COAL Lab

Project Report

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Submitted to: Dr. Madiha Tahir

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1) Title:

Building a **Calculator** in assembly language.

2) Objective:

The purpose of this project is to develop a calculator as it supports correct calculations. It is clear that a calculator should relieve the user of the need to do mental operations.

Using a calculator can help save a whole lot of computational time on basic arithmetical calculations. This makes it easier for them to stress more on important math concepts rather than stressing more on basic arithmetical calculations.

Calculator use can promote the higher-order thinking and reasoning needed for problem solving in our information- and technology-based society.

3) Implementation:

Firstly select the operation you want to perform. Next enter the operands using the keyboard. Result will be computed and will be displayed on the screen. The user will be asked whether they want to continue, if yes, the loop will run again. Calculator will restart. Then choose the operator and enter the operands.

9 different operations will be performed on the calculator.

1. **Addition (+)**
   To choose the addition operation, enter 1, then enter the first and second number and display the result of addition.
2. **Subtraction (-)**
   To choose the subtraction operation, enter 2, then enter the first and second number and display the result of subtraction.
3. **Multiplication (*)**
   To choose the multiplication operation, enter 3, then enter the first and second number and display the result of multiplication.
4. **Division (/)**
   To choose the division operation, enter 4, then enter the first and second number and display the result of division.
5. **Modulo (%)**
   To choose modulo operation, enter 5, then enter the first and second number and display the result of Mod.

6. **Factorial (!)**
   To choose the Factorial operation, enter 6, then enter any number between 0-7. Display the result of Factorial.

7. **Square (n^2)**
   To choose the Square operation, enter 7, then enter the number to find and display the result of its square.

8. **Cube (n^3)**
   To choose the cube operation, enter 8, then enter the number to find and display the result of its cube.

9. **Complex Number (a+bi)+(c+di)**
   To choose the Complex Number operation, enter 9, then enter the first, second, third and fourth number. Display the result of its Complex Number.

10. **Exit**
    To exit the calculator, enter 0.

