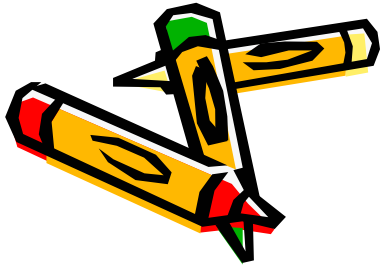
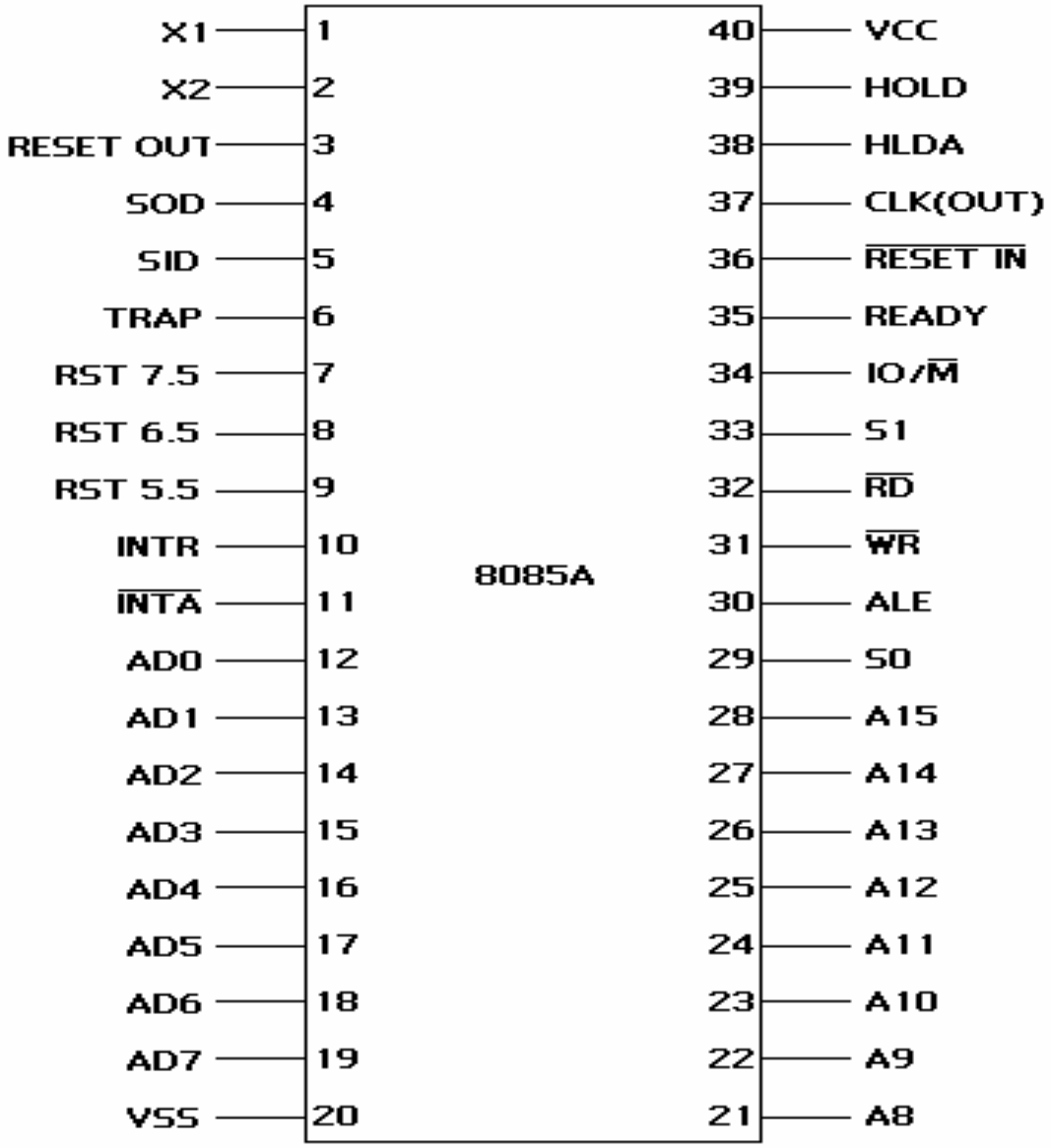
Designing a counter from 0 to 99 seconds.



8085 Microprocessor chip



Pin Configuration of 8085A Microprocessor

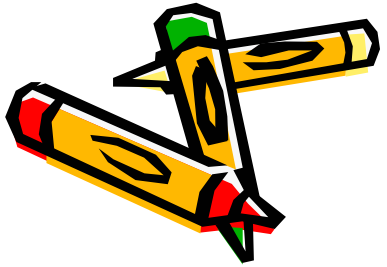
Signals of 8085 can be classified as:-

- Address bus-A_{15}-$A_{8,}$
- Data bus-AD_7-AD_0
- Control and Status signal-
  - ALE RD'
  - WR' IO/M'
  - S_1 S_0
- Power supply and frequency signal-
  - V_{SS} V_{CC}
  - X_1 X_2
  - CLK RESET IN'
  - RESET OUT
- Externally initiated signal-
  - INTR INTA'
  - TRAP RST 7.5
  - RST 6.5 RST 5.5
  - HOLD HLDA
  - READY
- Serial I/O ports-
  - SID SOD

