North South University

Department of Electrical & Computer Engineering

LAB REPORT

Course Name: **CSE332L- Computer Organization and Architecture Lab**

Experiment Number:

Experiment Name: Design of an MIPS ALUControl + Design a16-bitALU

Experiment Date: 7.11.2021

Report Submission Date: 7.11.2021

Section: 7

Group Number:

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Student ID: 1931746042	
Remarks:	

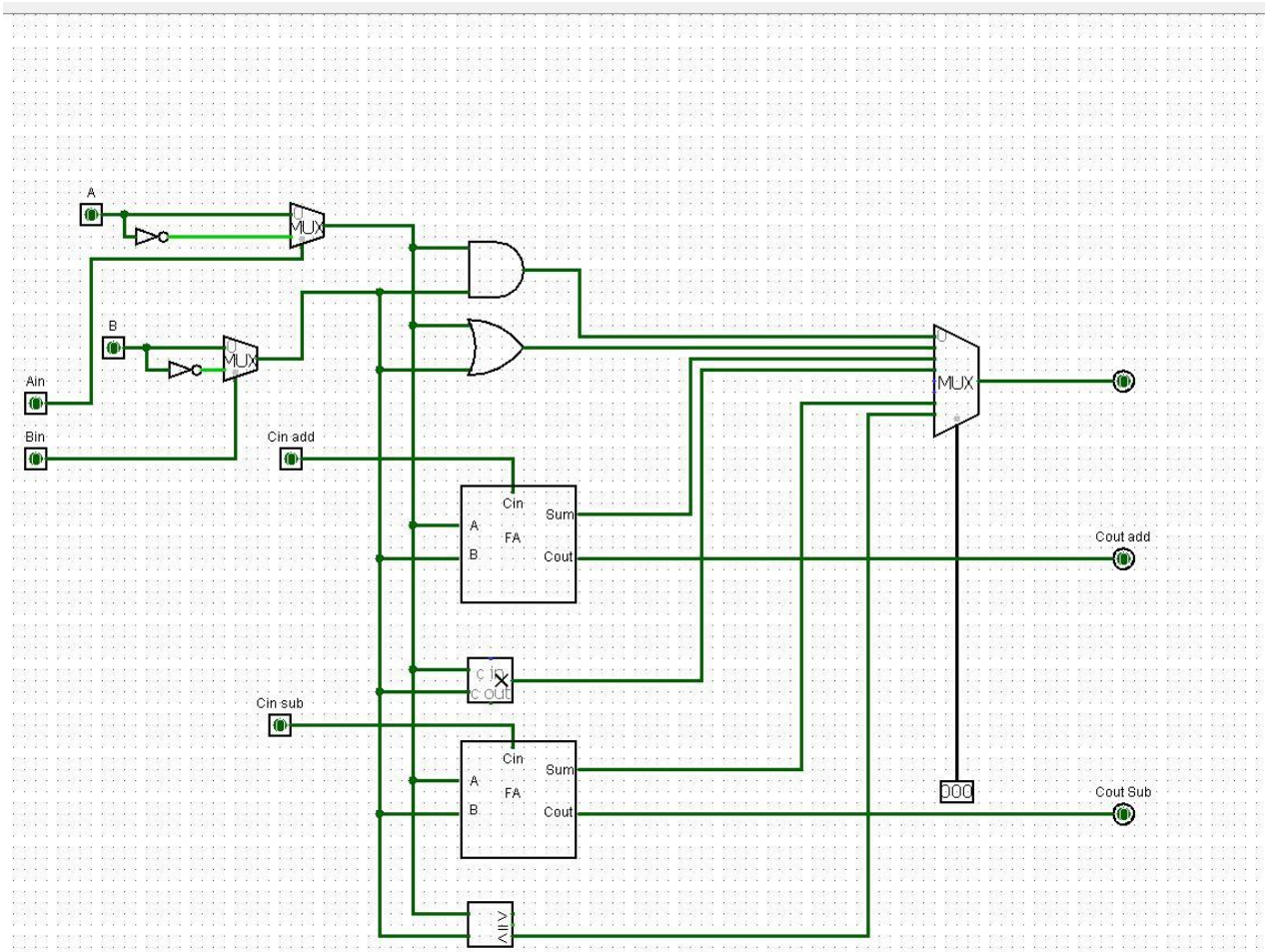
Exp Name: : Design of an MIPS ALUControl + Design a16-bitALU.

