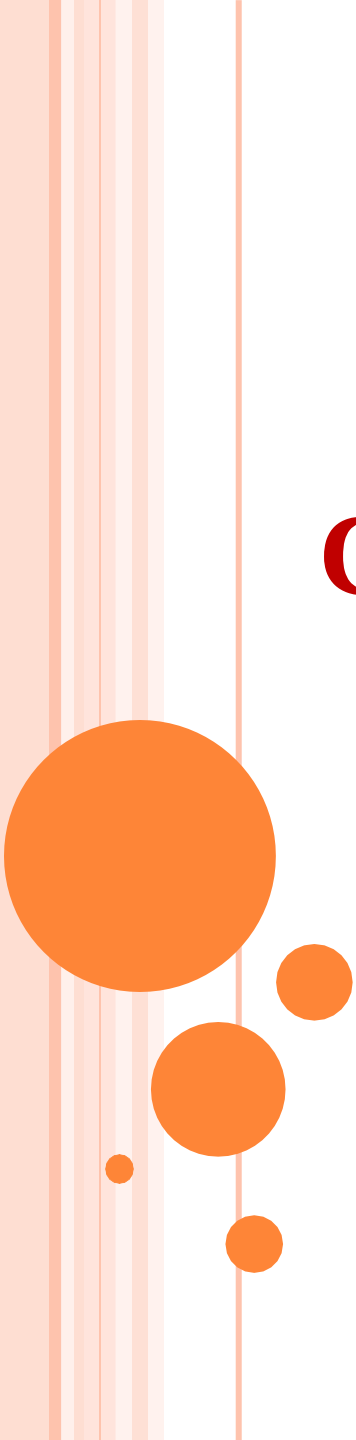


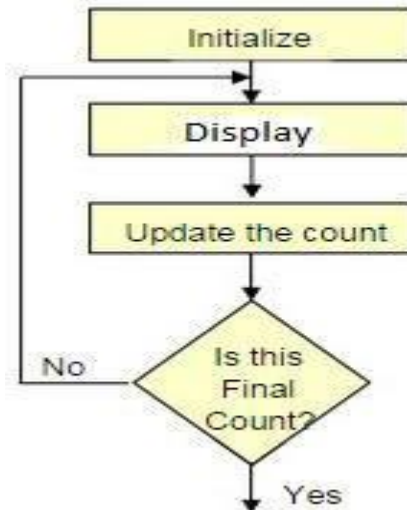


COUNTERS AND TIME DELAYS

By
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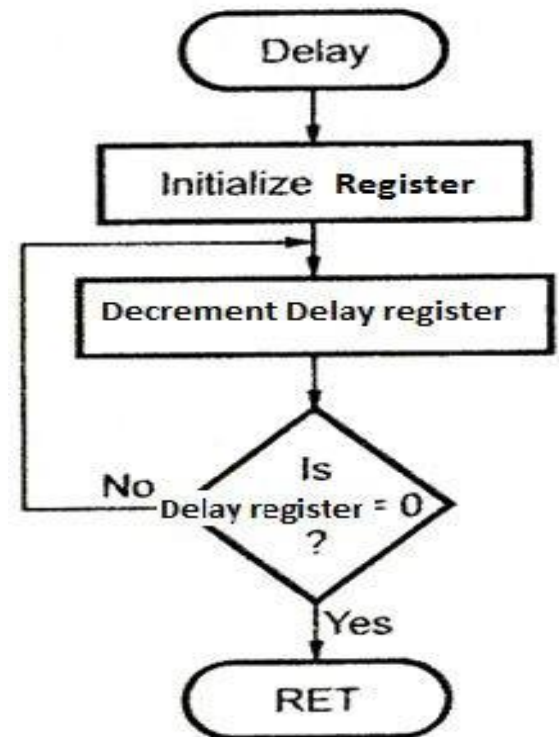
COUNTER AND TIME DELAYS

