**Saveetha School of Engineering**

**Saveetha Institute of Medical and Technical Sciences**

**CSA12 - Computer Architecture**

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**8-BIT ADDITION**

**EXP NO: 1**

**AIM:**

To write an assembly language program to implement 8-bit addition using 8085 processor.

**ALGORITHM:**

1. Start the program by loading the first data into the accumulator.
2. Move the data to a register.
3. Get the second data and load it into the accumulator.
4. Add the two register contents.
5. Check for carry.
6. Store the value of sum and carry in the memory location.
7. Halt.

**PROGRAM:**

LDA 8500

MOV B, A

LDA 8501

ADD B

STA 8502

RST 1

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**8-BIT SUBTRACTION**

**EXP NO: 2**

**AIM:** To write an assembly language program to implement 8-bit subtraction using 8085 processor.

**ALGORITHM:**

1. Start the program by loading the first data into the accumulator.
2. Move the data to a register.
3. Get the second data and load it into the accumulator.
4. Subtract the two register contents.
5. Check for borrow.
6. Store the difference and borrow in the memory location.
7. Halt.

**PROGRAM:**

LDA 8000

MOV B, A

LDA 8001

SUB B

STA 8002

RST 1

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**8-BIT MULTIPLICATION**

**EXP NO: 3**

**AIM:** To write an assembly language program to implement 8-bit multiplication using 8085 processor.

**ALGORITHM:**

1. Start the program by loading a register pair with the address of memory location.
2. Move the data to a register.
3. Get the second data and load it into the accumulator.
4. Add the two register contents.
5. Increment the value of the carry.
6. Check whether the repeated addition is over.
7. Store the value of product and the carry in the memory location.
8. Halt.

**PROGRAM:**

LDA 8500

MOV B, A

LDA 8501

MOV C, A

CPI 00

JZ LOOP

XRA A

LOOP1: ADD B

DCR C

JZ LOOP

JMP LOOP1

LOOP: STA 8502

RST 1

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**8-BIT DIVISION**

**EXP NO: 4**

**AIM:** To write an assembly language program to implement 8-bit division using 8085 processor.

**ALGORITHM:**

1. Start the program by loading a register pair with the address of memory location.
2. Move the data to a register.
3. Get the second data and load it into the accumulator.
4. Subtract the two register contents.
5. Increment the value of the carry.
6. Check whether the repeated subtraction is over.
7. Store the value of quotient and the reminder in the memory location.
8. Halt.

**PROGRAM:**

LDA 8501

MOV B, A

LDA 8500

MVI C,00

LOOP:CMP B

JC LOOP1

SUB B

INR C

JMP LOOP

STA 8503

DCR C

MOV A, C

LOOP1: STA 8502

RST 1

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**16-BIT ADDITION**

**EXP NO: 5**

**AIM:** To write an assembly language program to implement 16-bit addition using 8085 processor.

**ALGORITHM:**

1) Start the program by loading a register pair with address of 1st number.

2)     Copy the data to another register pair.

3)      Load the second number to the first register pair.

4)      Add the two register pair contents.

5)      Store the result in memory locations.

6)      Terminate the program.

**PROGRAM:**

LHLD 2500

XCHG

LHLD 2502

DAD D

SHLD 2504

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**16-BIT SUBTRACTION**

**EXP NO: 6**

**AIM:** To write an assembly language program to implement 16-bit subtraction using 8085 processor.

**ALGORITHM:**

1) Start the program by loading a register pair with address of 1st number.

2)     Copy the data to another register pair.

3)      Load the second number to first registre pair.

4)     Subtract the two register pair contents.

5)      Check for borrow.

6)      Store the value of difference and borrow in memory locations.

7)      End.