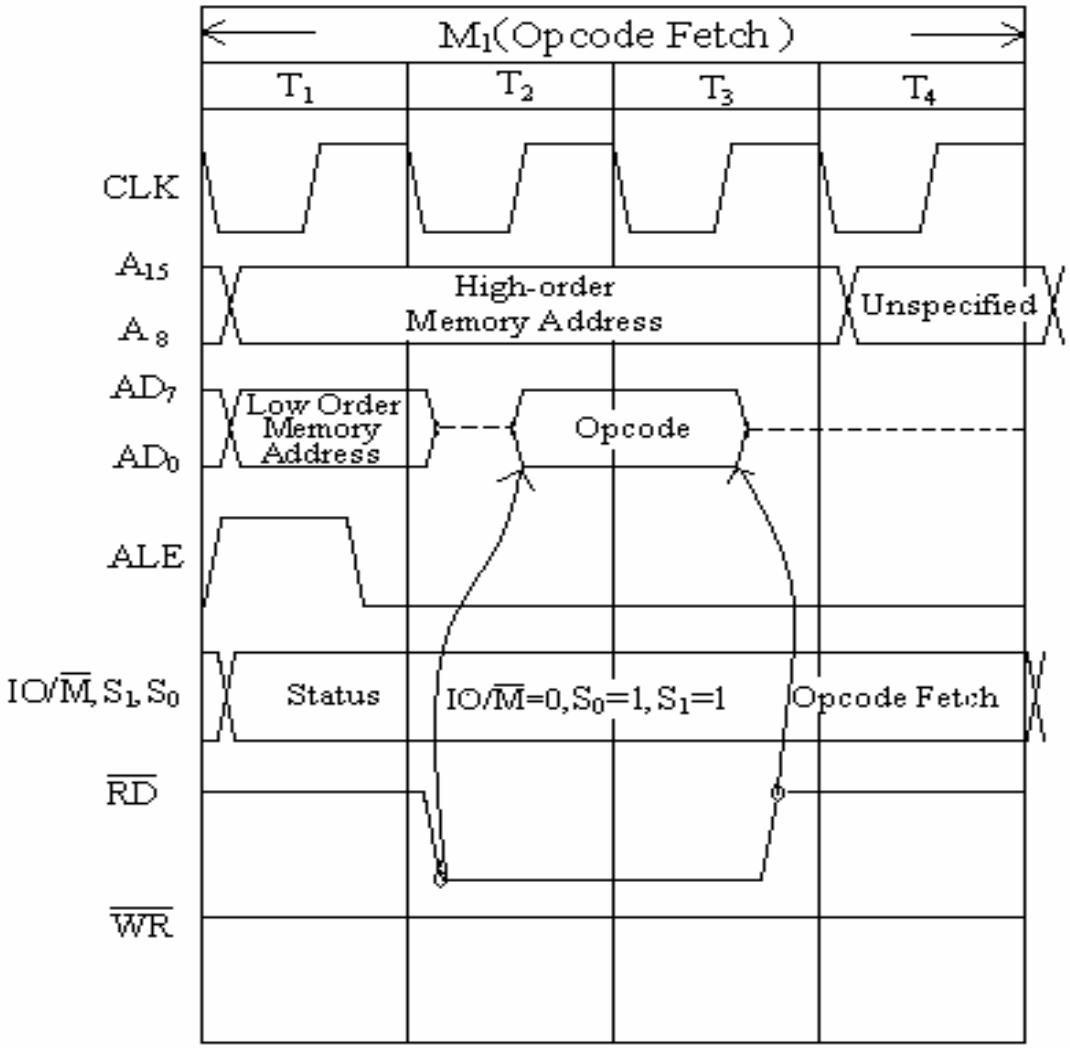
Basic concept of how 8085 works

The three main operations are:-

- Opcode Fetch
- Memory Read
- Memory Write

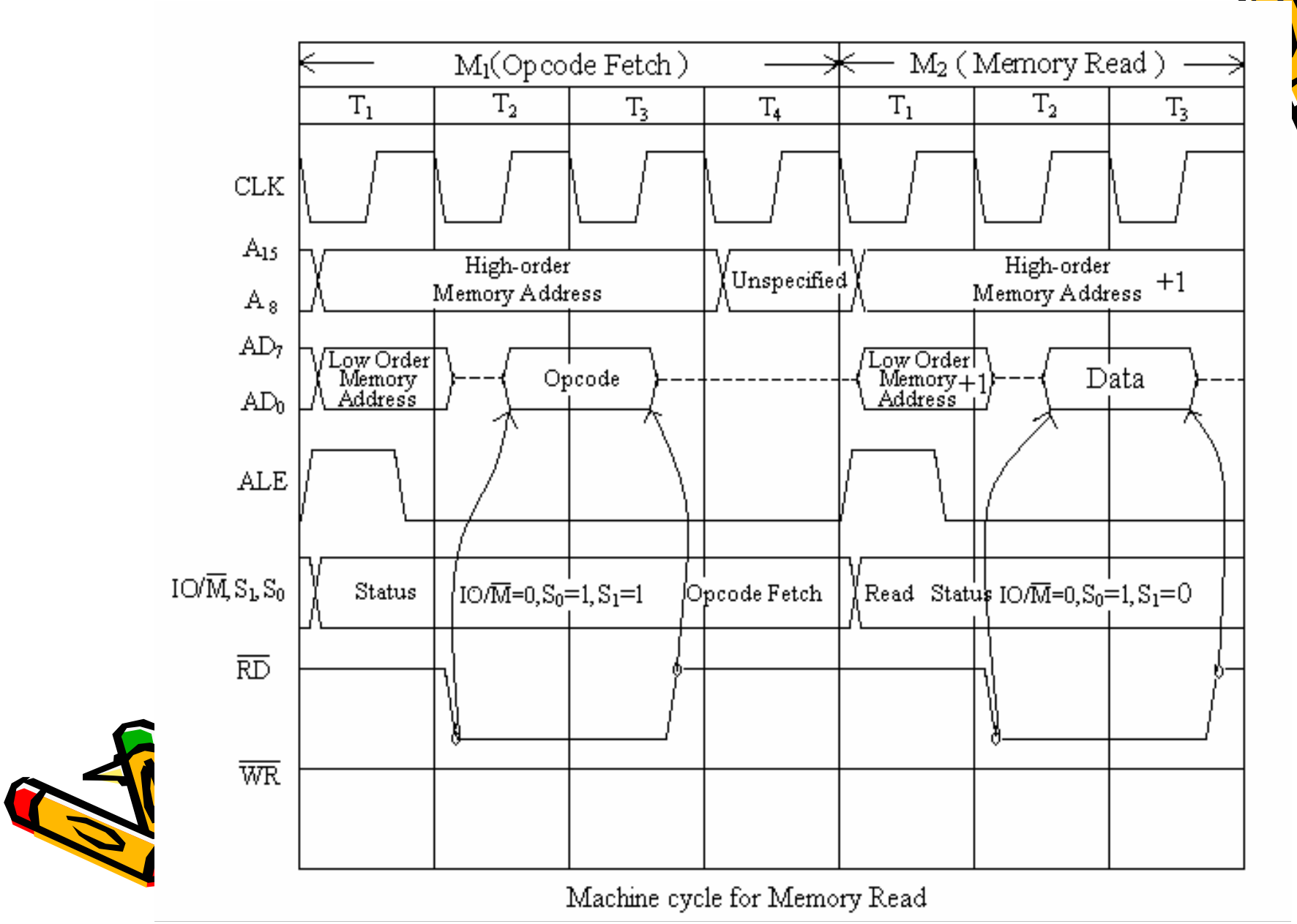


Opcode Fetch



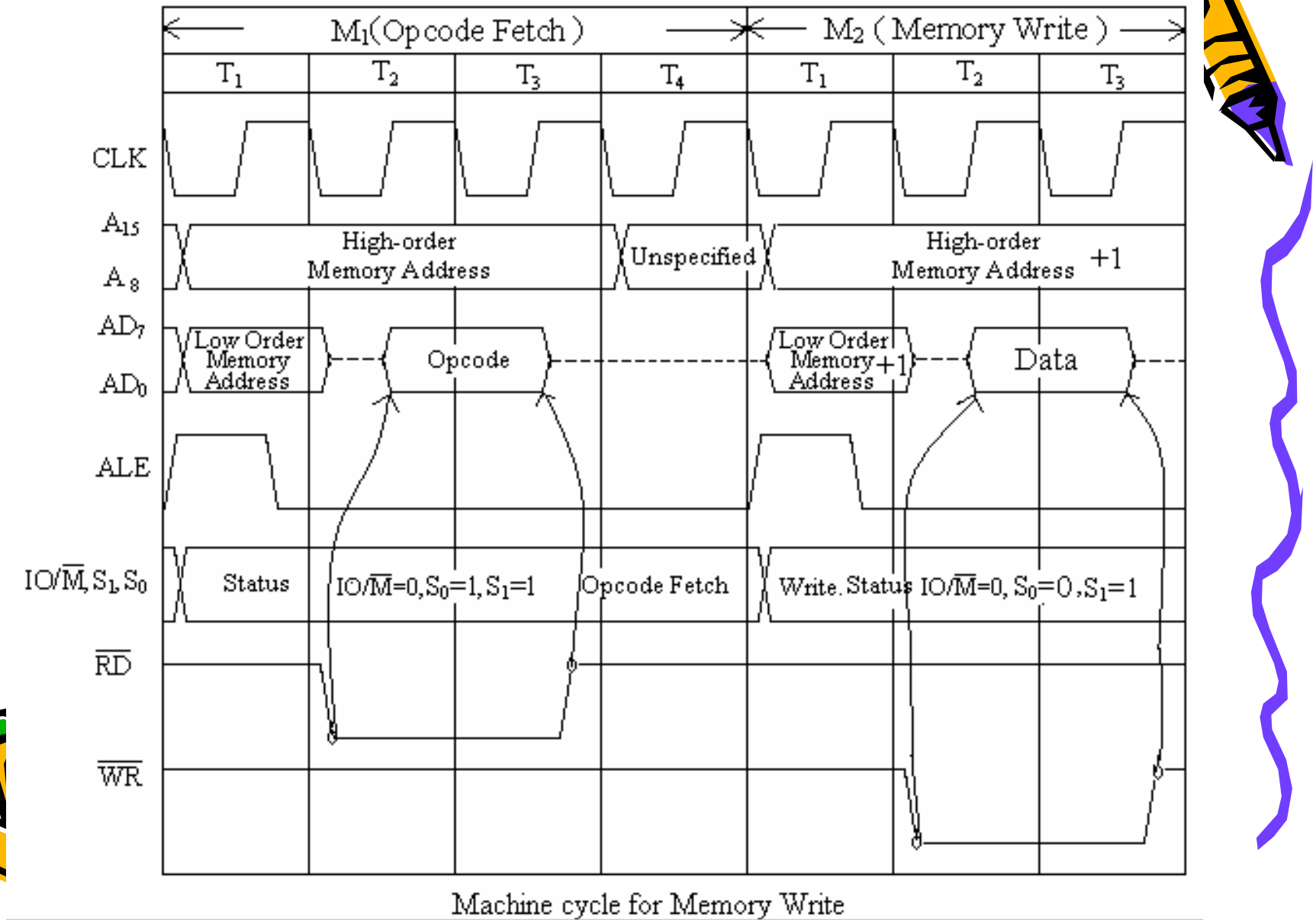
Machine cycle for opcode fetch

Memory Read



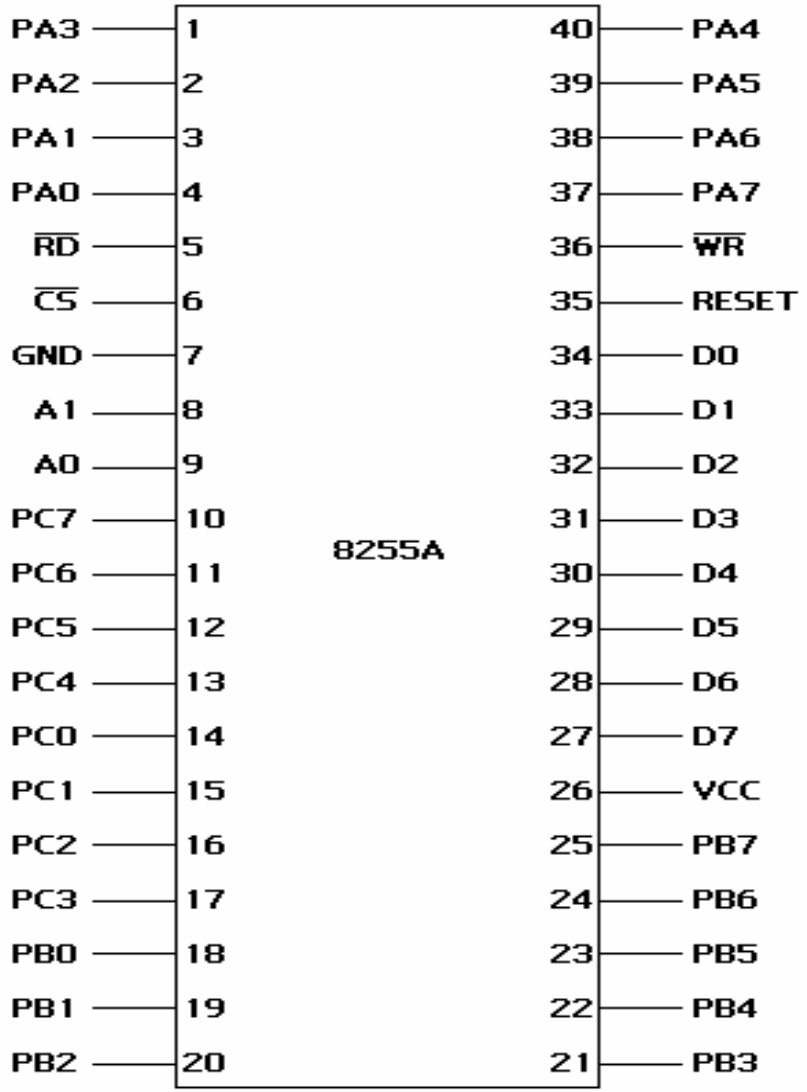
Machine cycle for Memory Read

Memory Write



Machine cycle for Memory Write