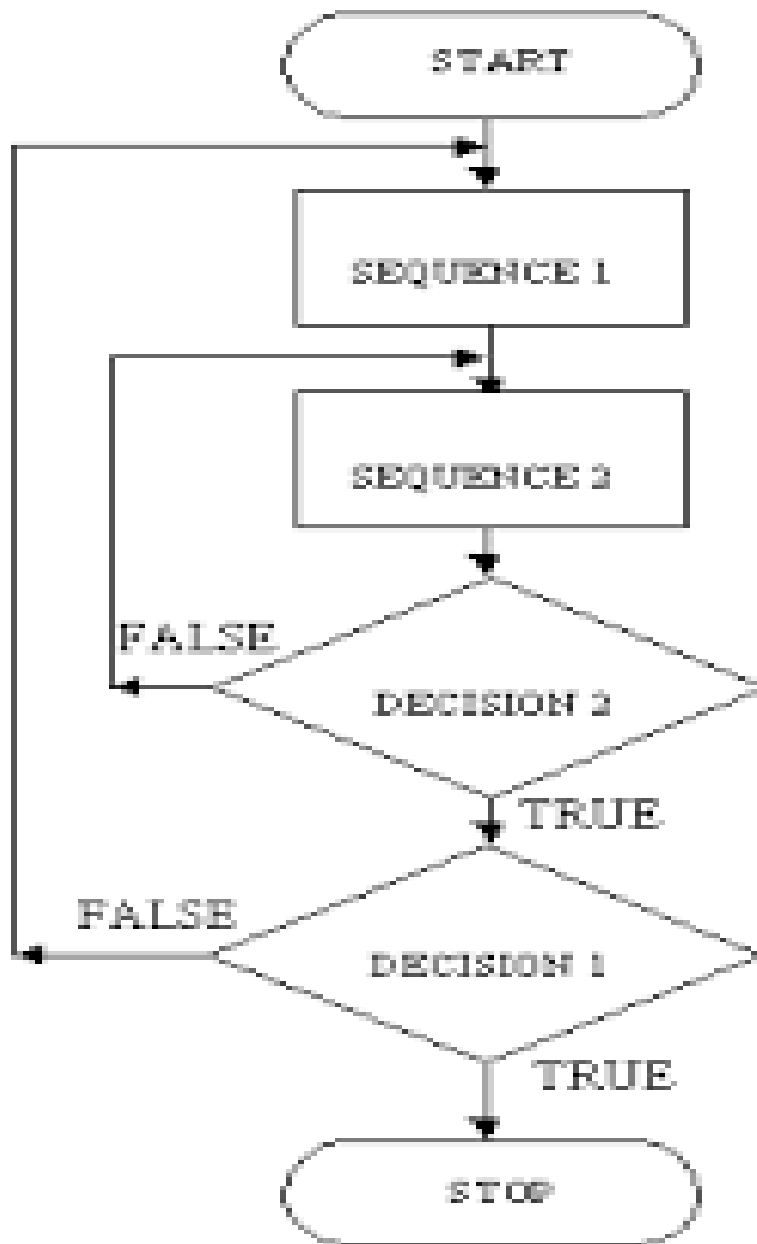
- A counter is designed simply by loading appropriate number into one of the registers and using INR or DNR instructions.
- Loop is established to update the count.
- Each count is checked to determine whether it has reached final number ;if not, the loop is repeated.



TIME DELAY

- Procedure used to design a specific delay.
- A register is loaded with a number , depending on the time delay required and then the register is decremented until it reaches zero by setting up a loop with conditional jump instruction.
- **Time delay using One register:**