**PROGRAM:**

LHLD 2050

XCHG

LHLD 2052

MVI C,00

MOV A, E

SUB L

STA 2054

MOV A, D

SUB H

STA 2055

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**16-BIT MULTIPLICATION**

**EXP NO: 7**

**AIM:** To write an assembly language program to implement 16-bit multiplication using 8085 processor.

**ALGORITHM:**

1. Load the first data in HL pair.
2. Move content of HL pair to stack pointer.
3. Load the second data in HL pair and move it to DE.
4. Make H register as 00H and L register as 00H.
5. ADD HL pair and stack pointer.
6. Check for carry if carry increment it by 1 else move to next step.
7. Then move E to A and perform OR operation with accumulator and register D.
8. The value of operation is zero, then store the value else go to step 3.

**PROGRAM:**

LHLD 2050

SPHL

LHLD 2052

XCHG

LXI H,0000H

LXI B,0000H

AGAIN: DAD SP

JNC START

INX B

START: DCX D

MOV A,E

ORA D

JNZ AGAIN

SHLD 2054

MOV L,C

MOV H,B

SHLD 2056

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**16-BIT DIVISION**

**EXP NO: 8**

**AIM:** To write an assembly language program to implement 16-bit divided by 8-bit using 8085 processor.

**ALGORITHM:**

1. Read dividend (16 bit)
2. Read divisor
3. count <- 8
4. Left shift dividend
5. Subtract divisor from upper 8-bits of dividend
6. If CS = 1 go to 9
7. Restore dividend
8. Increment lower 8-bits of dividend
9. count <- count - 1
10. If count = 0 go to 5
11. Store upper 8-bit dividend as remainder and lower 8-bit as quotient
12. Stop

**PROGRAM:**

LDA 8501

MOV B,A

LDA 8500

MVI C,00

LOOP:CMP B

JC LOOP1

SUB B

INR C

JMP LOOP

STA 8503

DCR C

MOV A,C

LOOP1: STA 8502

RST 1

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**FACTORIAL OF A GIVEN NUMBER**

**EXP NO: 9**

**AIM:** To find the factorial of a given number using 8085 microprocessor.

**ALGORITHM:**

1. Load the data into register B
2. To start multiplication set D to 01H
3. Jump to step 7
4. Decrements B to multiply previous number
5. Jump to step 3 till value of B>0
6. Take memory pointer to next location and store result
7. Load E with contents of B and clear accumulator
8. Repeatedly add contents of D to accumulator E times
9. Store accumulator content to D
10. Go to step 4

**PROGRAM:**

LDA 2001

MOV B,A

MVI C,#01

MVI E,#01

LOOP: MOV D,C

MVI A,00H

LP: ADD E

DCR D

JNZ LP

MOV E,A

INR C

DCR B

JNZ LOOP

MOV A,E

STA 2010

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**LARGEST NUMBER IN AN ARRAY**

**EXP NO: 10**

**AIM:** To find the largest number from an array using 8085 processor.

**ALGORITHM:**

1. Load the address of the first element of the array in HL pair.
2. Move the count to B register.
3. Increment the pointer.
4. Get the first data in A register.
5. Decrement the count.
6. Increment the pointer.
7. Compare the content of memory addressed by HL pair with that of A register.
8. If carry=0, go to step 10 or if carry=1 go to step 9
9. Move the content of memory addressed by HL to A register.
10. Decrement the count.

**PROGRAM:**

LXI H,2050

MOV C,M

DCR C

INX H

MOV A,M

LOOP1: INX H

CMP M

JNC LOOP

MOV A,M

LOOP: DCR C

JNZ LOOP1

STA 2058

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8086 processor simulator.

**SMALLEST NUMBER IN AN ARRAY**

**EXP NO: 11**

**AIM:** To find the smallest number from an array using 8085 processor.

**ALGORITHM:**

1. Load the address of the first element of the array in HL pair.
2. Move the count to B register.
3. Increment the pointer.
4. Get the first data in A register.
5. Decrement the count.
6. Increment the pointer.
7. Compare the content of memory addressed by HL pair with that of A register.
8. If carry=1, go to step 10 or if carry=0 go to step 9
9. Move the content of memory addressed by HL to A register.
10. Decrement the count.