8255 Programmable Peripheral Interfacing Chip

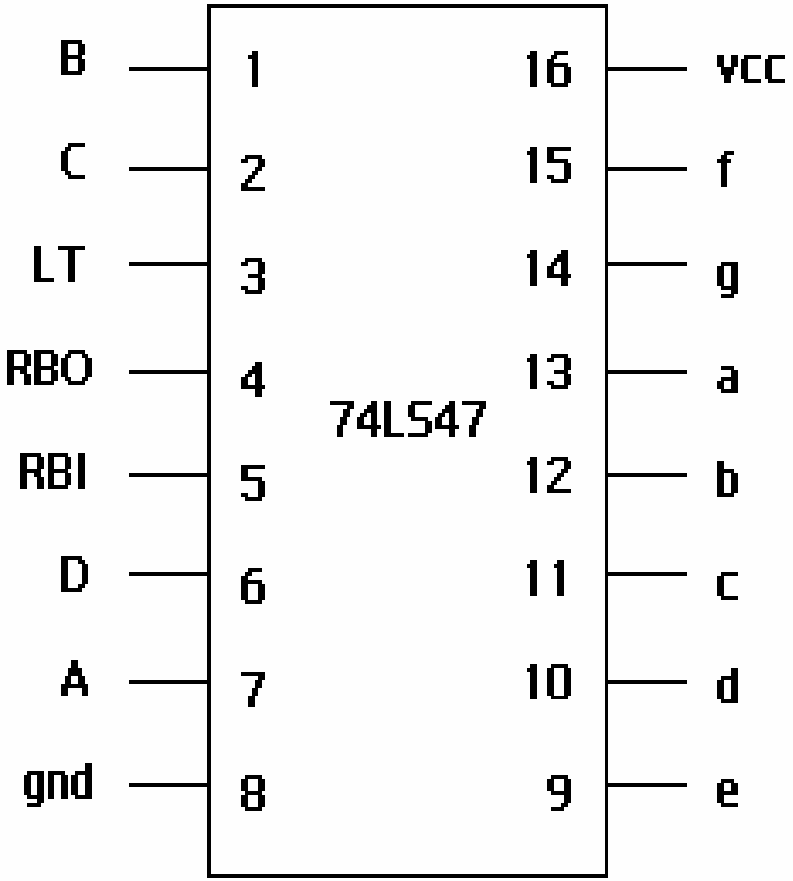


Pin Configuration of 8255A Programmable Peripheral Interface

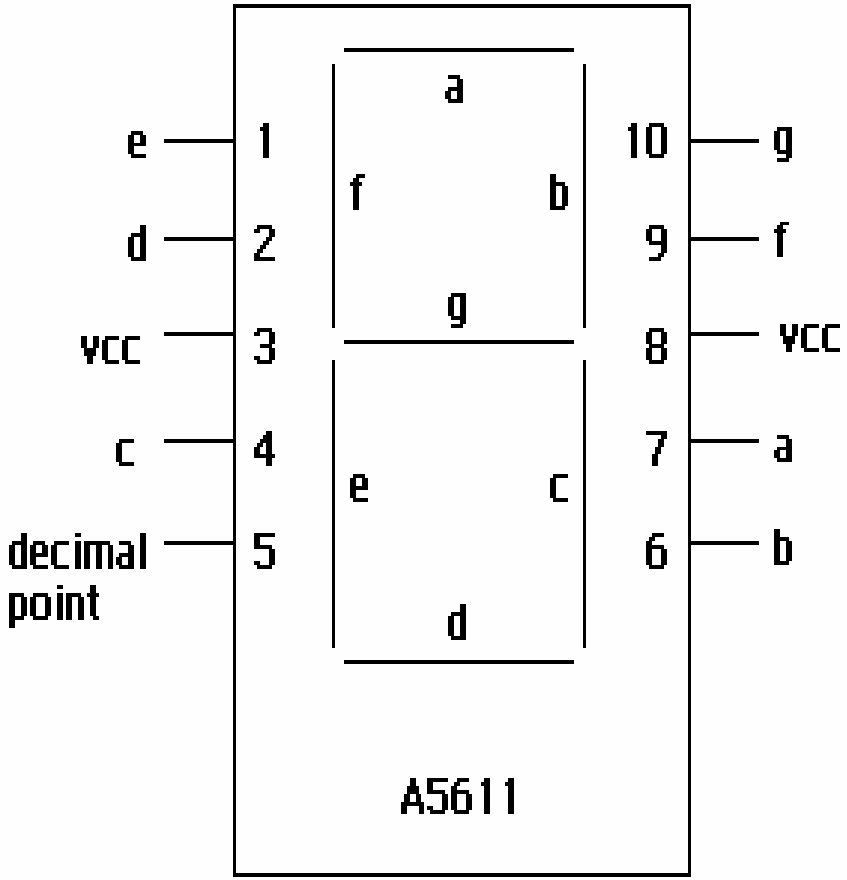
Signals of 8255

- Control signals-
  RD' WR'
  CS' A_0 A_1
  RESET
- Data lines-
  D_7-D_0
- I/O Port Lines-
  Port A - PA_7-PA_0
  Port B - PB_7-PB_0
  Port C - PC_7-PC_0
- Power supply-
  GND V_{cc}