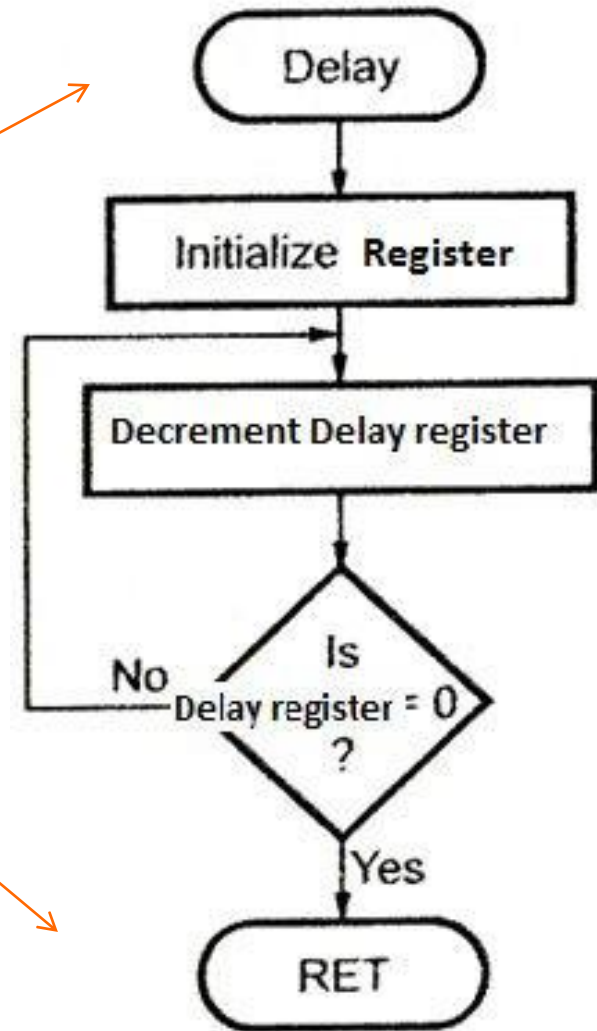
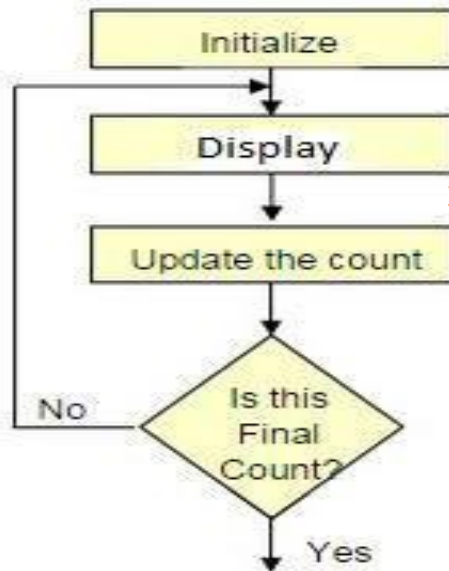