**PROGRAM:**

LXI H,2050

MOV C,M

DCR C

INX H

MOV A,M

LOOP1: INX H

CMP M

JC LOOP

MOV A,M

LOOP: DCR C

JNZ LOOP1

STA 2058

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**ASCENDING ORDER**

**EXP NO: 12**

**AIM:** To compute ascending order of an array using 8085 processor.

**ALGORITHM:**

1. Initialize HL pair as memory pointer.
2. Get the count at memory and load it into C register
3. Copy it in D register (for bubble sort (N-1)) times required).
4. Get the first value in A register.
5. Compare it with the value at next location.
6. If they are out of order, exchange the contents of A register and memory.
7. Decrement D register content by 1
8. Repeat step 5 and 7 till the value in D register become zero.
9. Decrement the C register content by 1.
10. Repeat steps 3 to 9 till the value in C register becomes zero.

**PROGRAM:**

LOOP: LXI H,3500

MVI D,00

MVI C,05

LOOP1: MOV A,M

INX H

CMP M

JC LOOP2

MOV B,M

MOV M,A

DCX H

MOV M,B

INX H

MVI D,01

LOOP2: DCR C

JNZ LOOP1

MOV A,D

RRC

JC LOOP

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**DESCENDING ORDER**

**EXP NO: 13**

**AIM:** To compute descending order of an array using 8085 processor.

**ALGORITHM:**

1. Initialize HL pair as memory pointer.
2. Get the count at memory and load it into C register
3. Copy it in D register (for bubble sort (N-1)) times required).
4. Get the first value in A register.
5. Compare it with the value at next location.
6. If they are out of order, exchange the contents of A register and memory.
7. Decrement D register content by 1
8. Repeat step 5 and 7 till the value in D register become zero.
9. Decrement the C register content by 1.
10. Repeat steps 3 to 9 till the value in C register becomes zero.

**PROGRAM:**

LOOP: LXI H,3500

MVI D,00

MVI C,05

LOOP1: MOV A,M

INX H

CMP M

JNC LOOP2

MOV B,M

MOV M,A

DCX H

MOV M,B

INX H

MVI D,01

LOOP2: DCR C

JNZ LOOP1

MOV A,D

RRC

JC LOOP

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**ADDITION OF N NUMBERS**

**EXP NO: 14**

**AIM:** To compute addition of N numbers using 8085 processor.

**ALGORITHM:**

1. Load the base address of the array in HL register pair.
2. Load the memory with data to be added.
3. Take it as count.
4. Initialize the accumulator with 00.
5. Add content of accumulator with content of memory.
6. Decrement count.
7. Load count value to memory location.
8. Repeat step 5.
9. Check whether count has become 0.
10. Halt.

**PROGRAM:**

LXI H,8000

MOV C,M

MVI A,00

MOV B,A

LOOP: ADD C

JNC SKIP

INR B

SKIP: DCR C

JNZ LOOP

LXI H,8007

MOV M,A

INX H

MOV M,B

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**SWAPPING OF NUMBERS**

**EXP NO: 15**

**AIM:** To compute swapping of numbers using 8085 processor.

**ALGORITHM:**

1. Load a 8-bit number from memory location into accumulator.
2. Move value of accumulator into register H.
3. Load a 8-bit number from next memory location into accumulator.
4. Move value of accumulator into register D.
5. Exchange both the registers pairs.
6. Halt

**PROGRAM:**

LDA 2001

MOV B,A

LDA 2002

MOV C,A

STA 2003

MOV A,B

STA 2004

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**SQUARE OF NUMBER**

**EXP NO: 16**

**AIM:** To compute square of number using 8085 processor.

**ALGORITHM:**

1. Load the base address of the array in HL register pair.
2. Assign accumulator as 0.
3. Load the content of memory location specified into register.
4. Add content of memory location with accumulator and decrement register content by 01.
5. Check if register holds 00, if so store the value of accumulator in memory location.

