SAVEETHA
SCHOOL OF ENGINEERING

Name of the Student : ....

Register Number : ....

Department : ....

Semestor : ....

Subject : ....

LABORATORY RECORD NOTE BOOK

SAVEETHA
INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES
(Declared as Deemed to be University under Section 3 of UGC Act 1956)

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SAVEETHA
SCHOOL OF ENGINEERING

Department Of ....

LABORATORY RECORD NOTE BOOK

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This is certify that this is a bonafide record of that work done by

Mr. / Ms ....Register Number ....

of the year ....B.E / B.Tech., Department of ....

in the ....Laboratory in the ....Semester

University Examination held on ....

Staff in - Charge | Head of the Department

Internal Examiner | External Examiner

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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:
    i. Extract the last digit by: remainder = n % 10
    ii. n = n/10
    iii. d = d + (remainder * 2ⁱ)
    iv. 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:

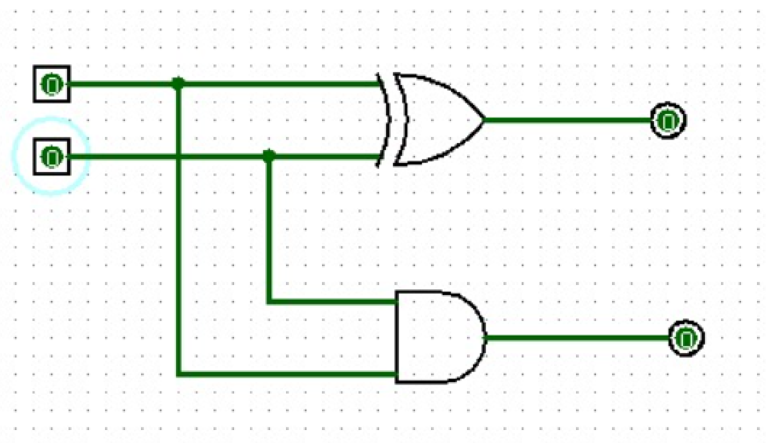
1) Pick and place the necessary gates.
2) Insert 2 inputs into the canvas.
3) Connect the inputs to the XOR gate and AND gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

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:

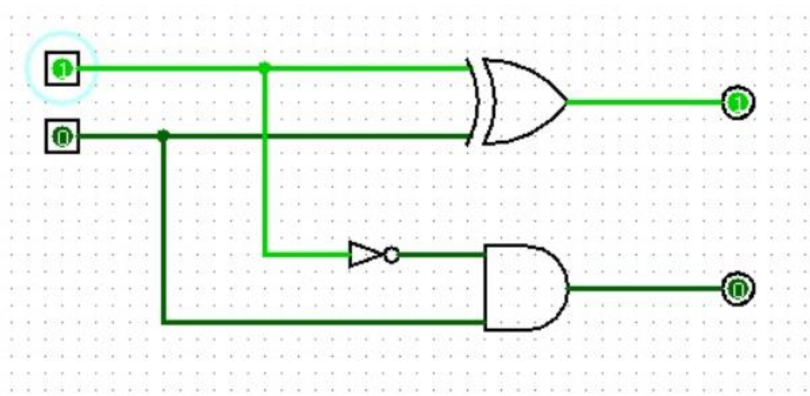
1) Pick and place the necessary gates.
2) Insert 2 inputs into the canvas.
3) Connect the inputs to the OR gate, AND gate and NOT gate.
4) Insert 2 outputs into the canvas.
5) Make the connections using the connecting wires.
6) Verify the truth table.

TRUTH TABLE:

Inputs		Outputs	
A	B	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Diff=A'B+AB'
Borrow = A'B

OUTPUT



RESULT: Thus 2-bit half subtractor has been designed and implemented successfully 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.

