REPORT:

**PROJECT NAME:**

“CALCULATOR”

**CONTENT OF PROJECT REPORT:**

1. Objective
2. Theory
3. Implementation
4. Debugging test-run

**Objective:**

The objective of our project is to implement a 16-bit calculator that would perform following arithmetic and trigonometric operations.

1-Addition

2-Subtraction

3-Multiplication

4-Divison

5-Square

6-Cube

7-Factorial

8-Power

9-Trigonometry.

**Theory:**

An **electronic calculator** is typically a portable electronic device used to perform calculations, ranging from basic arithmetic to complex mathematics. A calculator is a device that performs arithmetic operations on numbers. calculators can do only addition, subtraction, multiplication, and division which is basic.

In this project we have computed the assembly language code (8086) to do the basic functions, I have simulated the programmed in emulator software. This is a microprocessor emulator with an integrated 8086 Assembler. The emulator can run programs on a Virtual Machine, and emulate real hardware including screen, memory, and input and output devices. It helps you program in assembly language. The source code is compiled by assembler and then executed on Emulator step-by-step, allowing you to watch registers, flags and memory while your program runs.

The code we made acts like a 16 bits calculator that would perform arithmetic and trigonometric operations (Addition (+), Subtraction (-), Multiplication (\*), Division (/), Square (^2), Cube (^3), Factorial (!), Power (^), Trigonometry (Sin, Cos, Tan)). This calculator can perform 16 bits arithmetic and trigonometric operations. As our calculator acts like a 16 bits calculator so it has a range from 0-65535. We can enter any number in this range. If we enter a number having range above it would hit an error.

In our calculator when we run, it displays a menu that asks us to enter a choice from (1-9).

If we enter 1, we will be able to perform **addition** operation.

If we enter 2, we will be able to perform **multiplication** operation.

If we enter 3, we will be able to perform **subtraction** operation.

If we enter 4, we will be able to perform **division** operation.

If we enter 5, we will be able to perform **square** operation.

If we enter 6, we will be able to perform **cube** operation.

If we enter 7, we will be able to perform **factorial** operation.

If we enter 8, we will be able to perform **power** operation.

If we enter 9, we will be able to perform **trigonometric** operation.

After selecting one of our choices, we will get to that operation, and it will ask the user to enter numbers. There are two numbers that must be entered.

It will ask the user to please enter the first number and then the second number after entering that we will get the result of that operation that we chose.

**Addition operation:**

If we enter 1, we will be able to perform **addition** operation. Then the compiler will ask to enter the first number after entering the first number it will ask the user to enter the second number after that we will simply get our result of addition.

**Multiplication operation:**

If we enter 2, we will be able to perform **Multiplication** operation. Then the compiler will ask to enter the first number after entering the first number it will ask the user to enter the second number after that we will simply get our result of multiplication.

**Subtraction operation:**

If we enter 3, we will be able to perform **subtraction** operation. Then the compiler will ask to enter the first number after entering the first number it will ask the user to enter the second number after that we will simply get our result of subtraction.

**Division operation:**

If we enter 4, we will be able to perform **division** operation. Then the compiler will ask to enter the first number after entering the first number it will ask the user to enter the second number after that we will simply get our result of division.

**Square operation:**

If we enter 5, we will be able to perform **square** operation. Then the compiler will ask to enter the number after entering that we will simply get our result of Square.

**Cube operation:**

If we enter 6, we will be able to perform **cube** operation. Then the compiler will ask to enter the number after entering that we will simply get our result of cube.

**Factorial operation:**

If we enter 7, we will be able to perform **factorial** operation. Then the compiler will ask to enter the number after entering that we will simply get our result of addition.

**Power operation:**

If we enter 8, we will be able to perform **power** operation. Then the compiler will ask to enter the power of base after entering the power of base it will ask to enter the base number after entering that we will simply get our result of power operation.

**Trigonometric operation:**

If we enter 9, menu will appear and there will be three choices.

1-Sin theta

2-Cos theta

3-Tan theta

If we enter 1, we will be able to perform sin theta, if we enter 2, we will be able to perform cos theta and similarly if we enter 3, we will be able to perform tan theta.

**Sin theta:**

After entering the choice, the compiler will ask the user to enter the value of perpendicular after entering the value of perpendicular it will ask the user to enter the value of hypotenuse after entering these values, we will get our answer of sin theta.

