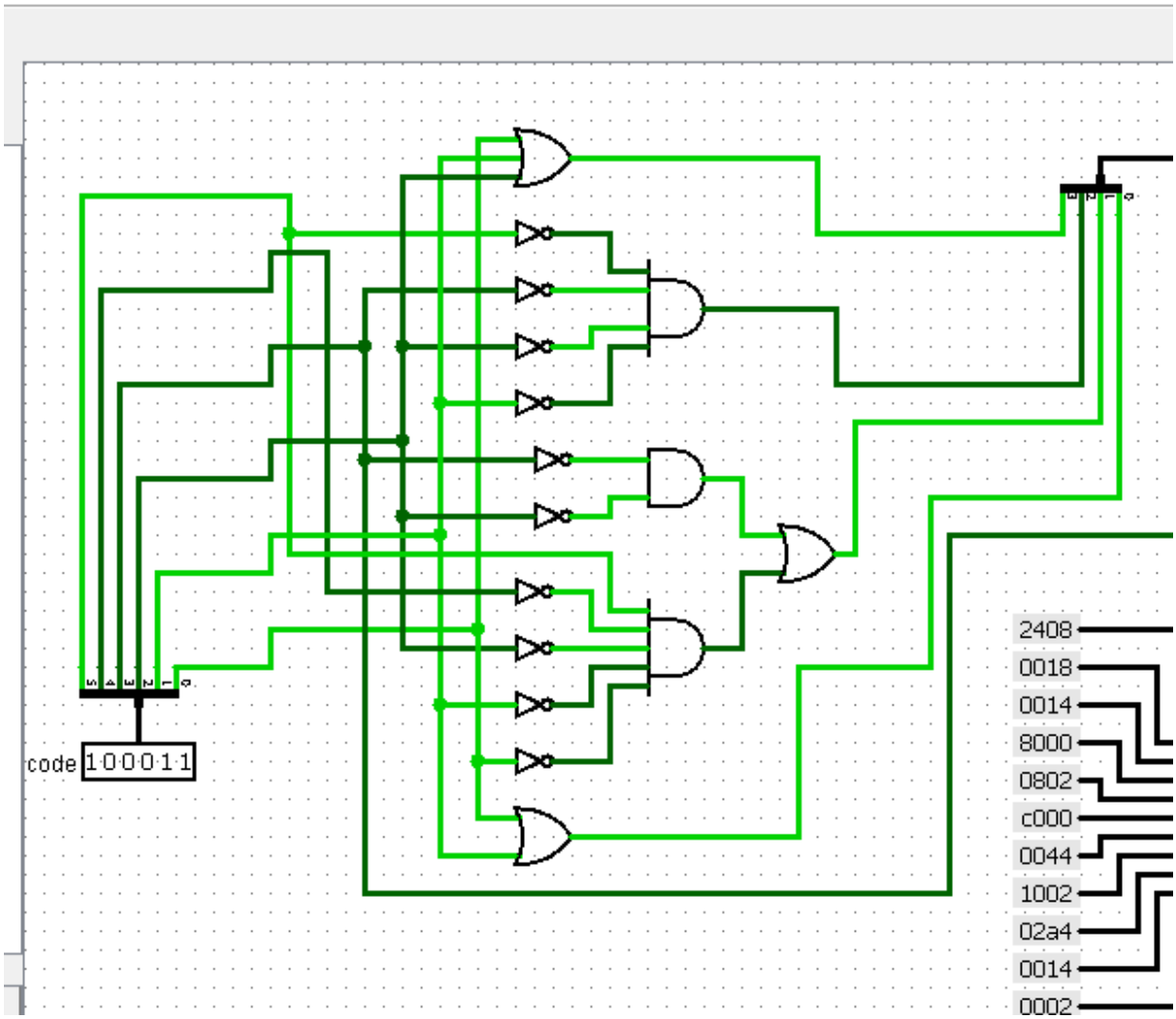
NAME: AMMAAR AHMAD

ROLL NO: 1801CS08

CS322 LAB 9

1. Old Control Unit with bugs



Changes:

