Homework 3   <u>Due</u>: Oct 24th , 2025

Please write legibly or type. Show your work to the extent possible.

1. (25 points) Modify the single-cycle datapath (page 3/3) by implementing the instruction 'SWI' (store-word-and-increment). Below is the syntax. The instruction below will store the value in $t0 to memory location at address ($s0+88). Then, it will increment $s0 by 4.

<p align="center">SWI $t0, 88($s0)</p>

This is the encoding of the instruction above:

unique	s0	t0	88
opcode (6)	**rs (5)**	**rt (5)**	**offset (16)**

Draw the changes on the datapath diagram and provide the values of all the control signals.

2. (25 points) Modify the single-cycle datapath (page 3/3)by implementing the conditional move instruction 'MOVNZ' (move-if-not-zero). Below is the syntax. The instruction below will move $t1 into $t0 if $t2!=0. Otherwise, $t0 will be set to "0".

<p align="center">MOVNZ $t0, $t1, $t2</p>

This is the encoding of the instruction above:

unique	t1	t2	t0	0	0
opcode (6)	**rs (5)**	**rt (5)**	**rd (5)**	**shamt (5)**	**funct (6)**

Draw the changes on the datapath diagram and provide the values of all the control signals.

3.(25 points) This instruction stores ($t0+4) into the memory at address $t1- what is the suitable format used and based on that , modify the datapath

<p align="center">swr4 $t0, $t1</p>

Draw the changes on the datapath diagram and provide the values of all the control signals.

4.(25 pointrs) Modify the datapath to implement 'load word and increment' (lwi), -provide instruction example, suggest suitable instruction format used and based on that format, modify the datapath

Draw the changes on the datapath diagram and provide the values of all the control signals.

Add

4

RegDst
Branch
MemRead
MemtoReg
ALUOp
MemWrite
ALUSrc
RegWrite

Instruction [31–26]   Control

Shift
left 2

Add   ALU
result

0
Mux
1

PC   Read
address

Instruction
[31–0]

Instruction
memory

Instruction [25–21]   Read
register 1

Instruction [20–16]   Read
register 2
0
Mux
1
Write
register
Instruction [15–11]   Write
data   Registers

Read
data 1

Read
data 2

Zero
ALU   ALU
result

0
Mux
1

Address   Read
data
1
Mux
0

Write
data   Data
memory

Instruction [15–0]   16   Sign
extend   32

ALU
control

Instruction [5–0]