**PROGRAM:**

LXI H,8000

XRA A

MOV B,M

LOOP: ADD M

DCR B

JNZ LOOP

STA 8001

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**ONEs AND TWOs COMPLEMENT**

**EXP NO: 17**

**AIM:** To compute one’s and two’s complement using 8085 processor.

**ALGORITHM:**

1. Load the base address of the array in a register pair.
2. Move the data from memory location into accumulator.
3. Convert all ones into zeros and zeros into ones.
4. Add 01 to the accumulator content.
5. Store the results of one’s and two’s complement.

**PROGRAM:**

LDA 3000

CMA

STA 3001

ADI 01

STA 3002

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**ROTATE LEFT OPERATION**

**EXP NO: 18**

**AIM:** To compute rotation of given data in left without carry using 8085 processor.

**ALGORITHM:**

1. Load the base address of the array in HL register pair.
2. Move the data from memory location into accumulator.
3. Shift left the accumulator content for four times.
4. Store the result in the specified location.

**PROGRAM:**

MVI A,02

RLC

RLC

RLC

RLC

STA 2000

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**ROTATE RIGHT OPERATION**

**EXP NO: 19**

**AIM:** To compute rotation of given data in right without carry using 8085 processor.

**ALGORITHM:**

1. Load the base address of the array in HL register pair.
2. Move the data from memory location into accumulator.
3. Shift right the accumulator content for four times left.
4. Store the result in the specified location.

**PROGRAM:**

MVI A,03

RRC

RRC

RRC

RRC

STA 2000

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**LOGICAL OPERATIONS**

**EXP NO: 20**

**AIM:** To compute various logical operations using 8085 processor.

**ALGORITHM:**

1. Load data to accumulator.
2. Load another data in register
3. Perform logical operations like AND, OR and XOR (Use ANA, ORA, XRA) with the accumulator content.
4. Store the result in specified memory location.

**PROGRAM:**

**AND OPERATION:**

MVI A,06

MVI B,04

ANA B

STA 2500

HLT

**OR OPERATION:**

MVI A,07

MVI B,06

ORA B

STA 2000

HLT

**XOR OPERATION:**

MVI A,03

MVI B,04

XRA B

STA 2000

HLT

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using 8085 processor simulator.

**DECIMAL TO BINARY CONVERSION**

**EXP NO: 21**

**AIM:** To write a C program to implement decimal to binary conversion.

**ALGORITHM:**

1. Check if your number is odd or even.
2. If it's even, write 0 (proceeding backwards, adding binary digits to the left of the result).
3. Otherwise, if it's odd, write 1 (in the same way).
4. Divide your number by 2 (dropping any fraction) and go back to step 1. Repeat until your original number is 0.

**PROGRAM:**

#include<stdio.h>

#include<stdlib.h>

int main()

{

int a[10],n,i;

printf("Enter the number to convert: ");

scanf("%d",&n);

for(i=0;n>0;i++)

{

a[i]=n%2;

n=n/2;

}

printf("\nBinary of Given Number is=");

for(i=i-1;i>=0;i--)

{

printf("%d",a[i]);

}

return 0;

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

**HEXADECIMAL TO DECIMAL CONVERSION**

**EXP NO: 22**

**AIM:** To write a C program to implement hexadecimal to decimal conversion.

**ALGORITHM:**

1. Start from the right-most digit. Its weight (or coefficient) is 1.
2. Multiply the weight of the position by its digit. Add the product to the result.  
   (0=0, 1=1, 2=2, … 9=9, A=10, B=11, C=12, D=13, E=14,F=15)
3. Move one digit to the left. Its weight is 16 times the previous weight.
4. Repeat 2 and 3 until you go through all hexadecimal digits.