lw (100011) - 0010

sw(101011) - 0010

addi (001000) - 1001

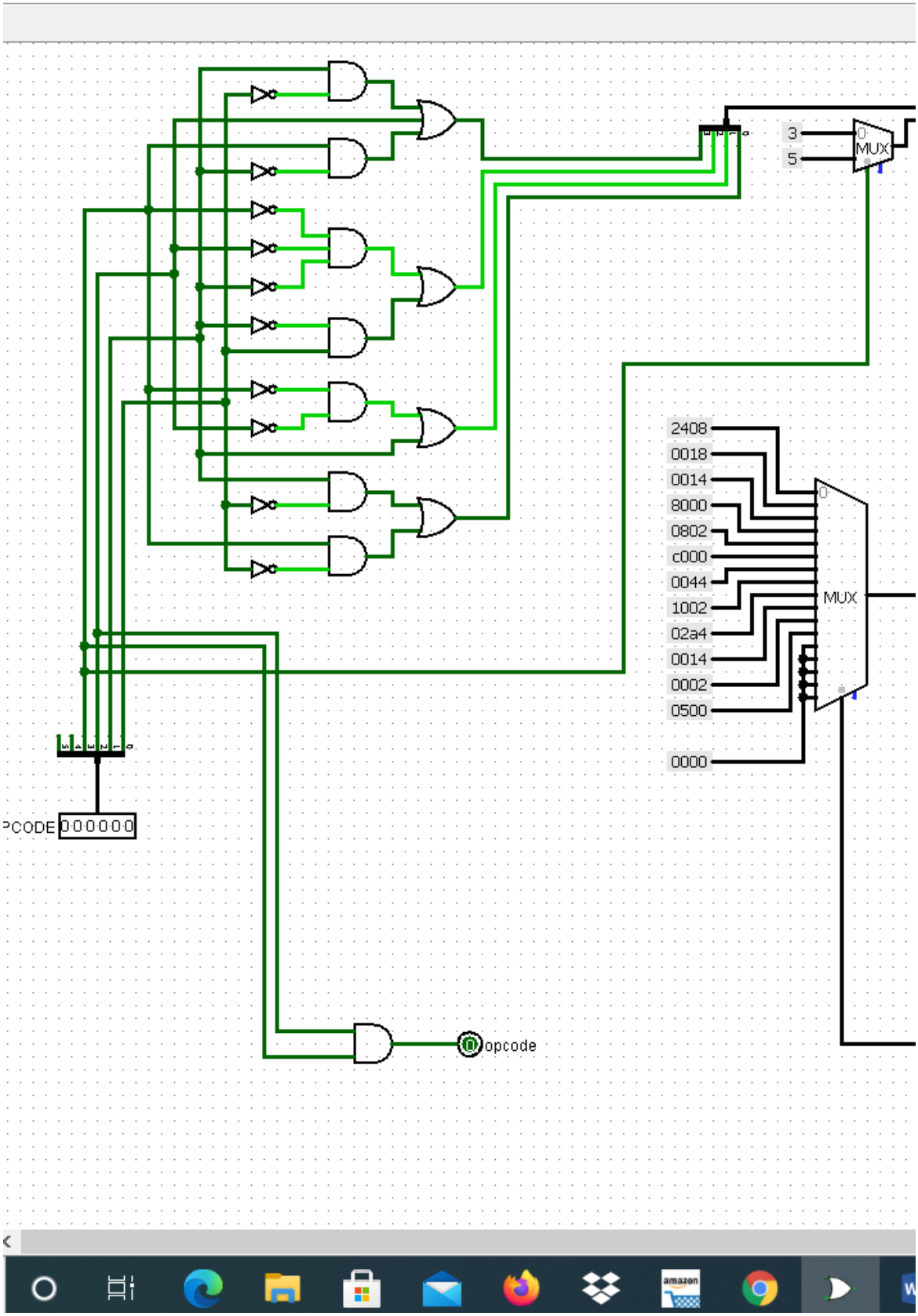
R Type (000000) – 0110

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.

