North South University

Department of Electrical & Computer Engineering

Lab Report

Experiment No:	7
Experiment Title:	Building a Single Cycle Data path
Course Code:	**CSE332L**
Course Name:	**Computer Organization & Architecture Lab**
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Date of Experiment:	14/12/2021
Date of Submission:	14/12/2021

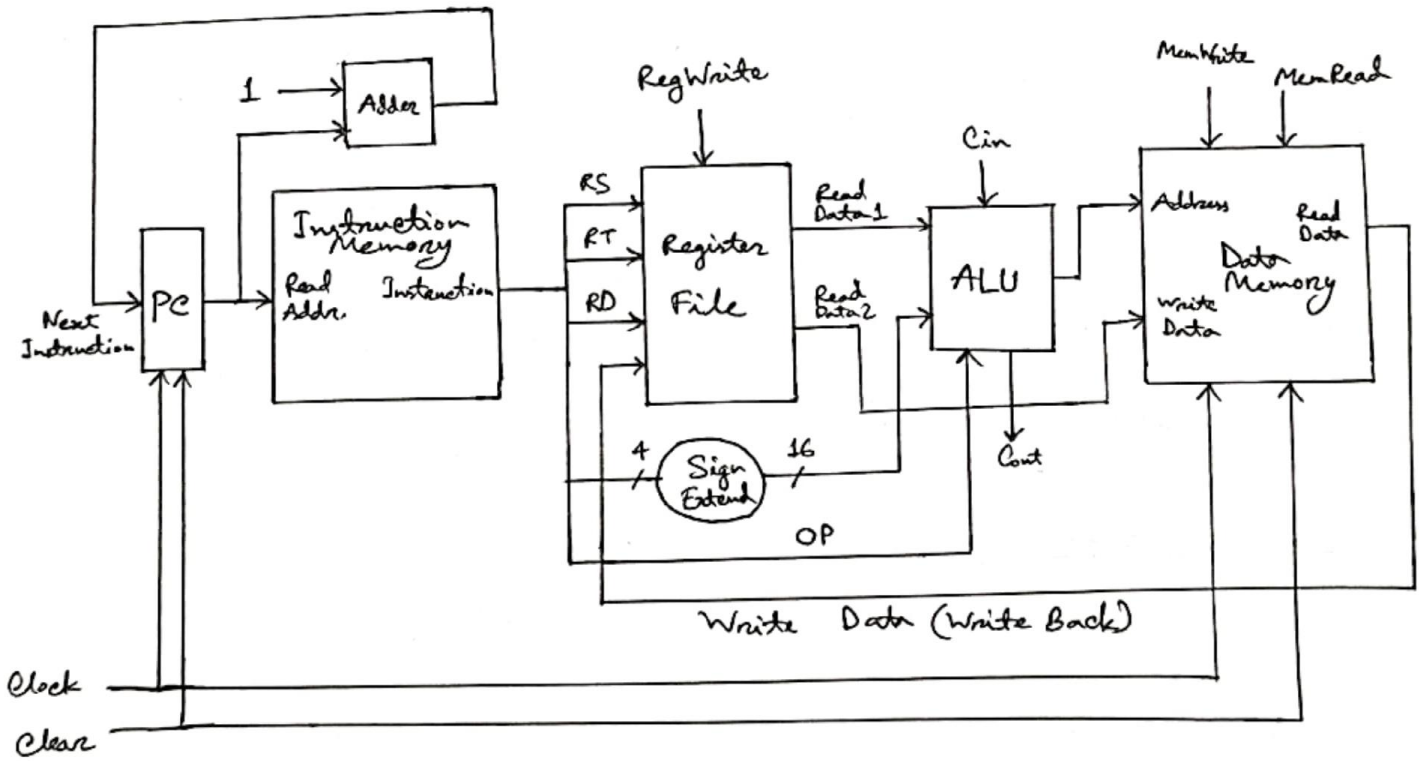
Objectives:

* Our objective in this experiment is to construct the datapath for I-type instructions.

Equipment List:

* Logisim Tool

Block Diagram:



Tables:

Our Register file is of 16-bit ISA with the following fields where the formats of the I-type instruction are:

OP (4-bit)	Rs (4-bit)	Rt/Rd (4-bit)	Immediate (4-bit)

Register Table:

Register Serial	Register No. (In Binary)	Register Name
$0	0000	$zero
$1	0001	$at
$2	0010	$v0
$3	0011	$a0
$4	0100	$a1
$5	0101	$t0
$6	0110	$t1
$7	0111	$t2
$8	1000	$t3
$9	1001	$s0
$10	1010	$s1
$11	1011	$s2
$12	1100	$s3
$13	1101	$k0
$14	1110	$gp
$15	1111	$ra