**PROGRAM:**

#include<stdio.h>

int main()

{

int n;

printf("enter the hex decimal number");

scanf("%x",&n);

printf("the decimal value is:%d",n);

return 0;

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

**DECIMAL TO OCTAL CONVERSION**

**EXP NO: 23**

**AIM:** To write a C program to implement decimal to octal conversion.

**ALGORITHM:**

1. Store the remainder when the number is divided by 8 in an array.
2. Divide the number by 8 now
3. Repeat the above two steps until the number is not equal to 0.
4. Print the array in reverse order now.

**PROGRAM:**

#include <stdio.h>

int main()

{

long decimal, remainder, quotient,octal=0;

int octalnum[100], i = 1, j;

printf("Enter the decimal number: ");

scanf("%ld", &decimal);

quotient = decimal;

while (quotient != 0)

{

octalnum[i++] = quotient % 8;

quotient = quotient / 8;

}

for (j = i - 1; j > 0; j--)

octal= octal\*10 + octalnum[j];

printf("Equivalent octal value of decimal no %d is: %d ", decimal,octalnum);

return 0;

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

**BINARY TO DECIMAL CONVERSION**

**EXP NO: 24**

**AIM:** To write a C program to implement binary to decimal conversion.

**ALGORITHM:**

1. Start
2. Read the binary number from the user, say ‘n’
3. Initialize the decimal number, d=0
4. Initialize i=0
5. Repeat while n != 0:
   * 1. Extract the last digit by: remainder = n % 10
     2. n = n/10
     3. d = d + (remainder \* 2<sup>i</sup>)
     4. Increment i by 1
6. Display the decimal number, d
7. Stop

**PROGRAM:**

#include <stdio.h>

void main()

{

int num, binary\_num, decimal\_num = 0, base = 1, rem;

printf (" Enter a binary number with the combination of 0s and 1s \n");

scanf (" %d", &num);

binary\_num = num;

while ( num > 0)

{

rem = num % 10;

decimal\_num = decimal\_num + rem \* base;

num = num / 10;

base = base \* 2;

}

printf ( " The binary number is %d \t", binary\_num);

printf (" \n The decimal number is %d \t", decimal\_num);

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

**TWO STAGE PIPELINE**

**EXP NO: 25**

**AIM:** To write a C program to implement two stage pipelining.

**PROCEDURE:**

Step1:Start

Step 2: Initialize the counter variable to 1.

Step 3:.Prompt the user to enter the first number (a).

Step 4:.Read the first number (a) from the user.

Step 5:Increment the counter by 1.

Step 6:Prompt the user to enter the second number (b).

Step 7:Read the second number (b) from the user.

Step 8:.Increment the counter by 1.

Step 9:Display the menu of operations: Addition, Subtraction, Multiplication, and Division.

Step 10:Prompt the user to select an operation (choice).

Step 11:Read the choice from the user.

Step 12:Use a switch statement to perform the operation based on the selected choice:

12.1For choice 1: Perform addition (res = a + b). Increment the counter by 1.

12.2For choice 2: Perform subtraction (res = a - b). Increment the counter by 1.

12.3. For choice 3: Perform multiplication (res = a \* b). Increment the counter by 1.

12.4 For choice 4: Perform division (res = a / b). Increment the counter by 1.

12.5. For any other choice: Display "Wrong input".

Step 13: Display the value of the counter (the number of cycles taken).

Step 14:Prompt the user to enter the number of instructions (ins).

Step 15:Read the number of instructions (ins) from the user.

Step 16:Calculate the performance measure by dividing the number of instructions (ins) by the counter and store it in the performance measure variable.