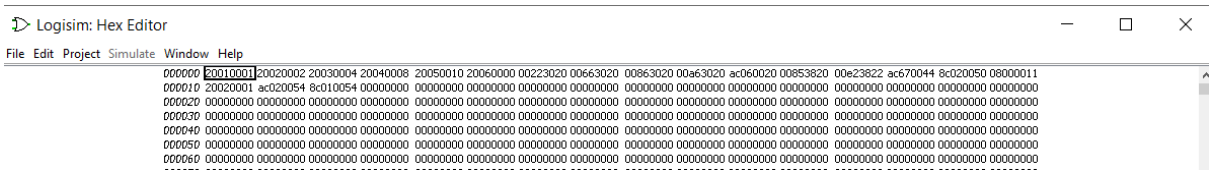
$1 = 34, $2 = 21, $3 = 15, $4 = 45, $5 = 12, Result of addition $6 = 0 initally

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

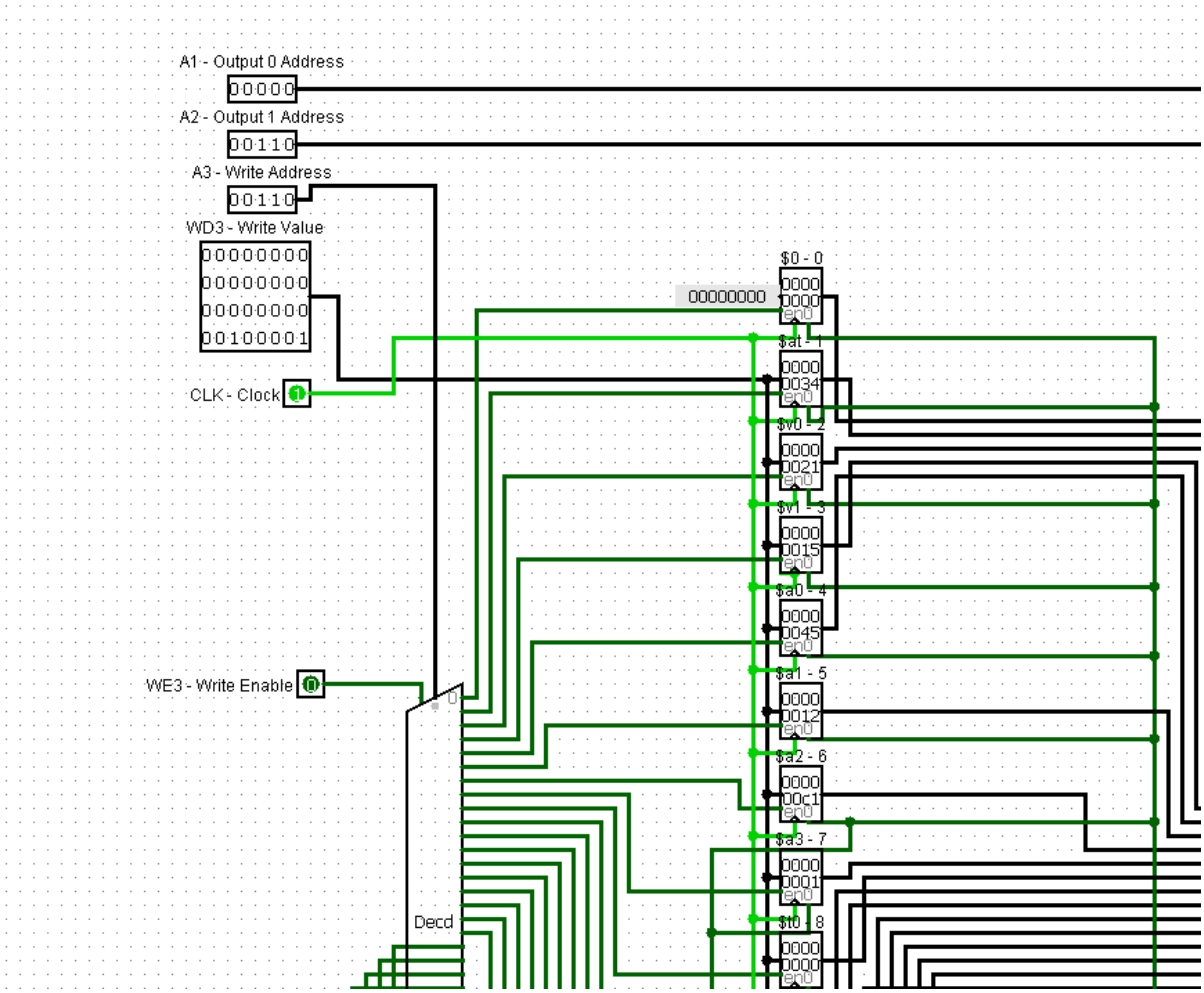
52+33+21+69+18=193=C1(Hex)

