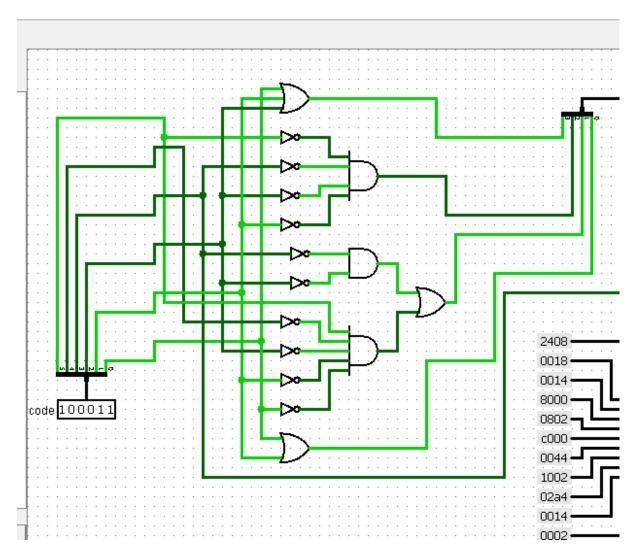
NAME: AMMAAR AHMAD

ROLL NO: 1801CS08

CS322 LAB 9

1. Old Control Unit with bugs



Changes:

lw (100011) - 0010

sw(101011) - 0010

addi (001000) - 1001

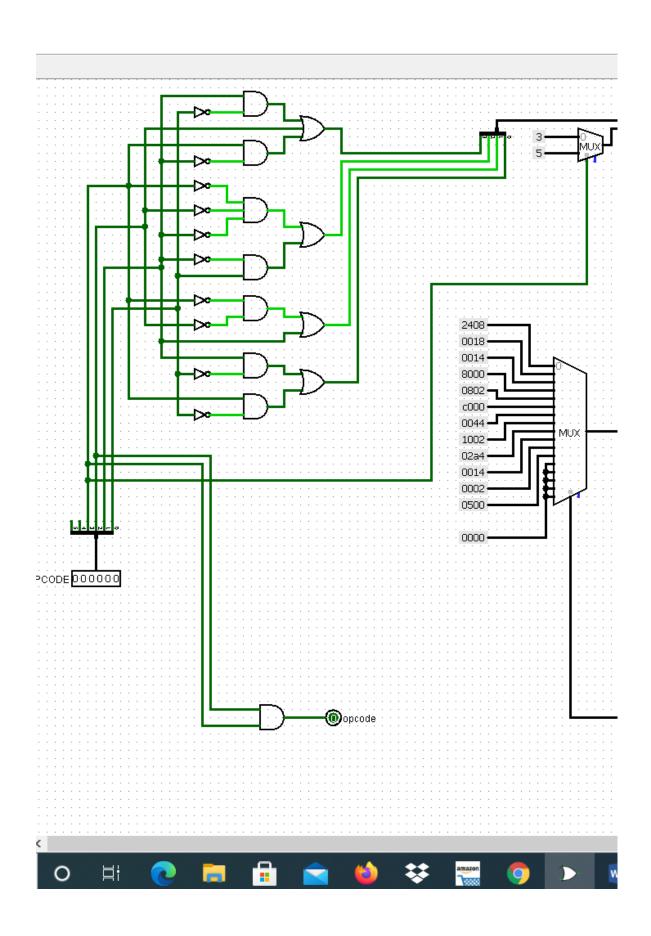
R Type (000000) – 0110

Beq (000100) - 1000

J (000010) - 1011

andi (001100) - 1001

New Control Unit without bugs



2. Program to add 5 numbers.

Initially 5 numbers are stored in registers no 1 to 5.

\$1 = 34, \$2 = 21, \$3 = 15, \$4 = 45, \$5 = 12, Result of addition \$6 = 0 initally

All numbers are in hexadecimal form. Final Result \$6 = C1(Hex)

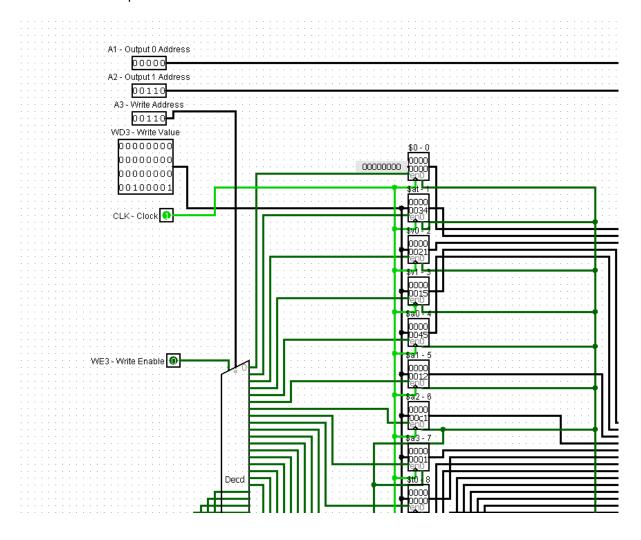
52+33+21+69+18=193=C1(Hex)

