Name : Nisarg Amlani .k.
Roll : CE001
ID : 22ceueg082
Lab : 4

AIM: 8087 programs using 8086 and 8087 instruction set

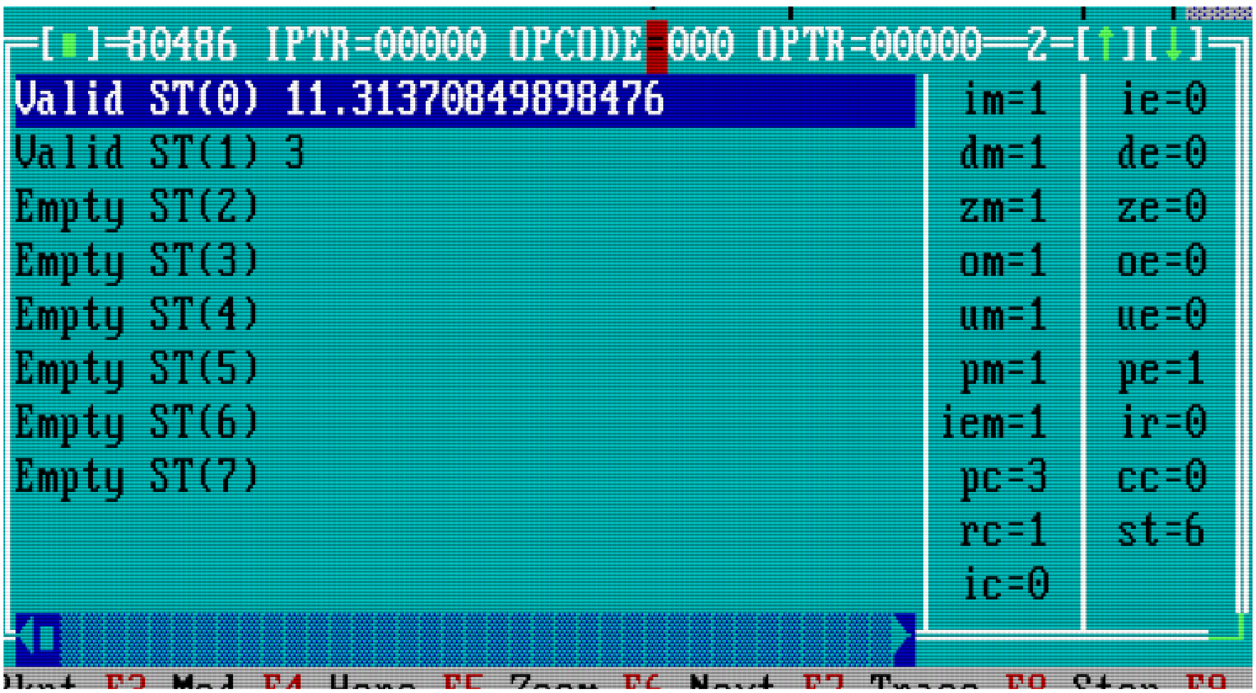
1. Compute x^y. x and y can be integer or real.

=> x = 2.0 , y = 3.5

Code:

```
data segment
x dd 2.0
y dd 3.5
power dd ?
intpower dd ?
res dd ?
cw dw 07ffh
data ends

code segment
assume cs:code, ds:data
start:
    mov ax, data
    mov ds, ax
    finit

    fld y           ; Load exponent (y) onto the FPU stack
    fld x           ; Load base (x) onto the FPU stack
    fyl2x           ; Calculate y * log2(x), result in st(0)
    fst power       ; Store the calculated power (y * log2(x))
    fldcw cw        ; Load control word for truncation
    frndint         ; Round st(0) to the nearest integer
    fst intpower    ; Store the integer part of the power

    fld power       ; Reload the power value
    fxch            ; Exchange st(0) and st(1) (intpower and fractional part)
    fsub            ; Subtract intpower from power to isolate the fractional part
    f2xm1           ; Calculate 2^(fractional part) - 1
    fld1            ; Load constant 1 onto the FPU stack
```

```
    fadd            ; Add 1 to calculate 2^(fractional part)

    fld intpower     ; Reload the integer part of the power
    fxch            ; Exchange st(0) and st(1) (fractional and integer parts)
    fscale           ; Scale result by 2^intpower (final result in st(0))
    fst res          ; Store the final result in memory

    int 3
code ends
end start
```