7-Segment Decoder/Driver and 7-Segment Display

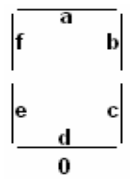


Pin Diagram of 74LS47,
BCD to 7-Segment Decoder/Driver



Pin Diagram of A5611,
Common Anode 7-Segment Display

NUMERICAL REPRESENTATION ON THE SEVEN-SEGMENT DISPLAY



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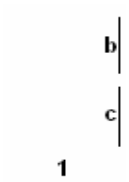

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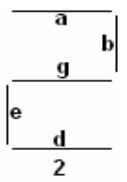

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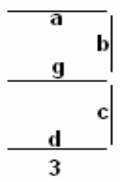

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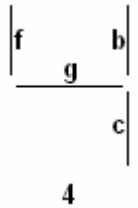

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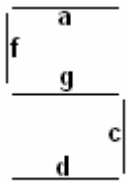

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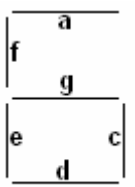

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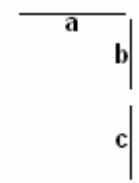

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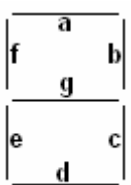

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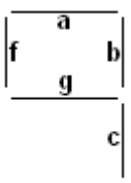
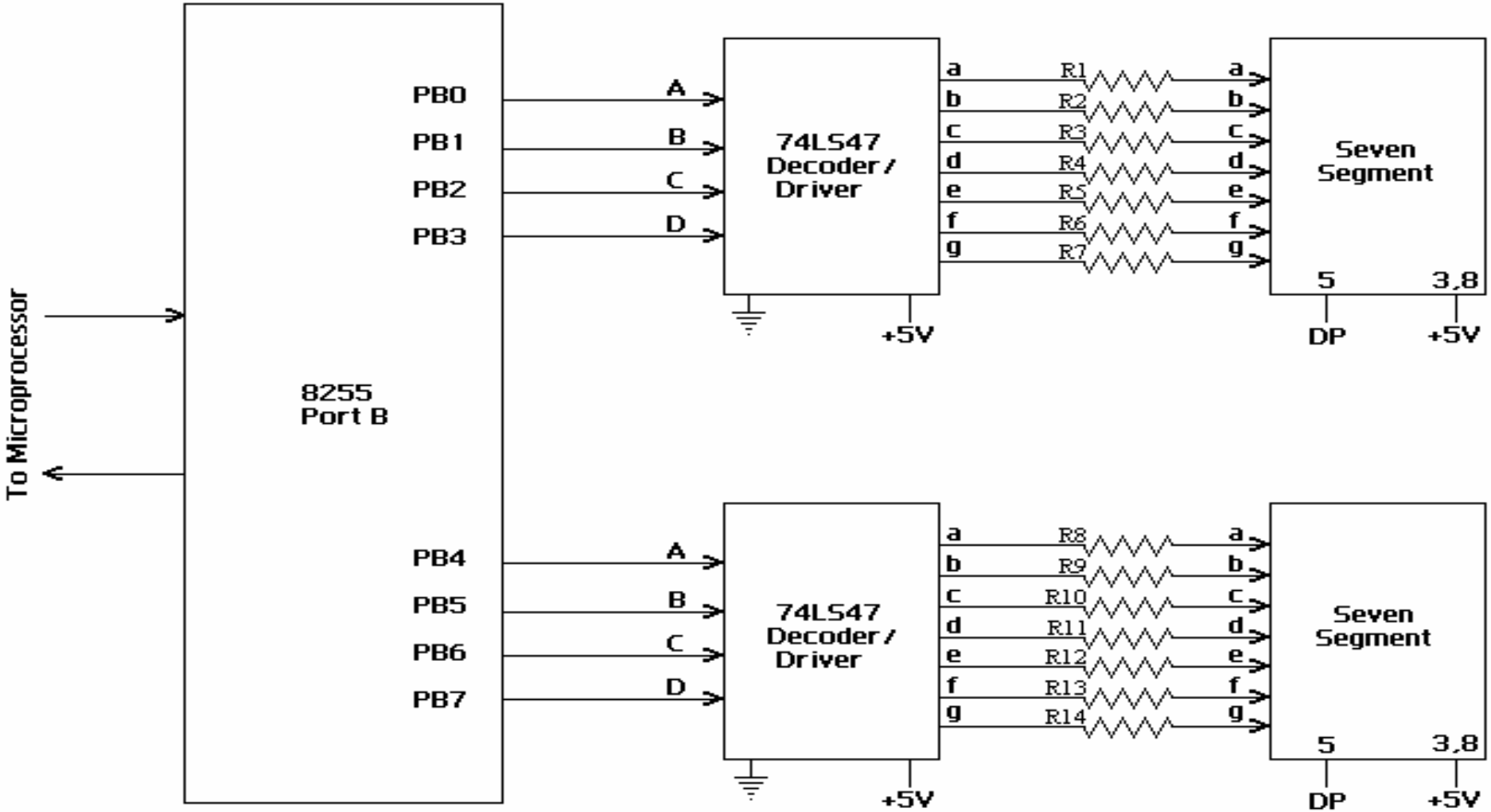


9

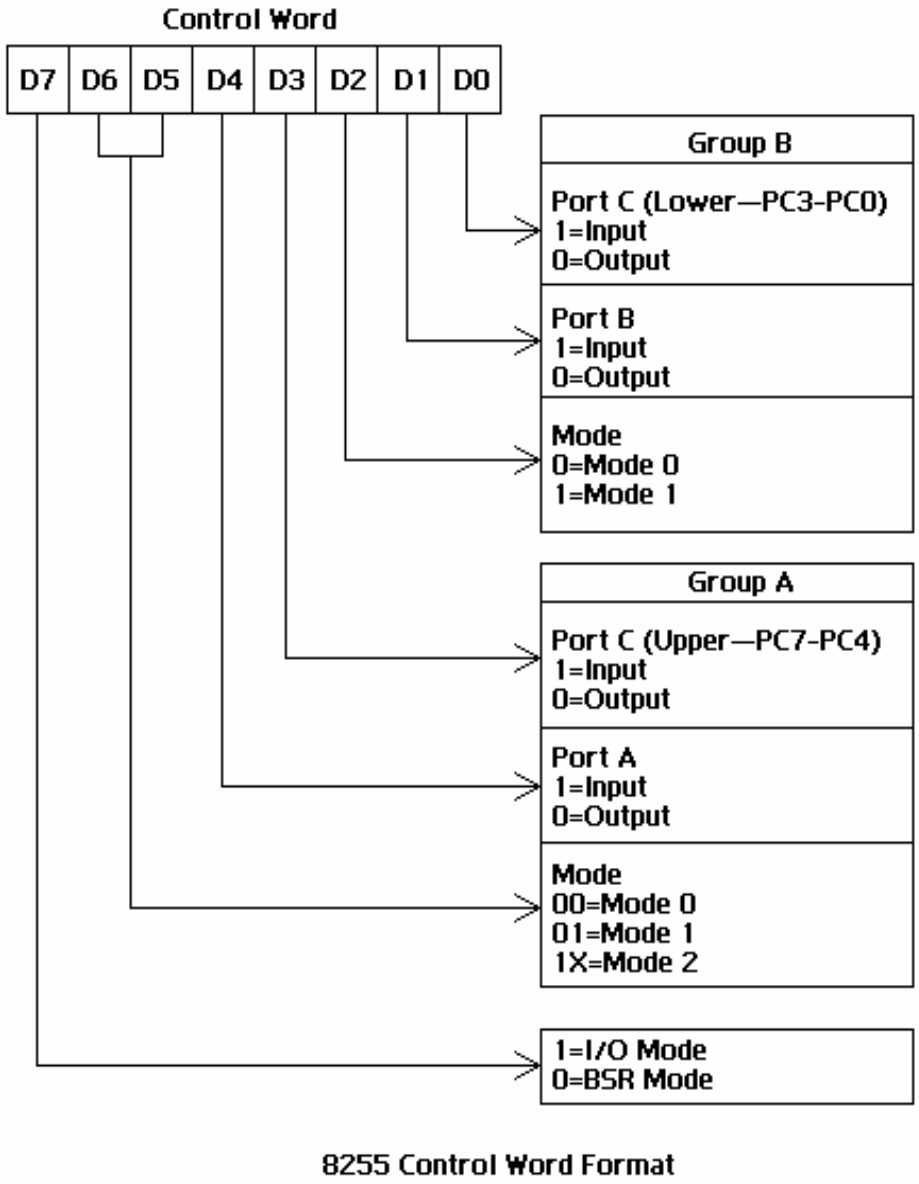
Interfacing the 8255 with the 7-Segment Decoder/Driver and the 7-segment Display