MIPS code	Machine Code
addi \$1, \$0, 52	0x20010034
addi \$2, \$0, 33	0x20020021
addi \$3, \$0, 21	0x20030015
addi \$4, \$0, 69	0x20040045
addi \$5, \$0, 18	0x20050012
addi \$6, \$0, 0	0x20060000
add \$6, \$1, \$2	0x00223020
add \$6, S3, \$6	0x00663020
add \$6, \$4, \$6	0x00863020
add \$6, \$5, \$6	0x00A63020
sw \$6, 32(\$0)	0xAC060020

ROM loaded with Machine Code

Description: Logisim: Hex Editor Logisim:	_	×
File Edit Project Simulate Window Help		
000000 20010001 20020002 20030004 20040008 20050010 20060000 00223020 00663020 00863020 00a63020 ac060020 00853820 00e23822 ac670044 8c020050 080000	11	^
000010 20020001 ac020054 8c010054 00000000 00000000 00000000 00000000	.00	
ppo 27 0000000 0000000 0000000 0000000 000000	.00	
0000000 00000000 00000000 00000000 00000	.00	
000040 0000000 0000000 0000000 0000000 000000	.00	
000050 0000000 0000000 0000000 0000000 000000	.00	
ppp 6p 0000000 0000000 0000000 0000000 000000	.00	

After addition \$6 stores value C1 or 193 in decimal



3. Adding new instruction andi (001100) to the circuit

Program to add 5 numbers and then mask last 4 bits
Initially 5 numbers are stored in registers no 1 to 5.

1 = 34, 2 = 21, 3 = 15, 4 = 45, 5 = 12, Result of addition 6 = 0 initally

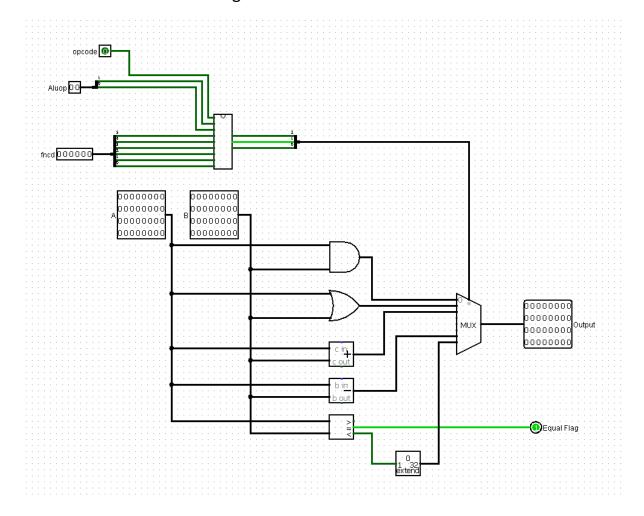
All numbers are in hexadecimal form. Final Result \$6 = C1(Hex)

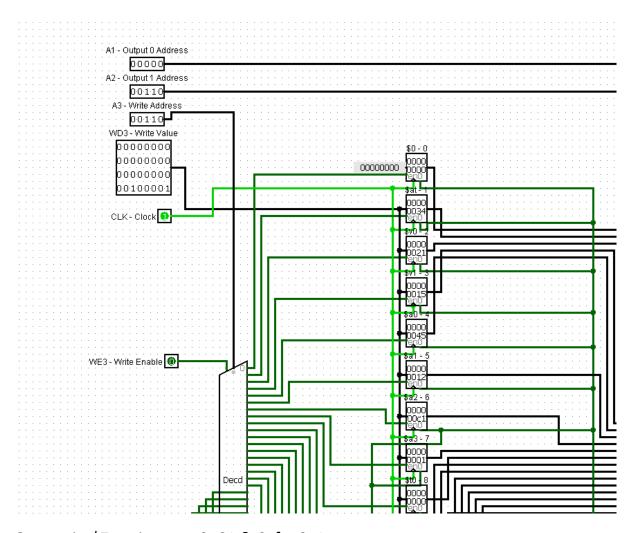
52+33+21+69+18=193=C1(Hex)

MIPS code	Machine Code
addi \$1, \$0, 52	0x20010034
addi \$2, \$0, 33	0x20020021
addi \$3, \$0, 21	0x20030015
addi \$4, \$0, 69	0x20040045
addi \$5, \$0, 18	0x20050012
addi \$6, \$0, 0	0x20060000
add \$6, \$1, \$2	0x00223020
add \$6, S3, \$6	0x00663020
add \$6, \$4, \$6	0x00863020
add \$6, \$5, \$6	0x00A63020
andi \$7, \$6, 15	0x30c7000f
sw \$6, 32(\$0)	0xAC060020



New ALU circuit after adding new instruction andi





Output in \$7 register => 0xC1 & 0xf = 0x1