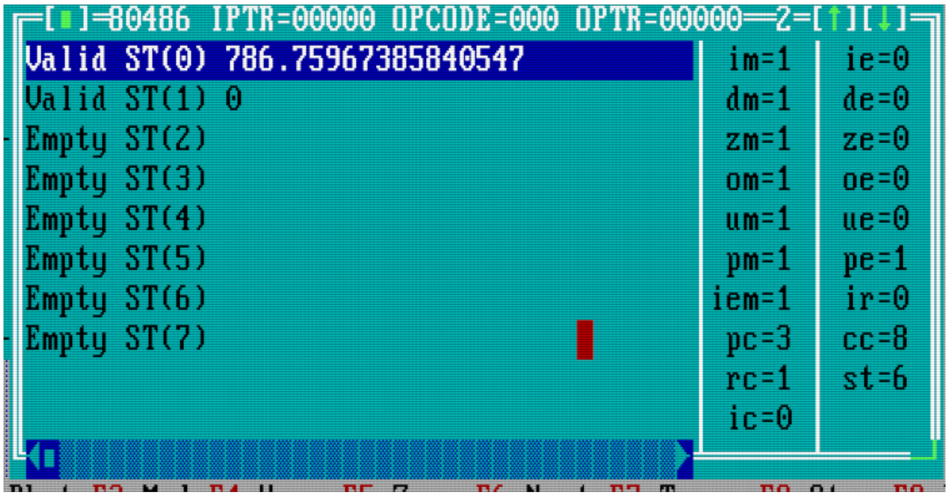


2. Compute P × (1 +r/ 100)^n. Example: P = 500.0, r =12% and n =4.0

Code:

```
data segment
r dd 12.0
n dd 4.0
p dd 500.0
divider dd 100.0
power dd ?
```

```
 intpower dd ?
res dd ?
cw dw 07ffh
data ends

code segment
assume cs:code, ds:data
start:
    mov ax, data
    mov ds, ax
    finit

    fld n              ; Load n (exponent) onto the FPU stack
    fld r             ; Load r (interest rate) onto the FPU stack
    fld divider        ; Load the divider value (100.0) onto the FPU stack
    fdiv              ; Divide st(1) by st(0) (r / divider), result in st(1)
    fld1              ; Load constant 1.0 onto the FPU stack
    fadd               ; Add st(0) and st(1) (r/divider + 1), result in st(0)
    fyl2x             ; Compute n * log2(st(0)) (exponentiation via logarithm), result in st(0)
    fst power          ; Store the calculated power (n * log2(1 + r/100))

    fldcw cw           ; Load control word to configure rounding mode
    frndint            ; Round st(0) to the nearest integer
    fst intpower       ; Store the integer part of the power in memory

    fld power          ; Reload the full power value (n * log2(1 + r/100))
    fxch              ; Exchange st(0) and st(1) (swap full power and integer power)
    fsub              ; Subtract integer part from full power to isolate the fractional part
    f2xm1              ; Compute 2^(fractional part) - 1, result in st(0)
    fld1              ; Load constant 1.0 onto the FPU stack
    fadd               ; Add 1 to compute 2^(fractional part)

    fld intpower       ; Reload the integer part of the power
    fxch              ; Exchange st(0) and st(1) (swap fractional part result and integer part)
    fscale            ; Scale st(0) by 2^st(1) (compute full 2^power)
    fmul p             ; Multiply the result by principal amount (p)
    fst res           ; Store the final result (res) in memory

    int 3
code ends
end start
```