**Flowchart
for
time delay
with
two
loops**



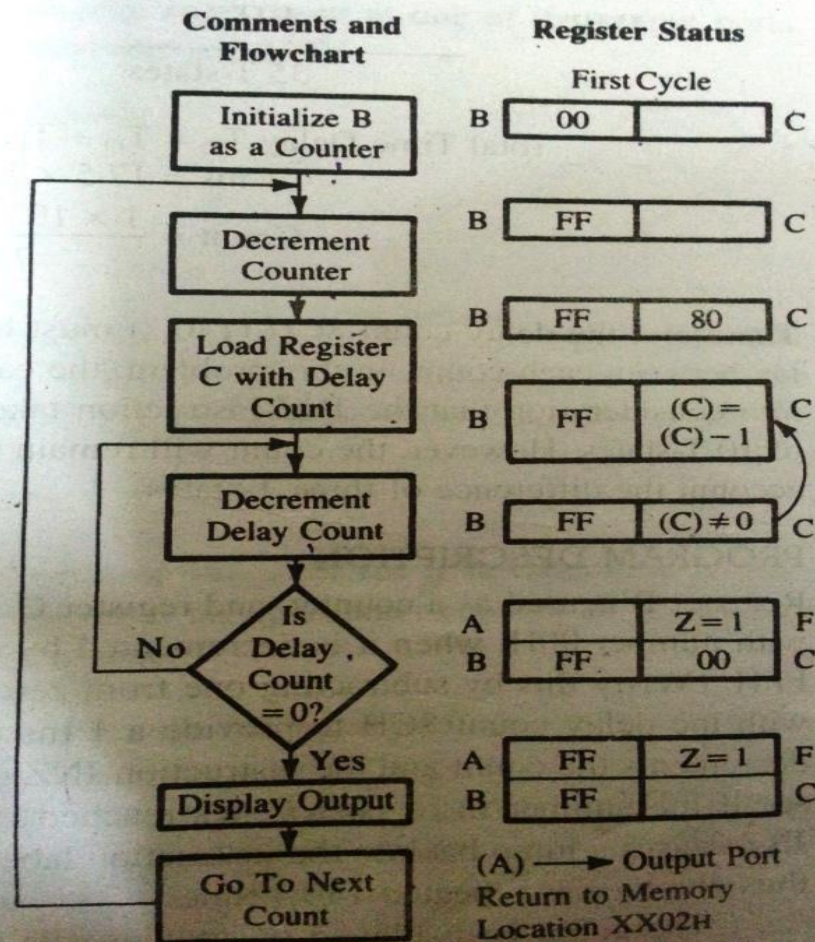
Flowchart of a counter with time delay



ILLUSTRATIVE PROGRAM: HEXADECIMAL COUNTER

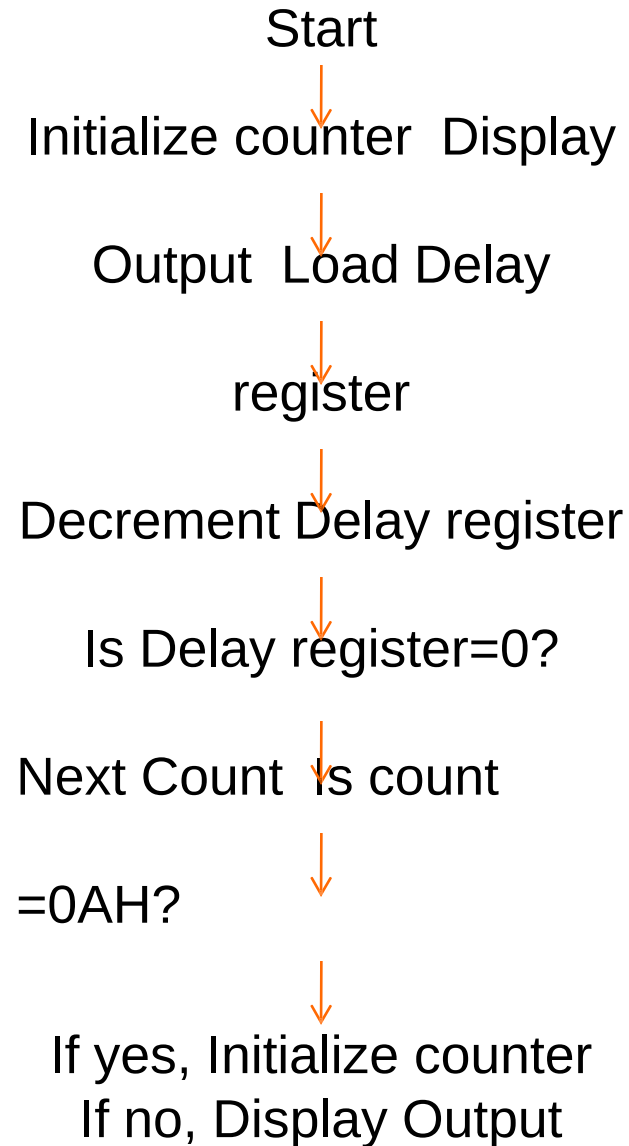
Write a Program to count continuously from FFH to 00H using register C with delay count 80H between each count and display the number at one of the output ports.

```
MVI B,00H
NEXT: DCR B
      MVI C,80H
DELAY: DCR C
      JNZ DELAY
      MOV A,B
      OUT PORT#
      JMP NEXT
```



ILLUSTRATIVE PROGRAM: ZERO TO NINE (MODULO TEN) COUNTER

```
START:  MVI B,00H
        MOV A,B
DSPLAY: OUT PORT #
        LXI H,16-bit
LOOP:   DCX H
        MOV A,L
        ORA H
        JNZ LOOP
        INR B
        MOV A,B
        CPI 0AH
        JNZ DSPLAY
        JZ  START
```



ILLUSTRATIVE PROGRAM: GENERATING PULSE WAVEFORMS

```
      MVI D, AAH
X:    MOV A, D
      RLC
      MOV D, A
      ANI 01H
      OUT PORT1
      MVI B, COUNT
Y:    DCR B
      JNZ Y
      JMP X
```

- Generates a continuous square wave with the period of 500 Micro Sec. Assume the system clock period is 325ns, and use bit D0 output the square wave.
- Delay outside loop: $T_o = 46 \text{ T states} * 325 = 14.95 \text{ micro sec.}$
- Loop delay: $T_L = 4.5 \text{ micro sec}$
- Total $T_d = T_o + T_L$
Count=34 H



DEBUGGING COUNTER AND TIME DELAY PROGRAMS

- It is designed to count from 100(base 10) to 0 in Hex continuously with a 1 second delay between each count.
- The delay is set up using two loops. The inner loop is executed to provide approximately 100ms delay and is repeated 10 times, using outer loop to provide a total delay of 1 second.
- The clock period of system is 330ns.

MVI A, 64H	7
X: OUT PORT1	10
Y:MVI B, 10H	7
Z:LXI D, X	10
DCX D	6
NOP	4
NOP	4
MOV A, D	4
ORA E	4
JNZ Z	10/7
DCR B	4
JZ Y	10/7
DCR A	4
CPI 00H	7
JNZ X	10/7

$\text{Delay in loop1} = 32T \times \text{count} \times 330 \times 10^{-9}$
 $100\text{ms} = 32T \times \text{count} \times 330 \times 10^{-9}$
 Count=9470