OP Code Table:

S1	S0	Cin	Microopertion
0	0	0	**Add**
0	0	1	**Add with Carry**
0	1	0	**Subtract with Borrow**
0	1	1	**Subtract**
1	0	0	**Transfer A** A1 A0 + 0 0 + 0 = Transfer A
1	0	1	**Increment A** A1 A0 + 0 0 + 1 = Increment A
1	1	0	**Decrement A** A1 A0 + 1 1 + 0 = Decrement A
1	1	1	**Transfer A** A1 A0 + 1 1 + 1 = Transfer A

Circuit Diagrams:

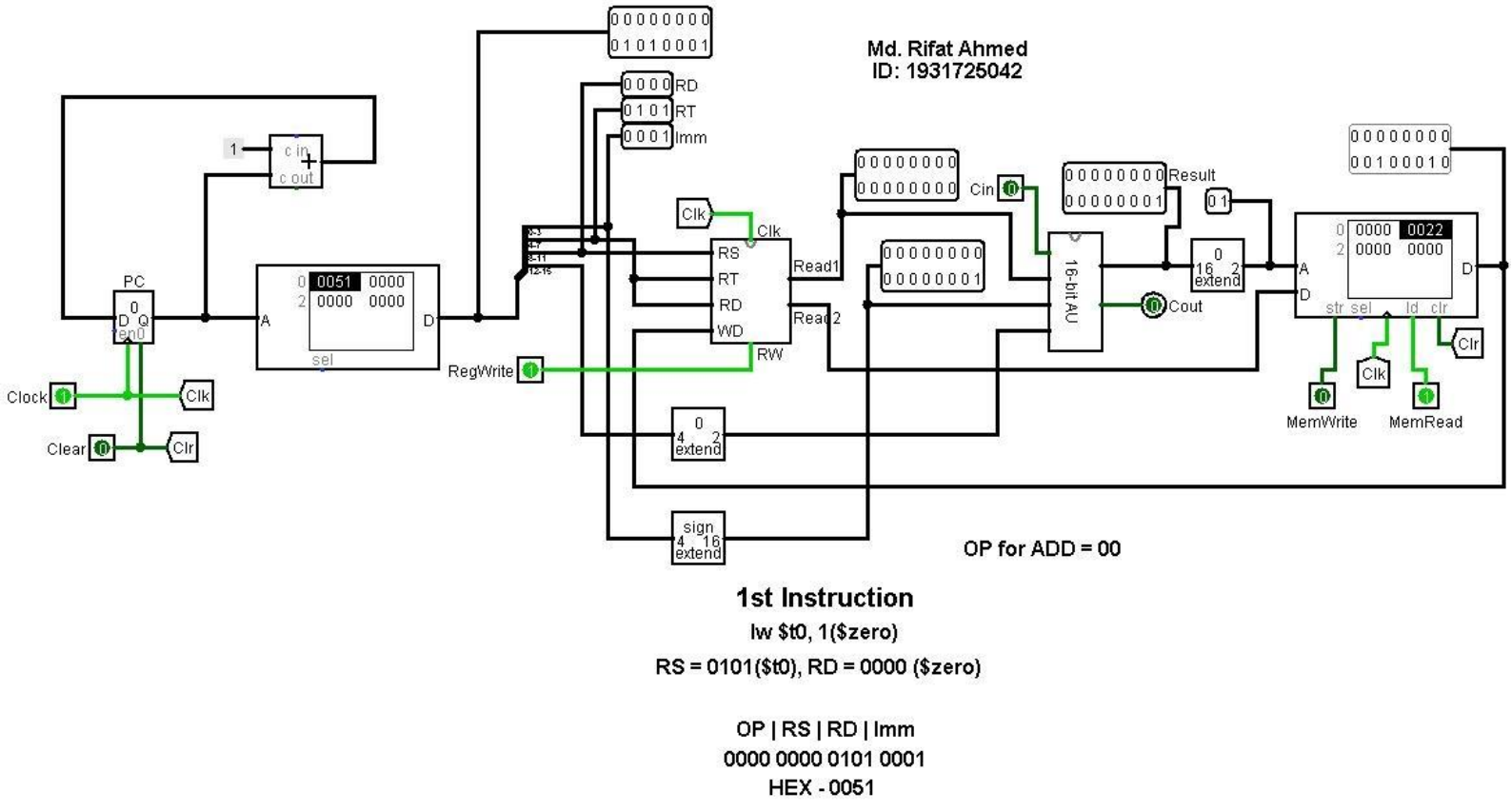


Figure – 2: I-format Instruction - For lw $t0, 1($zero)