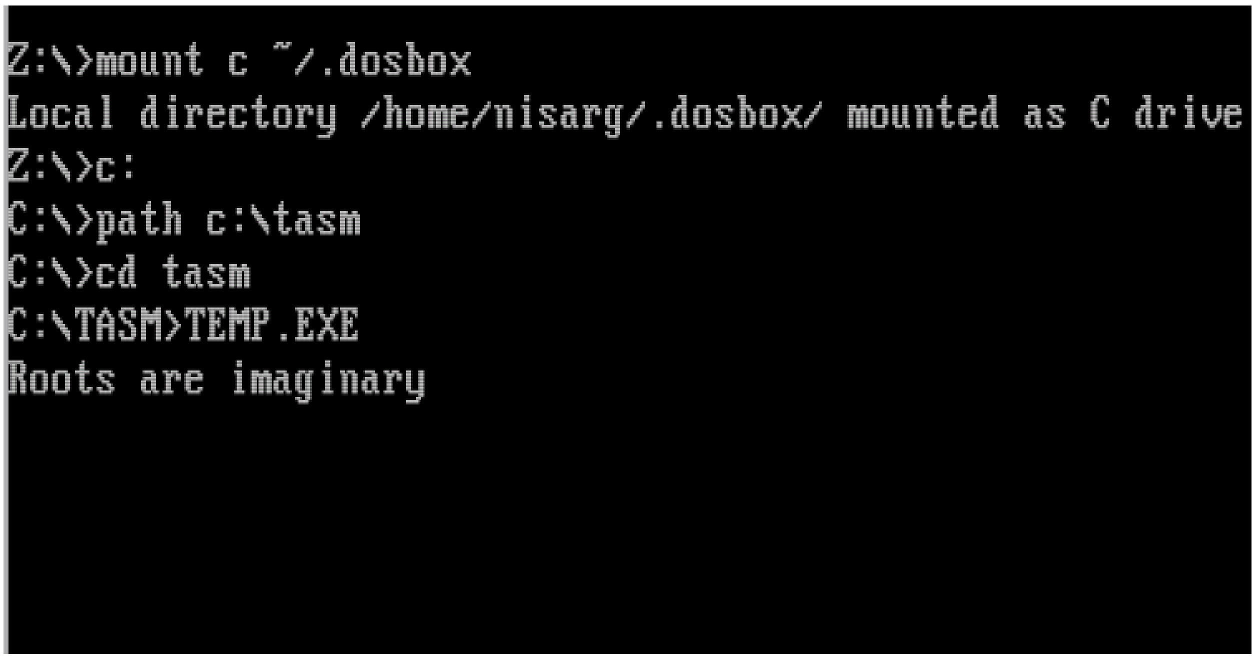
3. Compute roots of quadratic equation. If roots are imaginary display message “Roots are imaginary”.
Example: x^2 + 7x + 10 = 0

