40($s6)
```

```
sub $s6, $s1, $s2
```

```
add $s6, $s2, $s2
```

```
or $s3, $s6, $zero
```

```
sw $s6, 50($s1)
```


CSE490/590, Summer 2025, Homework 2

[Question 5]

Assume the time for stages is

- 100ps for register read or write
- 200ps for other stages

Compare pipelined datapath with single-cycle datapath for the following instruction sequence:

```
lw $1, 100($0)
lw $2, 200($0)
lw $3, 300($0)
```

The following table provides how much time is spent in each stage by a specific instruction:

Instr	Instr fetch	Register read	ALU op	Memory access	Register write	Total time
lw	200ps	100 ps	200ps	200ps	100 ps	800ps
sw	200ps	100 ps	200ps	200ps		700ps
R-format	200ps	100 ps	200ps		100 ps	600ps
beq	200ps	100 ps	200ps			500ps

[Question 6]

Consider the following list of instructions. Assume that the initial values for \$s1, \$s2, \$s3, \$s4, and \$s5 are all 0:

```
loop:    ADDI $s2, $s1, -2
         BNE $s5, $s2, target1
         ADDI $s3, $s3, 0
target1: ADDI $s1, $s1, 1
         ADDI $s4, $s1, -3
         BNE $s5, $s4, loop
```

Assume that we have a 1-bit branch predictor that stores the result of the last branch and makes the prediction based on the result. Show the results of all predictions throughout the execution. (Use T/N to represent Taken/ Not Taken)