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



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
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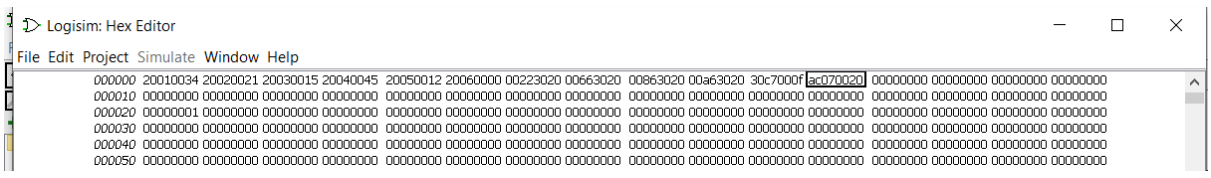
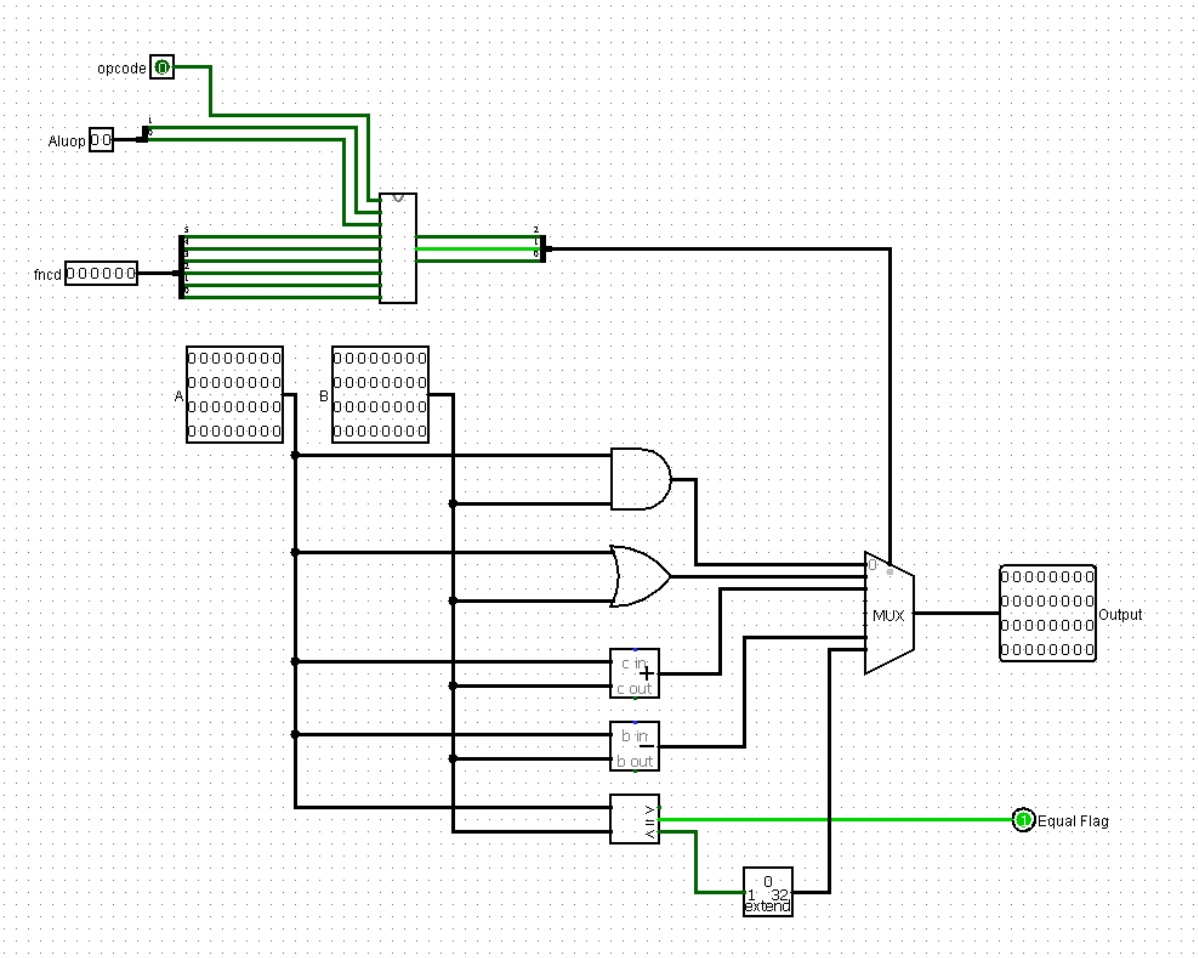
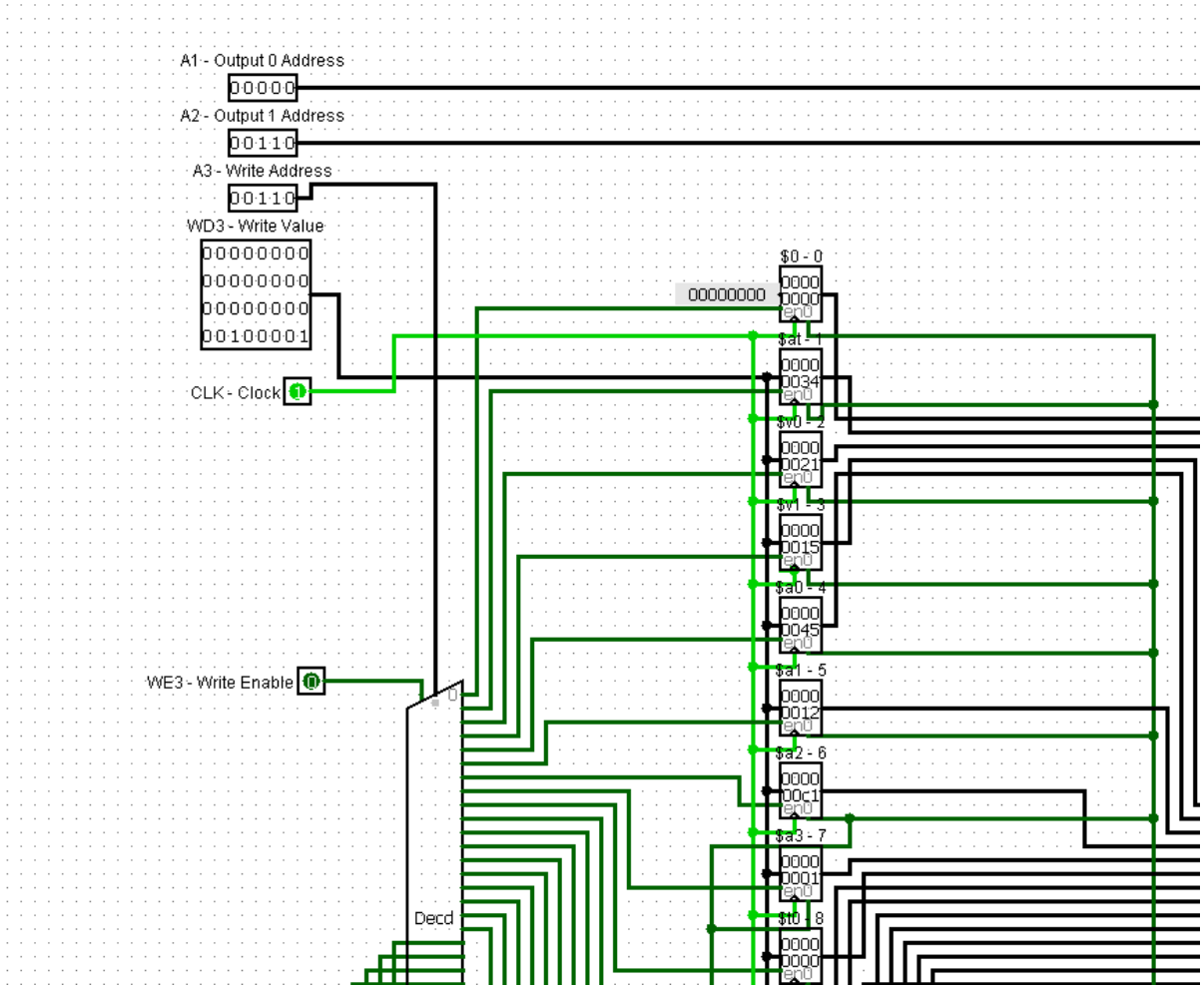
addi $4, $0, 69	0x20040045
addi $5, $0, 18	0x20050012
addi $6, $0, 0	0x20060000
add $6, $1, $2	0x00223020
add $6, S3, $6	0x00663020
add $6, $4, $6	0x00863020
add $6, $5, $6	0x00A63020
andi $7, $6, 15	0x30c7000f
sw $6, 32($0)	0xAC060020



New ALU circuit after adding new instruction andi





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