R1-R14— Resistence of 220ohms

Interfacing two Seven-Segment Displays with 8255 Port B through 74LS47 Decoder/Driver

The control word of the 8255



8255 Control Word Format

How to design the control word?

Example:-

8255 in I/O Mode

Port A-Input

Port B-Output

Port C(Upper)-Output

Port C(Lower)-Input

Port A-Mode 1

Port B-Mode 0

So the control word is:-

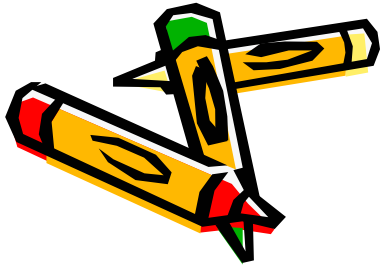
$D_7\ D_6\ D_5\ D_4\ D_3\ D_2\ D_1\ D_0$

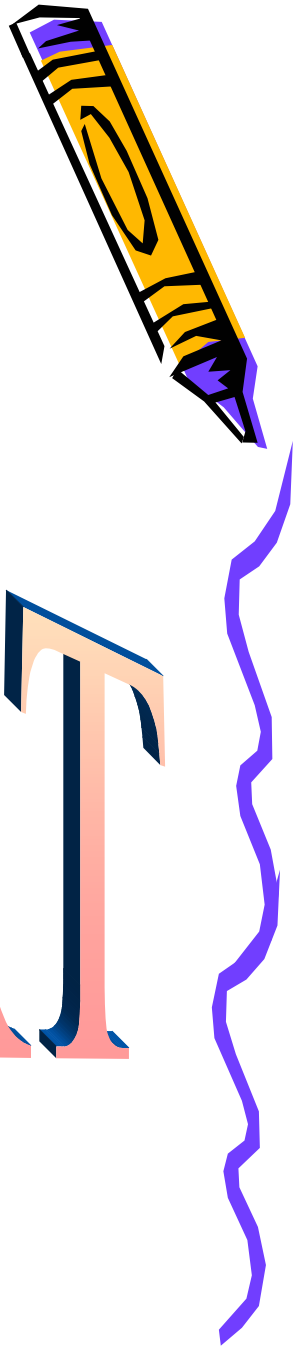
1 0 1 1 0 0 0 1 = B1H

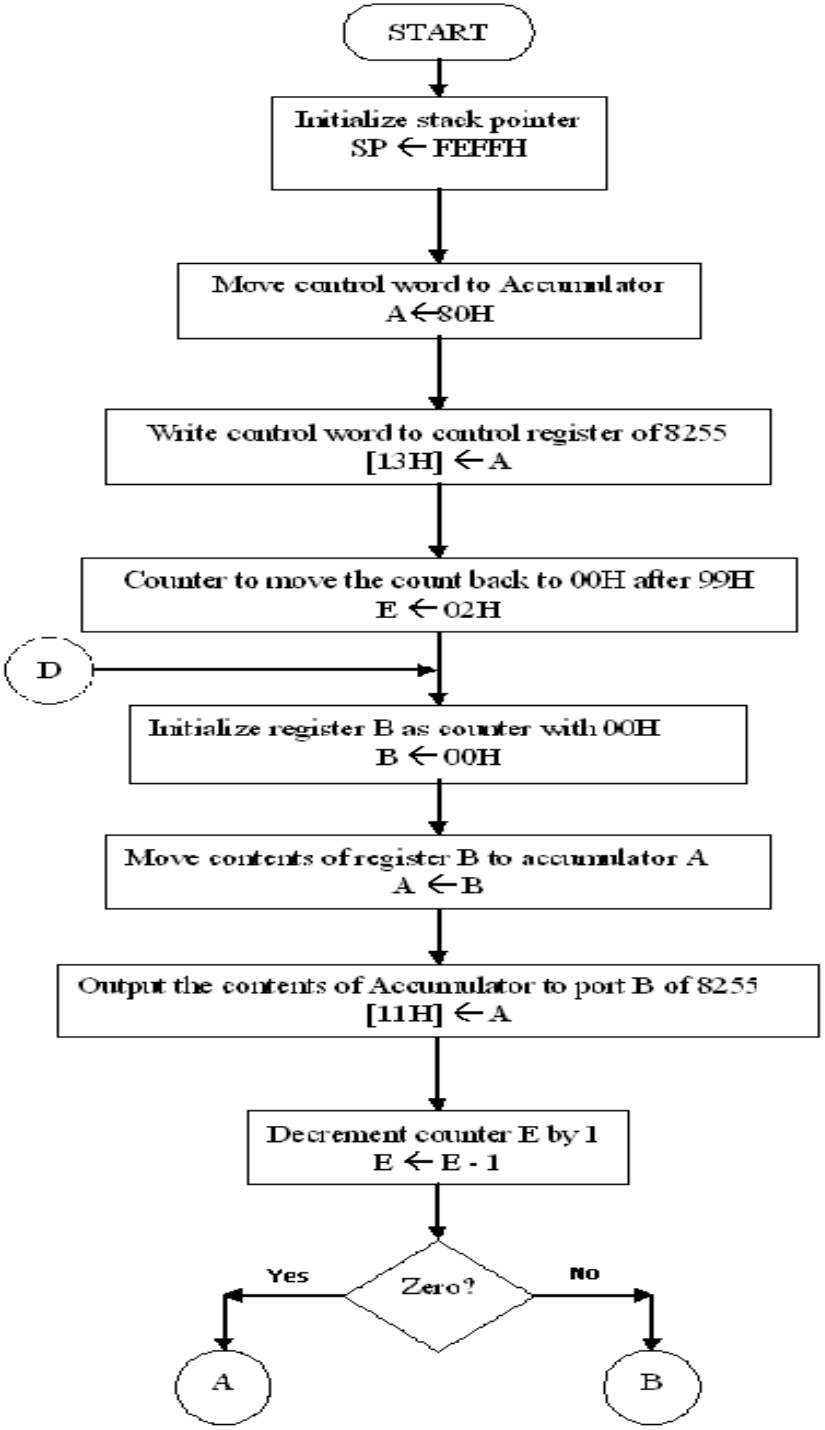
To write it in the control register:-

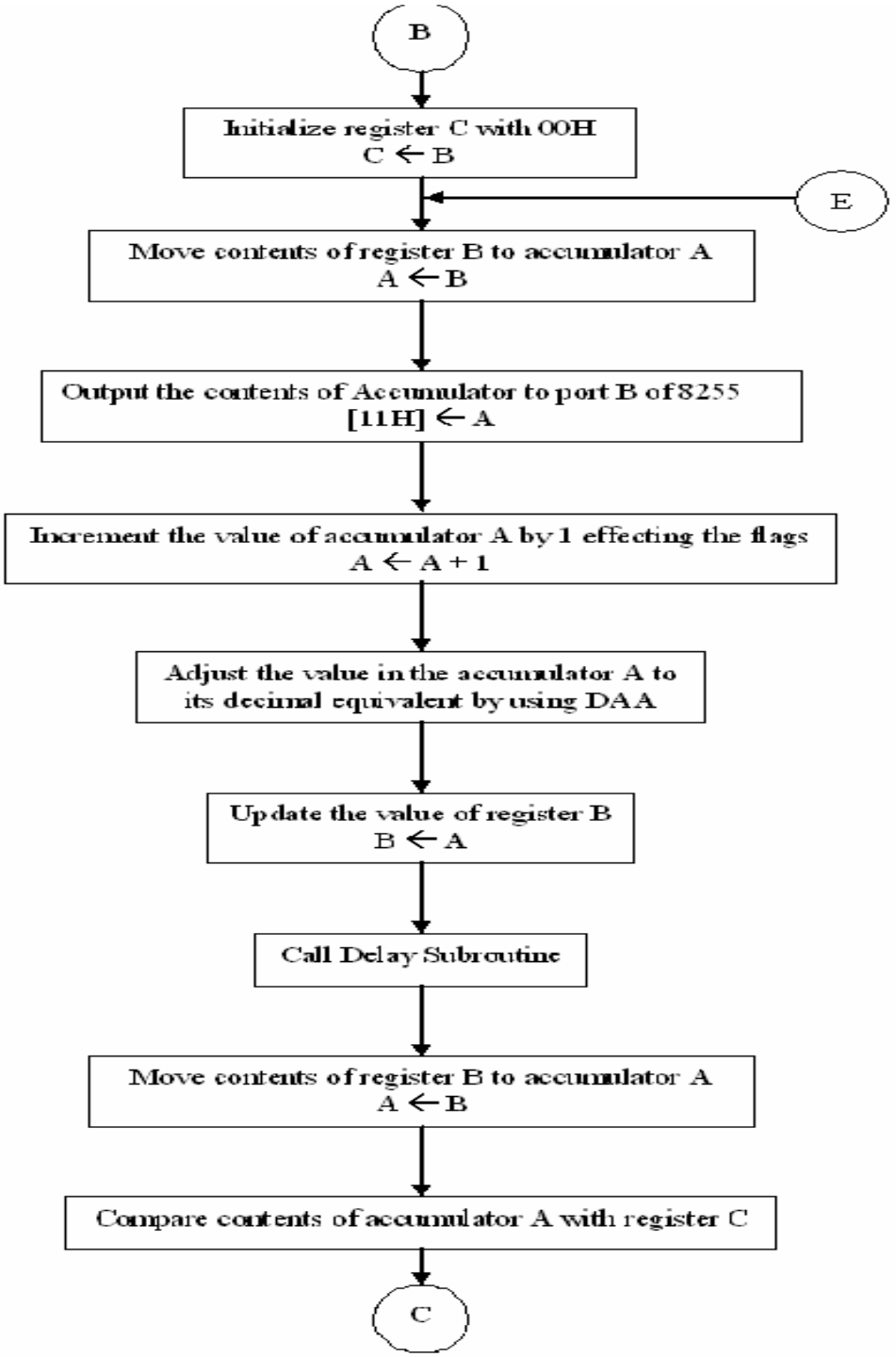
```
MVI A,B1H
OUT 13H
HLT
```

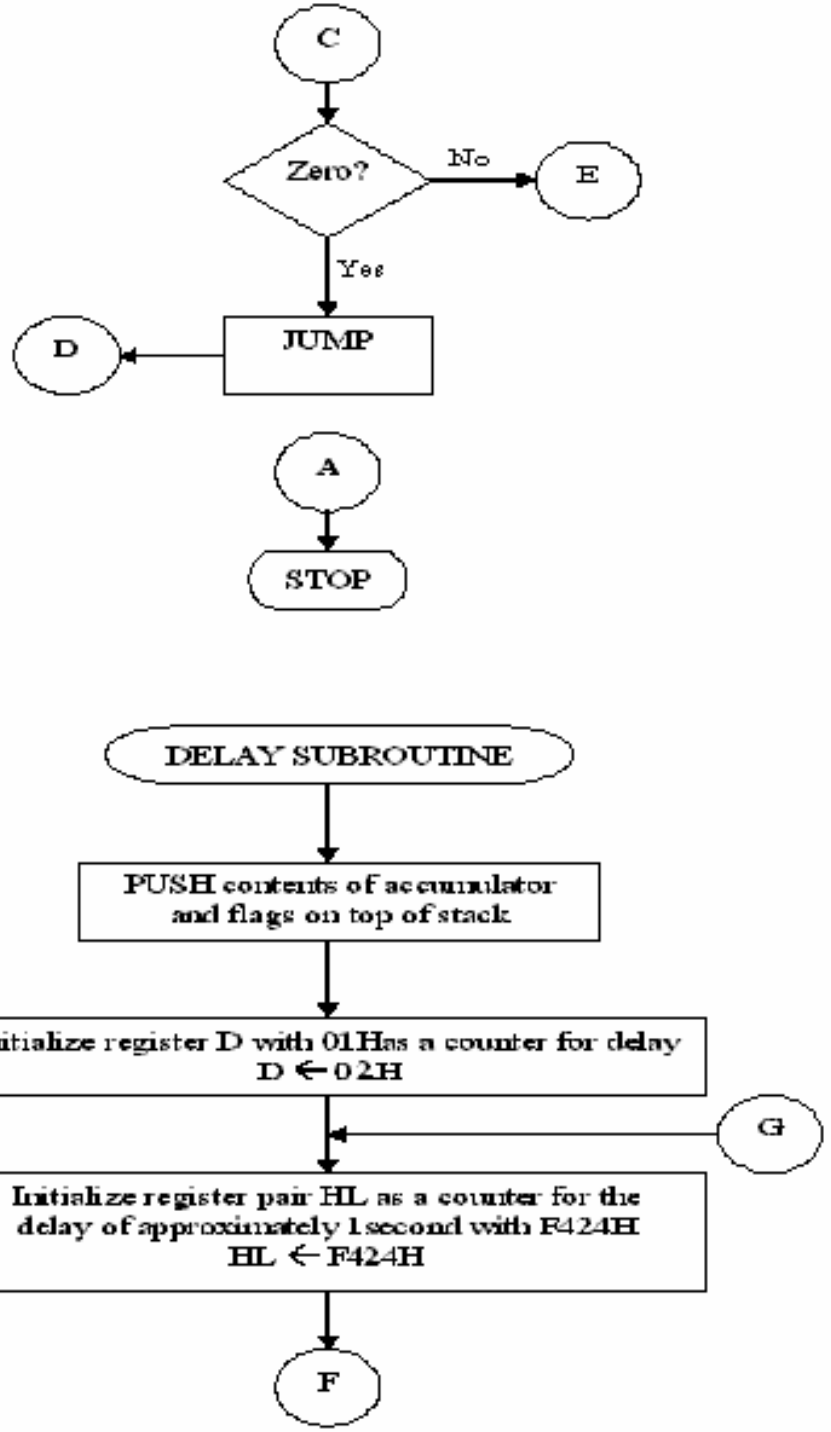
FLOWCHART

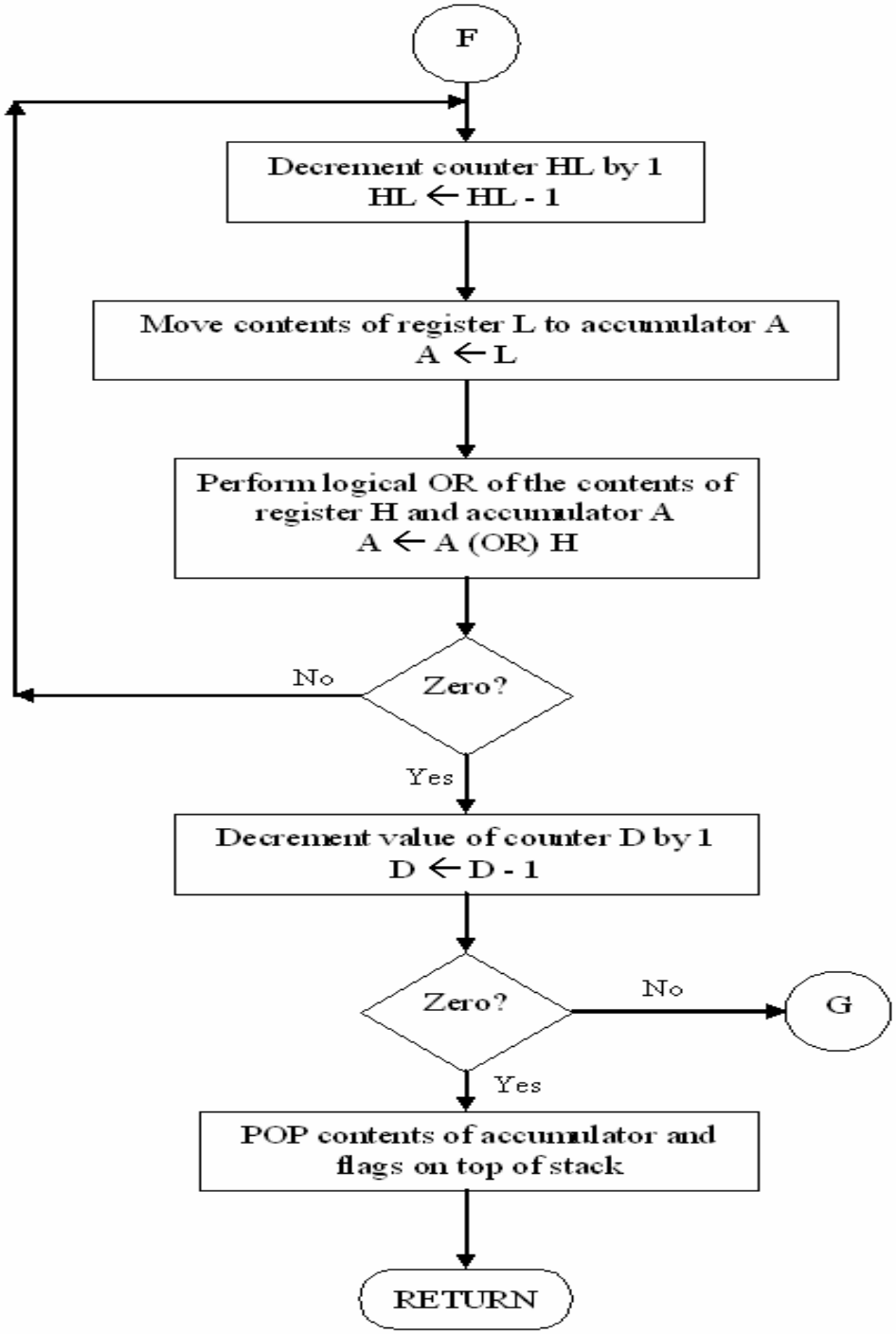





START
Initialize stack pointer
SP ← FEFFH
Move control word to Accumulator
A←80H
Write control word to control register of 8255
[13H] ← A
Counter to move the count back to 00H after 99H
E ← 02H
D
