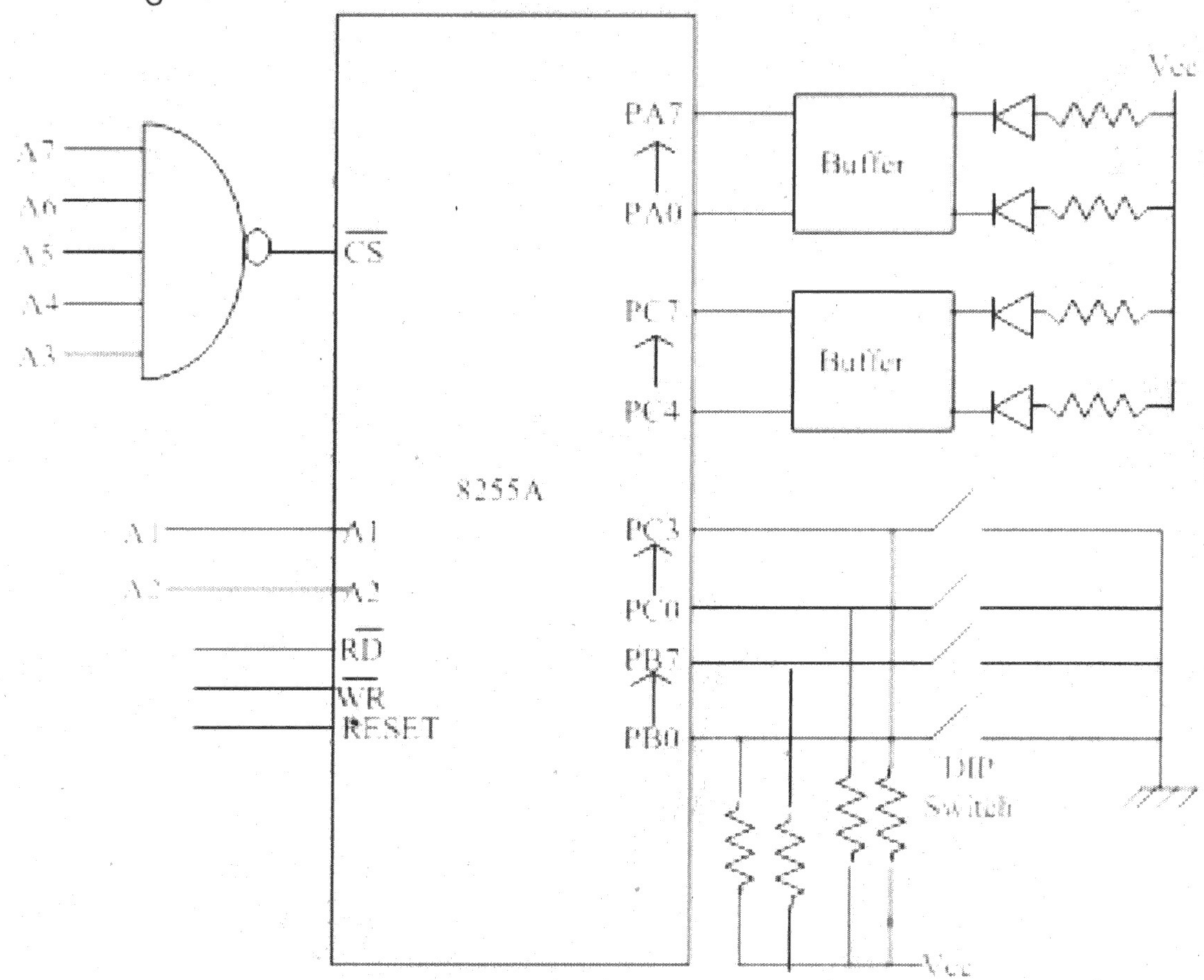
# Problems

**Problem 7:** Figure shows an 8255A interfaced with 8086 microprocessor. Perform the following-

(a) Identify the Port Address.

(b) Identify the Mode 0 control word to configure Port A and Port $C_U$ as output ports and Port B and Port $C_L$ as input ports.

(c) Write a program to read the DIP switches and display the reading from Port B at Port A, and from Port $C_L$ at Port $C_U$.