Step 17:Display the performance measure

Step 18:End

**PROGRAM:**

**#**include<stdio.h>

int main()

{

int counter =1,a,b,choice,res,ins;

printf("Enter number 1:");

scanf("%d",&a);

counter = counter+1;

printf("Enter number 2:");

scanf("%d",&b);

counter = counter +1;

printf("1-Addition:\n2-Subtraction:\n3-Multiplication:\n4-Division:");

scanf("%d",&choice);

switch(choice)

{

case 1: printf("Performing addition\n");

res = a+b;

counter = counter+1;

break;

case 2: printf("Performing subtraction\n");

res = a-b;

counter = counter+1;

break;

case 3: printf("Performing Multiplication\n");

res = a\*b;

counter = counter+1;

break;

case 4: printf("Performing Division\n");

res = a/b;

counter = counter+1;

break;

default: printf("Wrong input");

break;

}

printf("The cycle value is:%d\n",counter);

printf("Enter the number of instructions:");

scanf("%d",&ins);

int performance\_measure = ins/counter;

printf("The performance measure is:%d\n",performance\_measure);

return 0;

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

**CPU PERFORMANCE**

**EXP NO: 26**

**AIM:** To write a C program to implement CPU performance measures.

**ALGORITHM:**

Step 1: start

Step 2:Declare the necessary variables: cr (clock rate), p (number of processors), p1 (a copy of the number of processors), i (loop variable), and cpu (array to store CPU times).

Step 3: Initialize the cpu array elements to 0.

Step 4: Prompt the user to enter the number of processors (p).

Step 5: Store the value of p in p1.

Step 6: Start a loop from 0 to p-1:

a. Prompt the user to enter the cycles per instruction (cpi) for the current processor.

b. Prompt the user to enter the clock rate (cr) in GHz for the current processor.

c. Calculate the CPU time (ct) using the formula: ct = 1000 \* cpi / cr.

d. Display the CPU time for the current processor.

e. Store the CPU time in the cpu array at index i.

Step 7: Set max as the first element of the cpu array.

Step 8:Start a loop from 0 to p1-1:

a. If the CPU time at index i is less than or equal to max, update max to the current CPU time.

Step 9: Display the processor with the lowest execution time (max).

Step 10: Exit the program.

**PROGRAM:**

#include <stdio.h>

int main()

{

float cr;

int p,p1,i;

float cpu[5];

float cpi,ct,max;

int n=1000;

for(i=0;i<=4;i++)

{

cpu[5]=0;

}

printf("\n Enter the number of processors:");

scanf("%d",&p);

p1=p;

for(i=0;i<p;i++)

{

printf("\n Enter the Cycles per Instrcution of processor:");

scanf("%f",&cpi);

printf("\n Enter the clockrate in GHz:");

scanf("%f",&cr);

ct=1000\*cpi/cr;

printf("The CPU time is: %f",ct);

cpu[i]=ct;

}

max=cpu[0];

for(i=0;i<p1;i++)

{

if(cpu[i]<=max)

max=cpu[i];

}

printf("\n The processor has lowest Execution time is: %f ", max);

return 0;