**Cos theta:**

After entering the choice, the compiler will ask the user to enter the value of base after entering the value of base it will ask the user to enter the value of hypotenuse after entering these values, we will get our answer of cos theta.

**Tan theta:**

After entering the choice, the compiler will ask the user to enter the value of perpendicular after entering the value of perpendicular it will ask the user to enter the value of base after entering these values, we will get our answer of tan theta.

**FLOW CHART OF OUR CALCULATOR:**

USER

Result

**IMPLEMENTATION:**

;COAL PROJECT

;CALCULATOR

;GROUP MEMBERS

;NAME :MALIK ABDUL HADI (200901053) , M.SAAD BIN SHAFIQ (200901079)

include emu8086.inc

org 100h

.DATA

num1 dw ?

num2 dw ?

result dw ?

temp dw ?

perpendicular dw ?

hypotenuse dw ?

base dw ?

MAIN PROC

.CODE

jmp start

hey: db 0dh,0ah,0Dh,0Ah,0Dh,0Ah,0dh,"\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* A SIMPLE CALCULATOR \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* ",0Dh,0Ah,0Dh,0Ah,0Dh, '$'

Introduction1: db 0Dh,0Ah, "GROUP MEMBERS:",0Dh,0Ah,0Dh,0Ah, "MALIK ABDUL HADI(200901053) ",0Dh,0Ah,"M.SAAD BIN SHAFIQ (200901079) " ,0Dh,0Ah,0Dh,0Ah,0Dh,0Ah,'$'

Introduction2: db 0Dh,0Ah,0Dh,0Ah, "WELCOME TO OUR CALCULATOR: ",0Dh,0Ah,0Dh,0Ah,'$'

outlining: db "\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ",0Dh,0Ah,0Dh,0Ah,'$'

Option1: db 0dh,0ah,"1 for Addition",0dh,0ah,"2 for Multiplication",0dh,0ah,"3 for Subtraction",0dh,0ah,"4 for Division", 0Dh,0Ah,"5 for taking Square",0Dh,0Ah,"6 for taking Cube",0Dh,0Ah,"7 for taking Factorial",0Dh,0Ah,"8 for taking Power of a number",0Dh,0Ah,"9 for Trigonometry ",0Dh,0Ah,'$'

choice1: db 0dh,0ah, "Please, enter your choice: ", 0Dh,0Ah, '$'

choice2: db 0dh,0ah, "You have selected Addtion: ", 0Dh,0Ah, '$'

choice3: db 0dh,0ah, "You have selected Multiplication: ", 0Dh,0Ah, '$'

choice4: db 0dh,0ah, "You have selected Subtraction: ", 0Dh,0Ah, '$'

choice5: db 0dh,0ah, "You have selected Division: ", 0Dh,0Ah, '$'

choice6: db 0dh,0ah, "You have selected Square: ", 0Dh,0Ah, '$'

choice7: db 0dh,0ah, "You have selected Cube: ", 0Dh,0Ah, '$'

choice8: db 0dh,0ah, "You have selected Factorial: ", 0Dh,0Ah, '$'

choice9: db 0dh,0ah, "You have selected Power of a number: ", 0Dh,0Ah, '$'

choice10: db 0dh,0ah, "You have selected Trigonometry: ", 0Dh,0Ah, '$'

start:

mov ah,9

mov dx, offset hey

int 21h

mov ah,9

mov dx, offset Introduction1

int 21h

mov ah,9

mov dx, offset Introduction2

int 21h

mov ah,9

mov dx, offset outlining

int 21h

mov ah,9

mov dx, offset Option1

int 21h

mov ah,9

mov dx, offset choice1

int 21h

mov ah,0

int 16h

cmp al,31h

je Addition

cmp al,32h

je Multiplication

cmp al,33h

je Subtraction

cmp al,34h

je Division

cmp al,35h

je Square

cmp al,36h

je Cube

cmp al,37h

je Factorial

cmp al,38h

je Power

cmp al,39h

je Trigonomtery

jmp start

Addition:

mov ah,9

mov dx, offset choice2

int 21h

print "Please enter the first number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

print "Please enter the second number: "

call scan\_num

print 10

print 13

mov num2,cx

mov bx,num2

add ax,bx

mov result,ax

print "So Addition of two numbers is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Multiplication:

mov ah,9

mov dx, offset choice3

int 21h

print "Please enter the first number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

print "Please enter the second number: "