Initialize register B as counter with 00H
B ← 00H
Move contents of register B to accumulator A
A ← B
Output the contents of Accumulator to port B of 8255
[11H] ← A
Decrement counter E by 1
E ← E - 1
Zero?
Yes
No
A
B


B
Initialize register C with 00H
C ← B
E
Move contents of register B to accumulator A
A ← B
Output the contents of Accumulator to port B of 8255
[11H] ← A
Increment the value of accumulator A by 1 effecting the flags
A ← A + 1
Adjust the value in the accumulator A to
its decimal equivalent by using DAA
Update the value of register B
B ← A
Call Delay Subroutine
Move contents of register B to accumulator A
A ← B
Compare contents of accumulator A with register C
C


C
Zero?
No
E
Yes
JUMP
D
A
STOP
DELAY SUBROUTINE
PUSH contents of accumulator and flags on top of stack
Initialize register D with 01Has a counter for delay
D ← 02H
G
Initialize register pair HL as a counter for the delay of approximately 1second with F424H
HL ← F424H
F


F
Decrement counter HL by 1
HL ← HL - 1
Move contents of register L to accumulator A
A ← L
Perform logical OR of the contents of register H and accumulator A
A ← A (OR) H
Zero?
No
Yes
Decrement value of counter D by 1
D ← D - 1
Zero?
No
G
Yes
POP contents of accumulator and flags on top of stack
RETURN

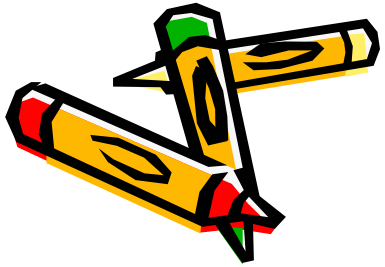
PROGRAM

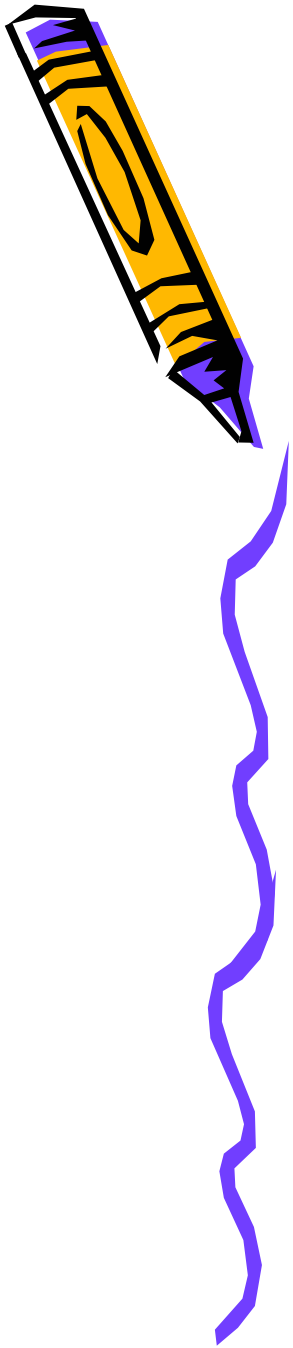
Main

```
        LXI SP,FEFFH
        MVI A,80H
        OUT 13H
        MVI E,02H
LBL:    MVI B,00H
        MOV A,B
        OUT 11H
        DCR B
        JZ STP
        MOV C,B
LOOP:   MOV A,B
        OUT 11H
        ADI 01H
        DAA
        MOV B,A
        CALL DELAY
        MOV A,B
        CMP C
        JNZ LOOP
        JMP LBL
STP:    HLT
```

Suroutine

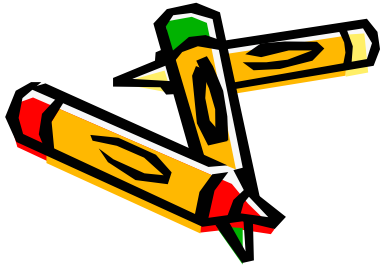
```
DELAY: PUSH PSW
       MVI D,02H
LOOP2: LXI H,F424H
LOOP1: DCX H
       MOV A,L
       ORA H
       JNZ LOOP1
       DCR D
       JNZ LOOP2
       POP PSW
       RET
```