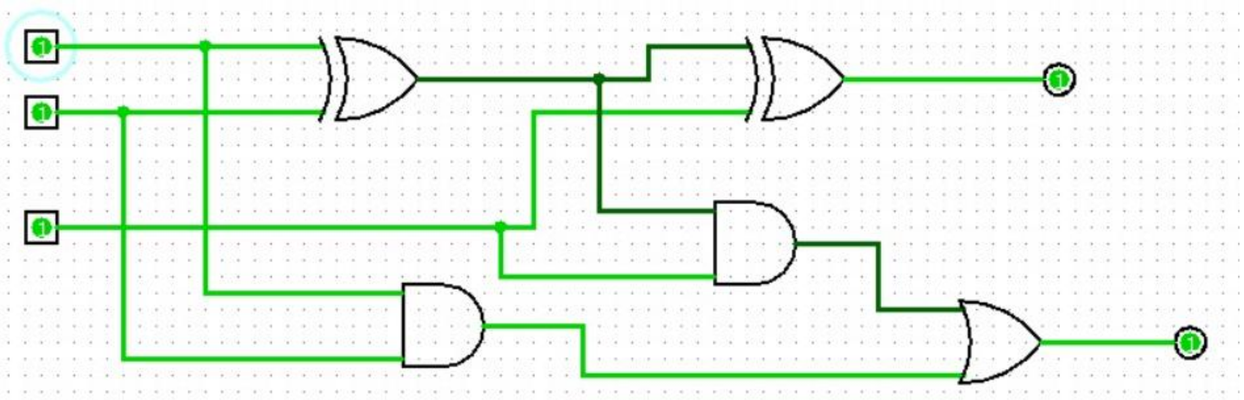
TRUTH TABLE:

Inputs			Outputs	
A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Sum=$(A \oplus B) \oplus C_{in}$

Carry=$A.B + (A \oplus B)$

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.

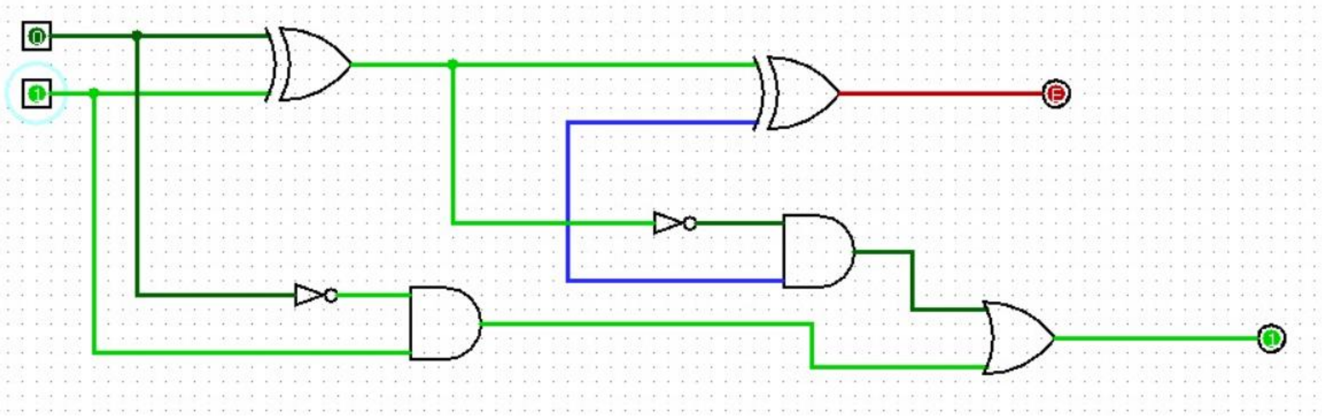
TRUTH TABLE:

Inputs			Outputs	
A	B	$Borrow_{in}$	Diff	Borrow
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Diff=$(A \oplus B) \oplus$ '$Borrow_{in'}$

Borrow=$A'.B + (A \oplus B)'$

OUTPUT



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