call scan\_num

print 10

print 13

mov num2,cx

mov bx,num2

mul bx

mov result,bx

print "So Multiplication of two numbers is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Subtraction:

mov ah,9

mov dx, offset choice4

int 21h

print "Please enter the first number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

print "Please enter the second number: "

call scan\_num

print 10

print 13

mov num2,cx

mov bx,num2

SUB ax,bx

mov result,ax

print "So Subtraction of two numbers is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Division:

mov ah,9

mov dx, offset choice5

int 21h

print "Please enter the first number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

print "Please enter the second number: "

call scan\_num

print 10

print 13

mov num2,cx

mov bx,num2

xor dx, dx

div bx

mov result,bx

print "So Division of two numbers is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Square:

mov ah,9

mov dx, offset choice6

int 21h

print "Please enter the number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

mul ax

print "So Square of the number is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Cube:

mov ah,9

mov dx, offset choice7

int 21h

print "Please enter the number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

mov bx,ax

mul ax

mul bx

print "So Cube of the number is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Factorial:

mov ah,9

mov dx, offset choice8

int 21h

print "Please enter the number: "

call scan\_num

print 10

print 13

mov num1,cx

mov ax,num1

mov cx,ax

dec cx

l2:

mul cx

loop l2

print "So Factorial of the number is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Power:

mov ah,9

mov dx, offset choice9

int 21h

print "Please enter the Power of Base: "

call scan\_num

print 10

print 13

mov num1,cx

mov dx,num1

print "Now enter the Base: "

call scan\_num

print 10

print 13

mov num2,cx

mov bx,num2

mov ax,1h

mov cx,dx

l3:

mul bx

loop l3

print "So Power of the number(base) is: "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Trigonomtery:

mov ah,9

mov dx, offset choice10

int 21h

print 10

print 13

print 10

print 13

print "Menu :"

print 10

print 13

print "\_\_\_\_\_\_"

print 10

print 13

print 10

print 13

print "1- Sin theta"

print 10

print 13

print 10

print 13

print "2- Cos theta"

print 10

print 13

print 10

print 13

print "3- Tan theta"

print 10

print 13

print 10

print 13

mov ah,9

mov dx, offset choice1

int 21h

mov ah,0

int 16h

cmp al,31h

je Sin

cmp al,32h

je Cos

cmp al,33h

je Tan

Sin:

print "You have selected Sin theta: "

print 10

print 13

print 10

print 13

print " Sin theta = Perpendicular/hypotenuse "

print 10

print 13

print 10

print 13

print "Please enter the value of Perpendicular: "

call scan\_num

mov perpendicular,cx

mov ax,perpendicular

print 10

print 13

print 10

print 13

print "Please enter the value of hypotenuse: "

call scan\_num

mov hypotenuse,cx

mov bx,hypotenuse

print 10

print 13

print 10

print 13

xor dx, dx

div bx

mov result,bx

print "So the answer of Sin theta is : "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Cos:

print "You have selected Cos theta: "

print 10

print 13

print 10

print 13

print " Cos theta = Base/hypotenuse "

print 10

print 13

print 10

print 13

print "Please enter the value of Base: "

call scan\_num

mov base,cx

mov ax,base

print 10

print 13

print 10

print 13

print "Please enter the value of hypotenuse: "

call scan\_num

mov hypotenuse,cx

mov bx,hypotenuse

print 10

print 13

print 10

print 13

xor dx, dx

div bx

mov result,bx

print "So the answer of Cos theta is : "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

Tan:

print "You have selected Tan theta: "

print 10

print 13

print 10

print 13

print " Tan theta = Perpendicular/Base "

print 10

print 13

print 10

print 13

print "Please enter the value of Perpendicular: "

call scan\_num

mov perpendicular,cx

mov ax,perpendicular

print 10

print 13

print 10

print 13

print "Please enter the value of Base: "

call scan\_num

mov base,cx

mov bx,base

print 10

print 13

print 10

print 13

xor dx, dx

div bx

mov result,bx

print "So the answer of Tan theta is : "

call print\_num

print 10

print 13

print 10

print 13

print "Thanks for using our calculator :)))"

ret

hlt

DEFINE\_SCAN\_NUM

DEFINE\_PRINT\_NUM

DEFINE\_PRINT\_NUM\_UNS

ENDP

END MAIN

**Debugging test-run:**

**Text

Description automatically generated**

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**END**