**Solution of problem 7:**

(a) When A3 to A7 are high then chip select ($\overline{CS}$) is enabled.

| A15 | A14 | A13 | A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | Address of Port |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 00F8H (Port A) |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 00F9H (Port B) |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 00FAH (Port C) |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 00FBH (CR) |

(b) Control Word

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Mod Set | Port A in Mode 0 | | Port A I/O | Port C upper o/p | Port B in Mode 0 | Port B input | Port C lower input |

Control Word = 83 H

# Problems

**Solution of problem 7(c)**

Program

```
PPICR   EQU  00FBH
PPIC    EQU  00FAH
PPIB    EQU  00F9H
PPIA    EQU  00F8H
MOV AL, 83H
OUT  PPICR , AL
IN AL, PPIB
OUT PPIA, AL
IN AL, PPIC
AND AL, 0FH
MOV CL, 04H
ROL  AL, CL
OUT PPIC, AL
HLT
```

**OR**

**Solution of problem 7(c)**

Program

```
PPICR   EQU  00FBH
PPIC    EQU  00FAH
PPIB    EQU  00F9H
PPIA    EQU  00F8H
MOV AL, 83H
OUT  PPICR , AL
IN AL, PPIB
OUT PPIA, AL
IN AL, PPIC
MOV CL, 04H
SHL  AL, CL
OUT PPIC, AL
HLT
```

# INTERFACING & DESIGN PROBLEMS

Q.1. Interface 8 keys & 8 LEDs with 8086 through 8255. WAP to flash the 8 LEDs connected to port B until port C becomes FFH.

```
        MOV  AL, 89H
        OUT  ~~ABH~~ AL
#       IN   AL, ~~AAH~~
        CMP  AL, FFH
        JE   *

        MOV  AL, FFH
        OUT  A9H, ~~AL~~
        CALL DELAY
        MOV  AL, 00H
        OUT  A9, AL
        CALL DELAY
        JMP  #
*       HLT
```

~~A8~~ PA
A9 PB
~~AA~~ PC
AB CWR.

Q.2. To interface stepper motor to 8086 using 8255, write an ALP to rotate stepper motor coils in clockwise and anti-clockwise direction.

BIT PATTERN IN FULL STEPPING

| MOTION | STEPS | HEX VALUE |
|---|---|---|
| CLOCKWISE | 1 | 03 |
| | 2 | 06 |
| | 3 | 0C |
| | 4 | 09 |
| | 5 | 03 |
| ANTICLOCKWISE | 1 | 03 |
| | 2 | 09 |
| | 3 | 0C |
| | 4 | 06 |
| | 5 | 03 |

```
        MOV  AL, CW
        OUT  ABH, AL
*       MOV  AL, 03H
        OUT  AAH, AL
        CALL DELAY
        MOV  AL, 06H
        OUT  ABH, AL
        CALL DELAY
        MOV  AL, 0CH
        OUT  ABH, AL
        CALL DELAY.
        MOV  AL, 09H
        OUT  ABH, AL
        CALL DELAY
        JMP  *
        INT  AS.
```

Q.3. Interface an 8-bit DAC to 8086 through 8255 and write the following programs for this interface.

① To generate square wave.

② To generate triangular wave.

PA = 98
PB = 99
PC = 9A
CWR = 9B

① 
```
        MOV AL, 80H ; Initialize all ports as o/p.
        OUT 9BH, AL
*       MOV AL, 00H
        OUT 99H, AL ; Output 00 for 0V level.
        Call Delay.
        MOV AL, FFH,
        OUT 99H, AL ; Output FF for 5V level.
        CALL DELAY,
        JMP *
```

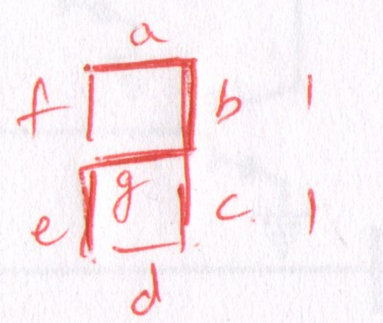
```
        MOV AL, 80H
        OUT 9BH, AL
Begin:  MOV AL, 00H
*       OUT 99H, AL
        INC AL
        CMP AL, FFH
        JNZ *
*       MOV AL, FFH
**      OUT 99H, AL
        DEC AL
        CMP AL, 00H
        JNZ **
        JMP Begin
```