Code:

```
data segment
	a dd 1.0
	b dd 7.0
	c dd 15.0
	val dd 4.0
	val1 dd 2.0
	temp dw ?
	alpha dd ?
	ans dd ?
	ans1 dd ?
	str1 db "Roots are imaginary$" ; Message for imaginary roots
data ends

code segment
	Assume cs:code, ds:data

start:
	mov ax, data
	mov ds, ax
```

```
        finit

        ; Calculate the discriminant: b^2 - 4*a*c
        fld b                 ; Load coefficient b onto the FPU stack
        fmul b                  ; Compute b^2
        fld a                 ; Load coefficient a onto the FPU stack
        fmul c                  ; Compute a * c
        fmul val                ; Compute 4 * a * c
        fsub                   ; Subtract 4 * a * c from b^2
        fsqrt                 ; Compute the square root of the discriminant
        fstsw temp              ; Store the FPU status word in temp
        mov ax, temp            ; Move the status word to AX
        and ax, 0001h           ; Check for invalid operation (e.g., sqrt of a negative number)
        cmp ax, 0001h           ; Compare the result with 1 (indicating imaginary roots)
        jz imaginary            ; If discriminant is negative, jump to the "imaginary" label
        fstp alpha              ; Store the square root of the discriminant in alpha

        ; Calculate the first root: (-b + sqrt(discriminant)) / (2 * a)
        fld b                 ; Load coefficient b onto the FPU stack
        fchs                   ; Negate b (-b)
        fadd alpha              ; Add the square root of the discriminant
        fld a                 ; Load coefficient a onto the FPU stack
        fmul val1               ; Multiply a by 2
        fdiv                  ; Divide (-b + sqrt(discriminant)) by (2 * a)
        fstp ans                ; Store the result in ans (first root)

        ; Calculate the second root: (-b - sqrt(discriminant)) / (2 * a)
        fld b                 ; Load coefficient b onto the FPU stack
        fchs                   ; Negate b (-b)
        fsub alpha              ; Subtract the square root of the discriminant
        fld a                 ; Load coefficient a onto the FPU stack
        fmul val1               ; Multiply a by 2
        fdiv                  ; Divide (-b - sqrt(discriminant)) by (2 * a)
        fstp ans1               ; Store the result in ans1 (second root)

        jmp exit                ; Jump to exit

imaginary:
        ; Print the message "Roots are imaginary"
        mov ah, 09h             ; DOS interrupt for string output
```

```
        lea dx, str1         ; Load the address of the message into DX
        int 21h              ; Execute the interrupt
        jmp exit             ; Jump to exit

exit:
        int 3                ; Terminate the program
code ends
end start
```



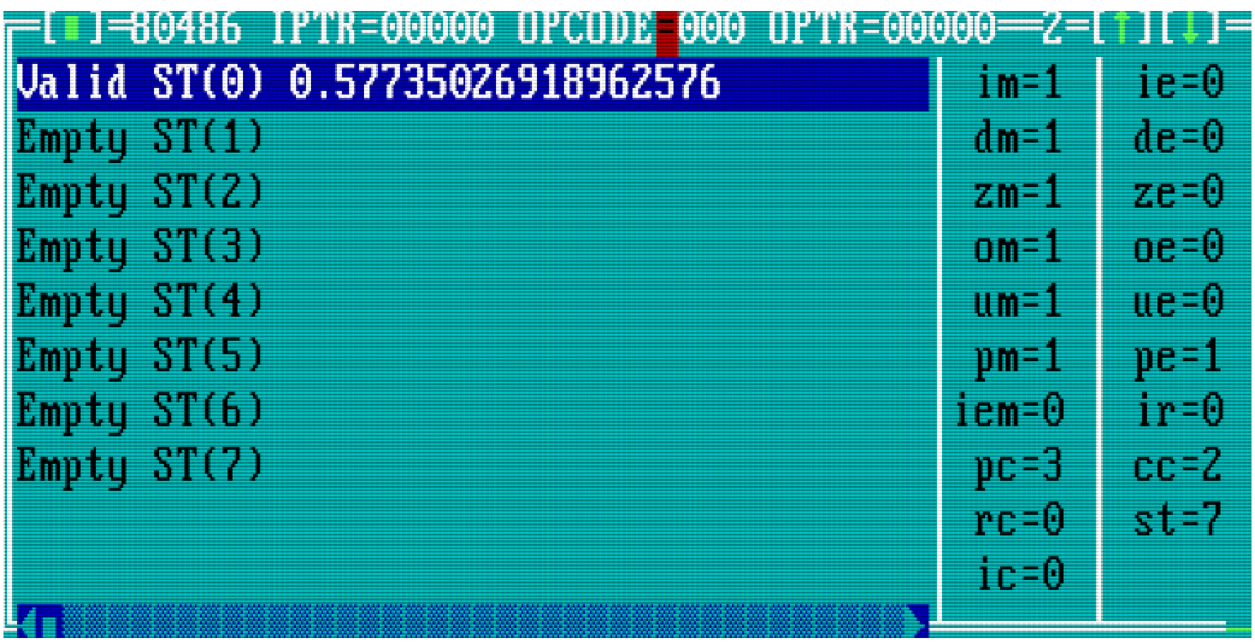
4. Compute sec(x), cosec(x) and cot(x).