Objectives:

We will have following objectives to fulfill:

1.Build a MIPS ALUControl Unitfor controlling the ALU Circuit
2.Build 1-bit ALU with specific set of instructions
3.Incorporate equality check (zero signal)& Overflow.
4.Build 16-bit ALU by connecting 16 one-bitALUs.

Circuit Diagrams:


A
B
Ain
Bin
Cin add
Cin sub
MUX
MUX
MUX
Cin
A
B
FA
Sum
Cout
Cout add
Cin sub
Cin
A
B
FA
Sum
Cout
Cout Sub
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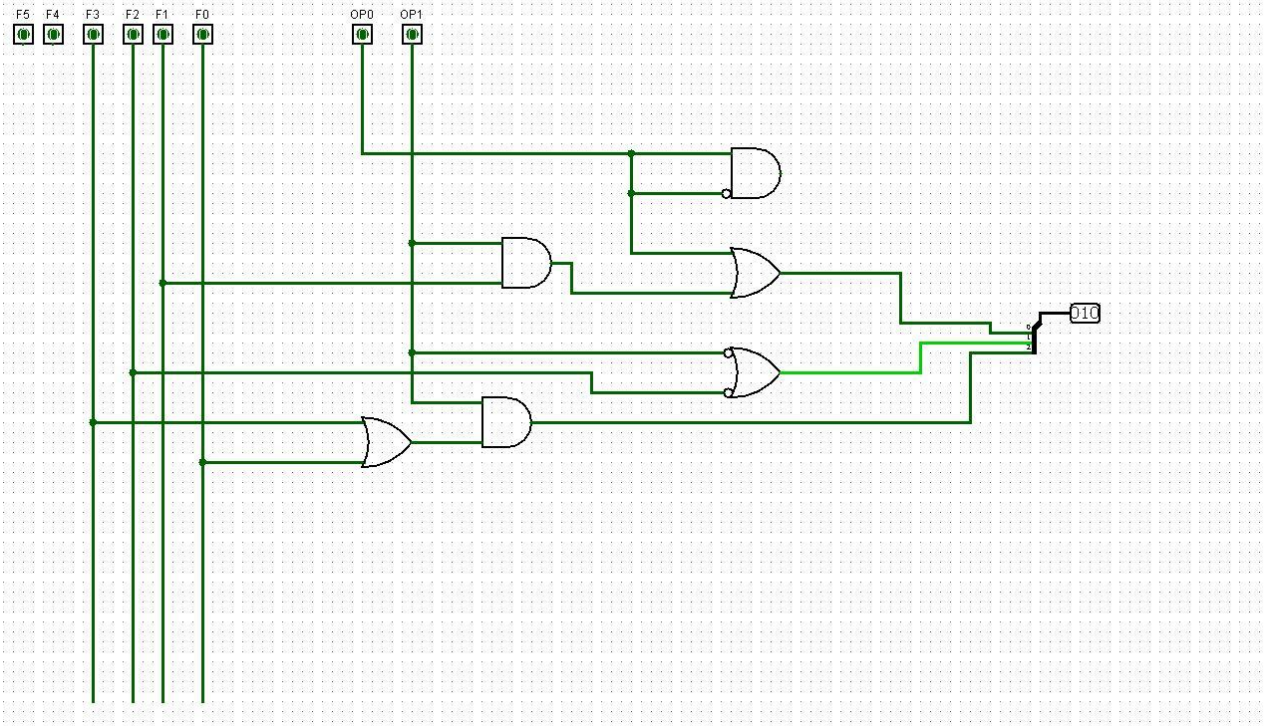
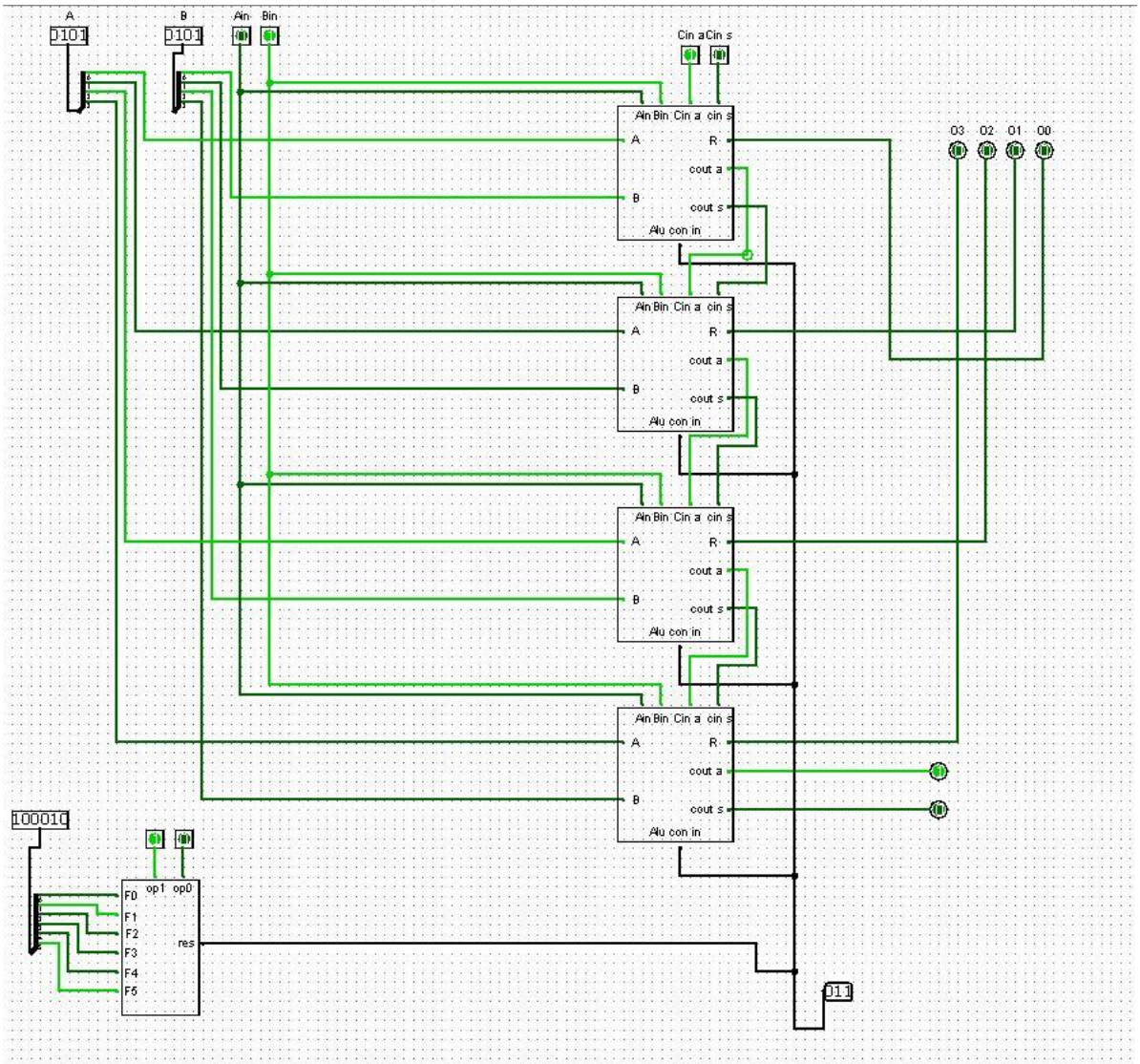
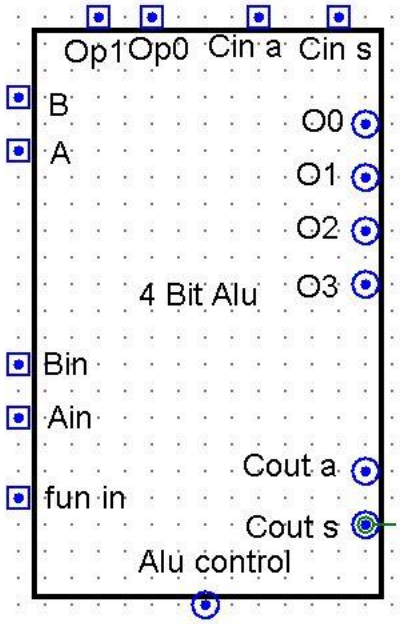