4) Code:

```
include emu8086.inc
org 100h

.data
    op1 db 10,13, '1 -> Addition ',13,10,'$'
    op2 db '2 -> Subtracion ',13,10,'$'
    op3 db '3 -> Multiplication',13,10,'$'
    op4 db '4 -> Division ',13,10,'$'
    op5 db '5 -> MOD ',13,10,'$'
    op6 db '6 -> Factorial ',13,10,'$'
    op7 db '7 -> Square',13,10,'$'
    op8 db '8 -> Cube',13,10,'$'
    op9 db '9 -> Complec Addition (a+bi)+(c+di)',13,10,'$'
    op10 db '0 -> Exit ',13,10,'$'
    option DB 10,13, 'Which operation do you want to perform? $'

num1 dw ?
num2 dw ?
num3 dw ?
num4 dw ?
RESULT dw ?

.code
MAIN PROC

    print '               ******************************'
    printn
```

```
 print '                    SCIENTIFIC CALCULATER'
 printn
 print '                ******************************'
 printn
 printn

Menu:
 MOV AX,@DATA
 MOV DS,AX

 LEA DX,op1
 MOV AH,9
 INT 21H

 LEA DX,op2
 MOV AH,9
 INT 21H

 LEA DX,op3
 MOV AH,9
 INT 21H

 LEA DX,op4
 MOV AH,9
 INT 21H

 LEA DX,op5
 MOV AH,9
 INT 21H

 LEA DX,op6
 MOV AH,9
 INT 21H

 LEA DX,op7
 MOV AH,9
 INT 21H

 LEA DX,op8
 MOV AH,9
 INT 21H

 LEA DX,op9
 MOV AH,9
 INT 21H

 LEA DX,op10
 MOV AH,9
 INT 21H

 LEA DX,option
```

```
  MOV AH,9
  INT 21H
  printn

  MOV AH,1
  INT 21H
  MOV BH,AL
  SUB BH,48

  CMP BH,1
  JE ADD

  CMP BH,2
  JE SUB

  CMP BH,3
  JE MUL

  CMP BH,4
  JE DIV

  CMP BH,5
  JE MOD

  CMP BH,6
  JE factorial

  CMP BH,7
  JE Square

  CMP BH,8
  JE Cube

  CMP BH,9
  JE Complex

  CMP BH, 0
  printn

   JMP Return

     ret

ADD:

    printn
    print ' _____________________ '
    printn
    printn

 print 'Enter 1st number = '
```

```
 call scan_num
 mov num1,cx

printn
 print 'Enter 2nd number = '
 call scan_num
 mov num2,cx

 mov ax,num1
 mov bx,num2
 ADD ax,bx
printn
printn
 print 'Result of Addition = '
 call print_num

 JMP EXIT_P

SUB:

      printn
   print ' _____________________ '
   printn
   printn

 print 'Enter 1st number = '
 call scan_num
 mov num1,cx
 printn
 print 'Enter 2nd number = '
 call scan_num
 mov num2,cx

 mov ax,num1
 mov bx,num2
 SUB ax,bx

 mov RESULT,ax
    printn
    printn
 print 'Result of Subtraction = '
 call print_num

 JMP EXIT_P

MUL:
      printn
   print ' _____________________ '
   printn
   printn
```

```
        print 'Enter 1st number = '
        call scan_num
        mov num1,cx
       printn
        print 'Enter 2nd number = '
        call scan_num
        mov num2,cx

        mov ax,num1

        Mul num2

        mov RESULT,ax
       printn
       printn
        print 'Result of Multiplication = '
        call print_num

        JMP EXIT_P

      DIV:
            printn
          print ' _____________________ '
          printn
          printn

        print 'Enter 1st number = '
        call scan_num
        mov num1,cx
         printn
        print 'Enter 2nd number = '
        call scan_num
        mov num2,cx

        mov dx,0
        mov ax,num1

        DIV num2
        printn
        printn
        print 'Result of Division = '

        mov RESULT,ax
        call print_num
        printn
        JMP EXIT_P

       MOD:
           printn
          print ' _____________________ '
          printn
```

```
        printn

        print 'Enter 1st number = '
         call scan_num
        mov num1,cx
        printn
         print 'Enter 2nd number = '
         call scan_num
         mov num2,cx

         mov dx,0
         mov ax,num1

         DIV num2
          printn
          printn
         print 'Result of MOD = '
         mov ax,dx
         call print_num

        JMP EXIT_P

    factorial:

           printn
        print ' _____________________ '
        printn
        printn

          print 'Enter number between 0 to 7'
         printn

          print 'Enter number = '
         call scan_num
          mov num1,cx

          mov ax, num1
          mov bx,ax
         L:
            dec bx
            mul bx
            cmp bx,1
         jne L
         mov cx,ax
           printn
           printn
         print 'Result of Factorial = '
        call print_num
        printn

       JMP EXIT_P
```