Code:

=> Cot(x)

```
data segment
th dd 60.0
d dd 180.0
pi dd 3.1428
res dd ?
data ends
```

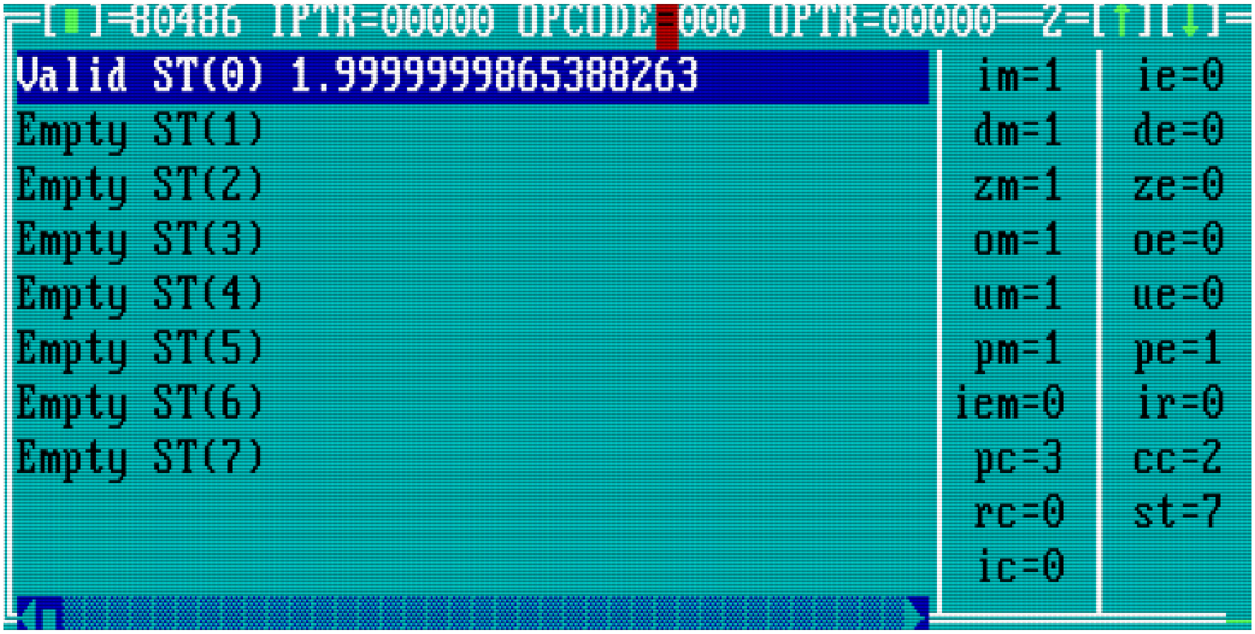
```
code segment

assume cs:code , ds:data
start:
mov ax, data
mov ds, ax
finit
fld th
fldpi
fmul
fdiv d
fptan
fxch
fdiv
fst res

int 03h
code ends
end start
```



=> Sec

```
data segment
th dd 60.0
```

```
d dd 180.0


res dd ?
data ends


code segment


assume cs:code , ds:data
start:
mov ax, data
mov ds, ax
finit
fld th
fldpi
fmul
fdiv d
fptan
fxch
fst res


fmul res
fadd
fsqrt
int 03h
code ends
end start
```



=> **cosec**(x)

```
data segment
th dd 60.0
d dd 180.0
pi dd 3.142
one dd 1.0
res dd ?
data ends

code segment
assume cs:code , ds:data
start:
mov ax, data
mov ds, ax
finit
fld th
fldpi
fmul
fdiv d
fptan
fxch
fdiv
fst res
fmul res
```

```
fld one
fadd
fsqrt
fst res


int 03h
code ends
end start
```