}

**INPUT:**

**OUTPUT:**

**RESULT:** Thus the program was executed successfully using DevC++.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **HALF ADDER**  **EXP.NO: 27**  **AIM:**  To design and implement the two bit half adder using Logisim simulator.  **PROCEDURE:**   1. Pick and place the necessary gates. 2. Insert 2 inputs into the canvas. 3. Connect the inputs to the XOR gate and AND gate. 4. Insert 2 outputs into the canvas. 5. Make the connections using the connecting wires. 6. Verify the truth table.   **TRUTH TABLE:**   |  |  |  |  | | --- | --- | --- | --- | | **A** | **B** | **S** | **C** | | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | 0 | | 1 | 0 | 1 | 0 | | 1 | 1 | 0 | 1 |   S = A XOR B C = A AND B  **OUTPUT**    **RESULT:** Thus 2-bit half adder has been designed and implemented successfully using logisim simulator. |
| **TWO BIT HALF SUBTRACTOR**  **EXP.NO: 28**  **AIM:**  To design and implement the two bit half subtractor using Logisim simulator.  **PROCEDURE:**   1. Pick and place the necessary gates. 2. Insert 2 inputs into the canvas. 3. Connect the inputs to the OR gate, AND gate and NOT gate. 4. Insert 2 outputs into the canvas. 5. Make the connections using the connecting wires. 6. Verify the truth table.   **TRUTH TABLE:**  Half Subtractor  Diff=A'B+AB' Borrow = A'B  **OUTPUT**    **RESULT:** Thus 2-bit half subtractor has been designed and implemented successfully using logisim simulator. | **TWO BIT HALF ADDER USING LOGISIM SIMULATOR** |
| **FULL ADDER**  **EXP.NO: 29**  **AIM:**  To design and implement the full adder using Logisim simulator.  **PROCEDURE:**   1. Pick and place the necessary gates. 2. Insert 3 inputs into the canvas. 3. Connect the inputs to the XOR gate, AND gate and OR gate. 4. Insert 2 outputs into the canvas. 5. Make the connections using the connecting wires. 6. Verify the truth table.   **TRUTH TABLE:**  Full Adder  Sum=(A ⊕ B) ⊕ Cin  Carry=A.B + (A ⊕ B)  **OUTPUT**    **RESULT:** Thus full adder has been designed and implemented successfully using logisim simulator. |

**FULL SUBTRACTOR**

**EXP.NO: 30**

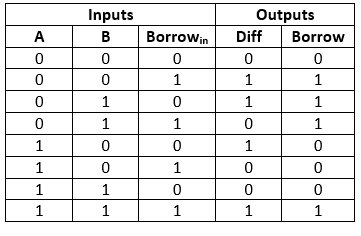
**AIM:**

To design and implement the full subtractor using Logisim simulator.

**PROCEDURE:**

1. Pick and place the necessary gates.
2. Insert 3 inputs into the canvas.
3. Connect the inputs to the XOR gate, AND gate and OR gate.
4. Insert 2 outputs into the canvas.
5. Make the connections using the connecting wires.
6. Verify the truth table.

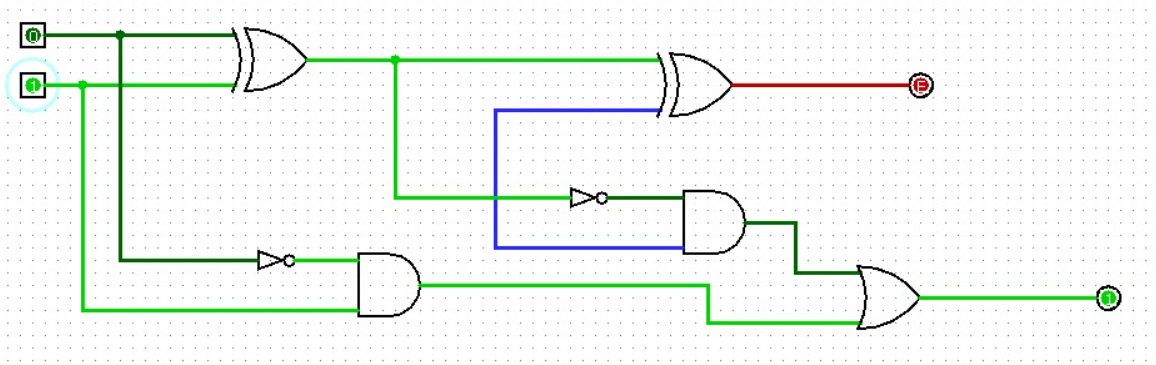
**TRUTH TABLE:**



Diff=(A ⊕ B) ⊕ 'Borrowin'

Borrow=A'.B + (A ⊕ B)'

**OUTPUT**



**RESULT:** Thus full subtractor has been designed and implemented successfully using logisim simulator.