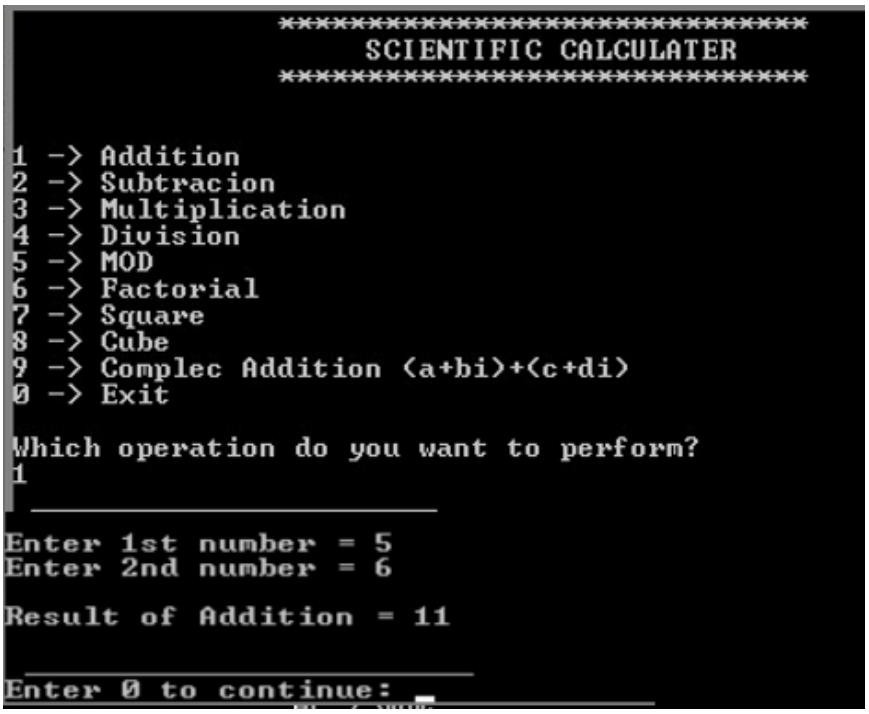
```
Square:
       printn
    print ' _____________________ '
    printn
    printn

     print 'Enter number = '
     call scan_num
     mov num1,cx
       printn
     mov bx,num1
     mul num1
     mov ax,bx
     Mul bx
       printn
       printn
     print 'Result of the Square of given number = '

       call print_num

   JMP EXIT_P

Cube:
       printn
    print ' _____________________ '
    printn
    printn

     print 'Enter number = '
     call scan_num
     mov num1,cx
       printn
     mov bx,num1
     mul num1
     mov ax,bx
     Mul bx
     Mul bx

       printn
       printn
     print 'Result of the cube of given number = '
     call print_num

    JMP EXIT_P

Complex:

    printn
    print ' _____________________ '
    printn
```

```
          printn

           print 'Enter 1st number = '
           call scan_num
           mov num1 , cx
           printn
           print 'Enter 2nd number = '
           call scan_num
           mov num2 , cx
           printn
           print 'Enter 3rd number = '
           call scan_num
           mov num3 ,cx

          printn
           print 'Enter 4th number = '
           call scan_num
           mov num4 ,cx

           mov ax,num1
            mov bx,num3
            add ax,bx
            printn
            call print_num
            print '+'
            mov ax,num2
            mov bx,num4
            add ax,bx

            call print_num
            print 'i'

           JMP EXIT_P
          printn

        ret

        EXIT_P:
             printn
             printn
             print ' _________________________ '

             printn
             print "Enter 0 to continue: "
                 MOV AH,1
             INT 21H
             MOV BH,AL
             SUB BH,48

             CMP BH,0
             JE  menu
```

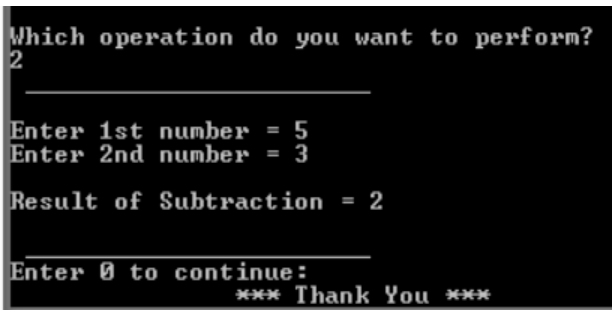
```
        call Return

        Return:
        printn
        print '                *** Thank You ***'

      EXIT:

define_print_num
define_print_num_uns
define_scan_num
     MOV AH,4CH
     INT 21H

END MAIN
```

5) Output:

1. **Addition (+)**



2. **Subtraction (-) and Exit**



3. Multiplication (*)

```
Which operation do you want to perform?
3
 _____________________

Enter 1st number = 5
Enter 2nd number = 3

Result of Multiplication = 15
```

4. Division (/)

```
Which operation do you want to perform?
4
 _____________________

Enter 1st number = 4
Enter 2nd number = 2

Result of Division = 2
```

5. Modulo (%)

```
Which operation do you want to perform?
5
 _____________________

Enter 1st number = 7
Enter 2nd number = 3

Result of MOD = 1
```

6. Factorial (!)

```
Which operation do you want to perform?
6
 _____________________

Enter number between 0 to 7
Enter number = 5

Result of Factorial = 120
```

7. Square (n^2)

```
Which operation do you want to perform?
7
 _____________________

Enter number = 9


Result of the Square of given number = 81
```

8. Cube (n^3)

```
Which operation do you want to perform?
8
 _____________________

Enter number = 2


Result of the cube of given number = 8
```

9. Complex Number (a+bi)+(c+di)

```
Which operation do you want to perform?
9
 _____________________

Enter 1st number = 5
Enter 2nd number = 4
Enter 3rd number = 3
Enter 4th number = 2
8+6i
```

Thank you