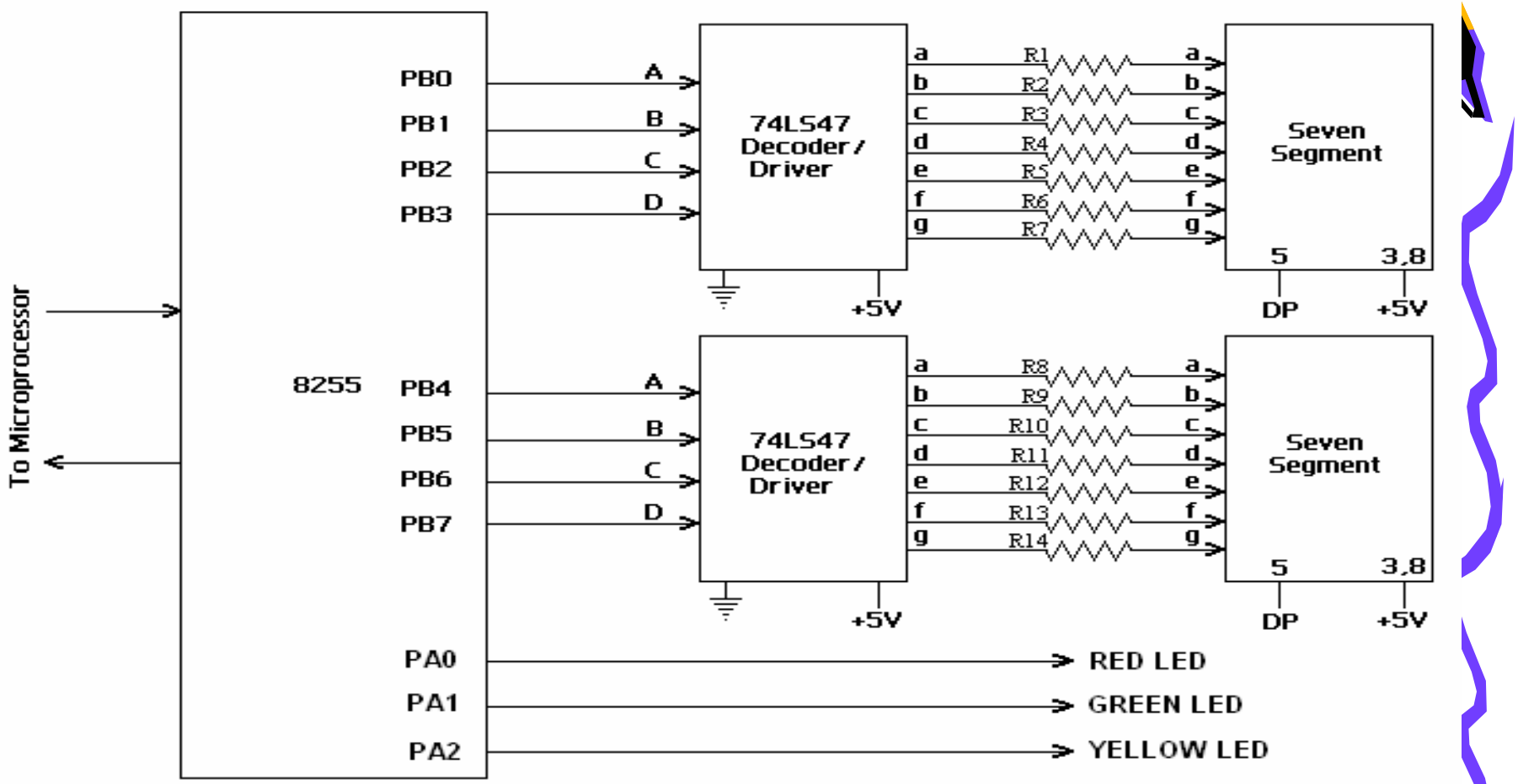


One of the application of this counter

Controlling the Traffic Signal Lighting



Interfacing the 8255 with the 7-Segment Decoder/Driver and the 7-segment Display along with the lights



R1-R14— Resistence of 220ohms

Interfacing two seven-Segment Displays with 8255 Port B through Decoder/Driver and connecting three LEDs with Port A of the 8255 for the Traffic Light signals

PROGAM FOR CONTROLLING THE TRAFFIC LIGHTS

Main

```
        LXI SP,FEFFH
        MVI A,80H
        OUT 13H
LOOP3:  MVI A,01H
        OUT 10H
        CALL COUNT
        MVI A,02H
        OUT 10H
        CALL COUNT
        MVI A,04H
        OUT 10H
        CALL DELAY
        CALL DELAY
        CALL DELAY
        CALL DELAY
        JMP LOOP3
        HLT
```

Subroutine Count

```
COUNT:  PUSH PSW
        MVI E,02H
LBL:    MVI B,00H
        MOV A,B
        OUT 11H
        DCR E
        JZ STP
        MOV C,B
LOOP:   MOV A,B
        OUT 11H
        ADI 01H
        DAA
        MOV B,A
        CALL DELAY
        MOV A,B
        CMP C
        JNZ LOOP
        JMP LBL
STP:    POP PSW
        RET
```

Suroutine Delay

```
DELAY:  PUSH PSW
        MVI D,02H
LOOP2:  LXI H,F424H
LOOP1:  DCX H
        MOV A,L
        ORA H
        JNZ LOOP1
        DCR D
        JNZ LOOP2
        POP PSW
        RET
```

Acknowledgement:-

- Prof. Diptiman Raichoudhuri, Department of Electronic Science, University of Calcutta
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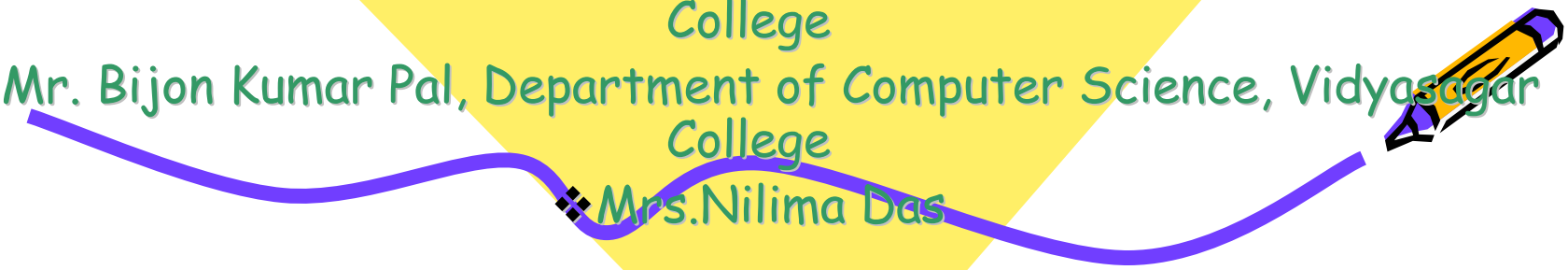
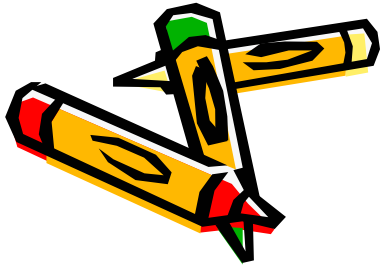
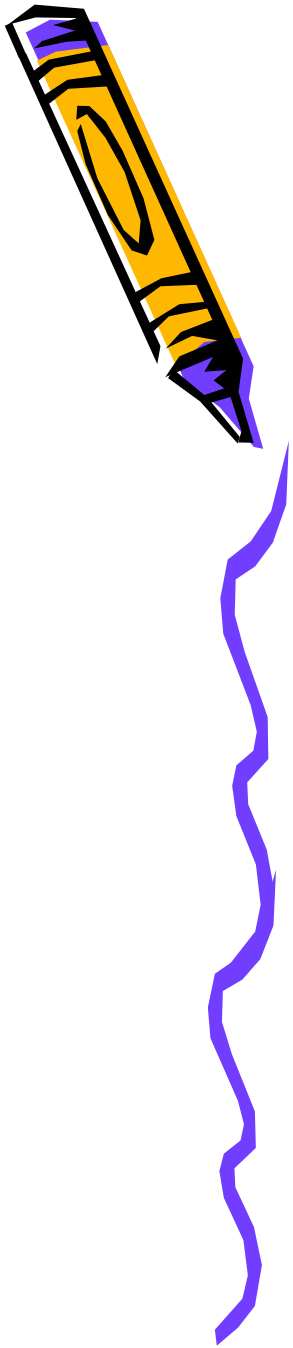
- Prof. Paramita Sikdar, Head of the Department of Computer Science, Vidyasagar College
- Prof. Raj Kumar Panda, Department of Computer Science, Vidyasagar College
- Mr. Sourov Saha, Department of Computer Science, Vidyasagar College
- Mr. Bijon Kumar Pal, Department of Computer Science, Vidyasagar College
- Mrs.Nilima Das



Thank You

Thank You





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