F5
F4
F3
F2
F1
F0
OP0
OP1
010


A
0101
B
0101
Ain
Bin
Cin a
Cin s
Ain Bin Cin a cin s
A
R
cout a
B
cout s
Alu con in
O3
O2
O1
O0
100010
op1
op0
F0
F1
F2
F3
F4
F5
res
011


Op1
Op0
Cin a
Cin s
B
A
O0
O1
O2
O3
4 Bit Alu
Bin
Ain
Cout a
fun in
Cout s
Alu control

Data table:

Instruction Opcode	**ALU OP**	**Instruction Operation**	**Function code**	**Desired Alu Action**	**ALU Control Input**
LW	00	Load word	xxxxxx	add	010
SW	00	Store word	xxxxxx	add	010
Branch	01	Branch equal	xxxxxx	subtract	110
R-Type	10	Add	100000	add	010
R-Type	10	Sub	100010	subtract	110
R-Type	10	AND	100100	and	000
R-Type	10	Or	100101	or	001
R-Type	10	Slt	101010	slt	111

Update the ALU control unit Table for Immediate Instructions						
Instruction opcode	ALU Op	Instruction operation	opcode	Function field	Desired ALU Action	ALU control input
LW	00	load word	xxxxxx	xxxxxx	add	010
SW	00	store word	xxxxxx	xxxxxx	add	010
Branch equal	01	branch equal	xxxxxx	xxxxxx	subtract	110
R-type	10	add	xxxxxx	100000	add	010
R-type	10	subtract	xxxxxx	100010	subtract	110
R-type	10	AND	xxxxxx	100100	and	000
R-type	10	OR	xxxxxx	100101	or	001
R-type	10	set less than	xxxxxx	101010	set less than	111
Immediate	11	addi	001000	xxxxxx	add	010
Immediate	11	andi	001100	xxxxxx	and	000
Immediate	11	ori	001101	xxxxxx	or	001
Immediate	11	set less than immediate	001010	xxxxxx	set less than	111

Discussion:

In this expriment,i gather knowledge about 1 bit ALU and 4 bit ALU.Firstly,i make 1 bit ALU which is comparatively easier than 4 bit ALU. For implementing 1 bit ALU,I use a multiplexer.Then I add many operation in the ALU like add,subtract,nand,nor,multiplier,slt.For implementin these operation,I use 1 bit adder which is mainly use add and subtraction.By implementing 1 bit ALU, I gather knowledge about multiplexer which I used for making ALU.I use And,OR,X-OR gate for makingAdder.I learn how to make a ic by our own circit .It is very helpful but I do not have to make same circuit again and again.I also learn how to make 4 or more bit ALU by using 1 or more bit ic.

For making 4 bit ALU,I use four 1 bit ALU ic.Firstly,I take one copy of 1 bit ic from 1 bit ALU ic's part.Then I take rest of the three 1 bit ic in the same process.I use two splitter for taking the input of 4 ic's .One splitter use for take input of A and another one use for taking input of B .Then,I make ALU control unit which is consist two ALU operaton input and 5 functional input.This circuit will produce 3 bit output for selecting which operation I will do.Then I make the ic of ALU control unit.Then this ic is used in the 4 bit ALU as a selector.

During the experiment,I face a problem,like my circuit output is showing wrong output .By the help of my lab instructor ,I solve the problem.Then I do the all thing successfully.