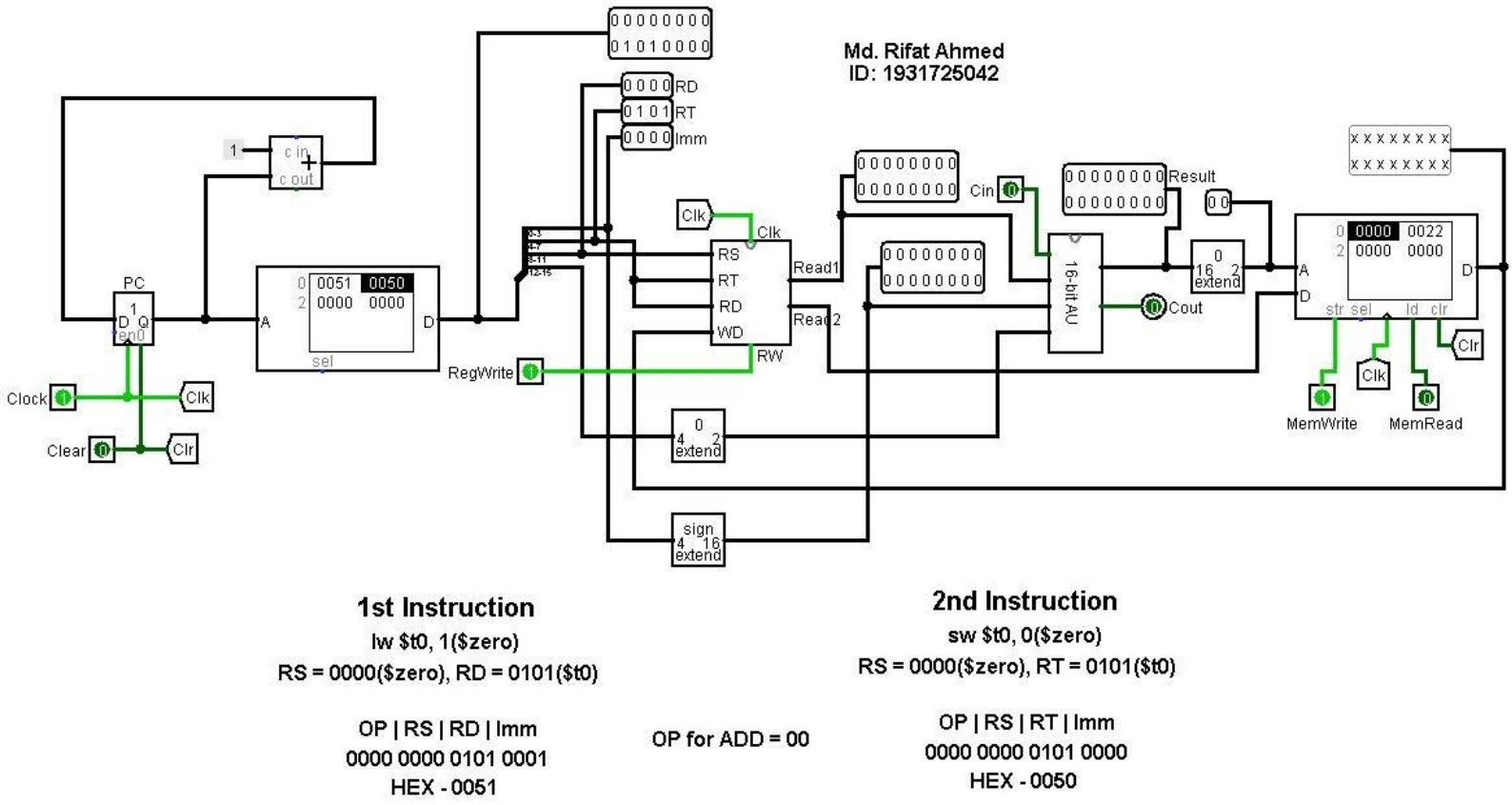


Figure – 3: I-format Instruction - For sw $t0, 0($zero)

Discussion:

In this experiment we constructed the datapath for I-format instruction like load and store. Like R-format we built the IF Unit then from there we got RS, RT/RD, Immediate value and OP code. Now for load instruction we need the 4-7 LSB in RD pin of the Register file and for store we need those same bits going into the RT pin of the Register file. Now the immediate value is of 4-bits so we needed to use a bit extender to extend it to 16-bit for the ALU. Then we took the Data Memory and connected the result of the ALU to its Address input pin this ~~it~~ is for the the effective address that we'll get. And in the ALU we add the offset with the registers value to get this effective address. Then in the data memory there are 2 input pins to select when to write and when to Read called MemWrite and MemRead. Then we added the clock to PC along with the Data memory also the clear pin and thus our I-format datapath for both load and store instructions is ready.