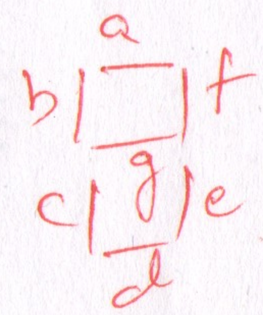
# Interfacing 7-Seg Display with 8086

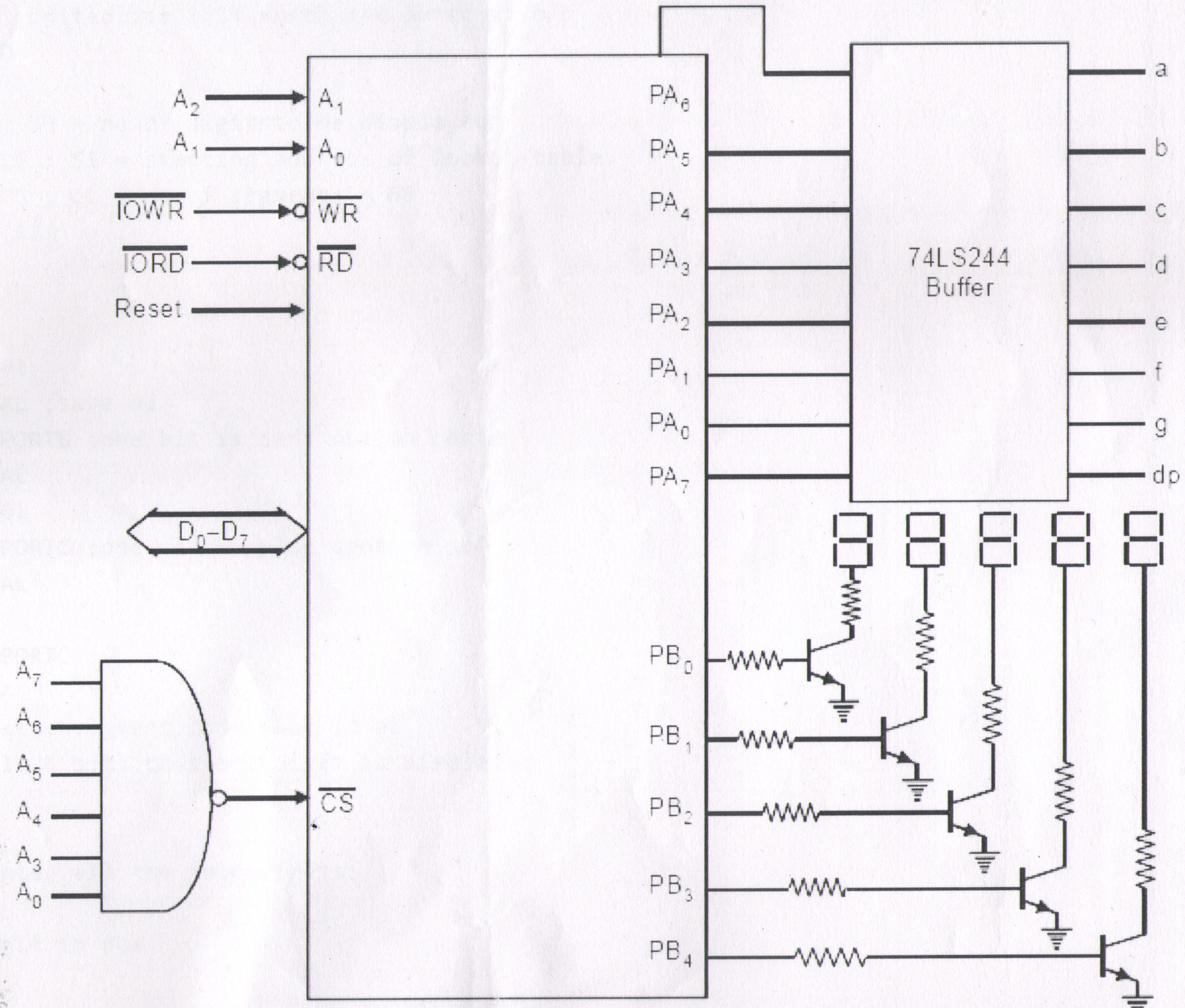
**Example 3:- Interface an 8255 with 8086 at 80H as an I/O address of Port A. Interface five 7 segment displays with the 8255. Write an ALP to display 1, 2, 3, 4 and 5 over the 5 displays continuously as per their positions starting with 1 at the least significant position ?**

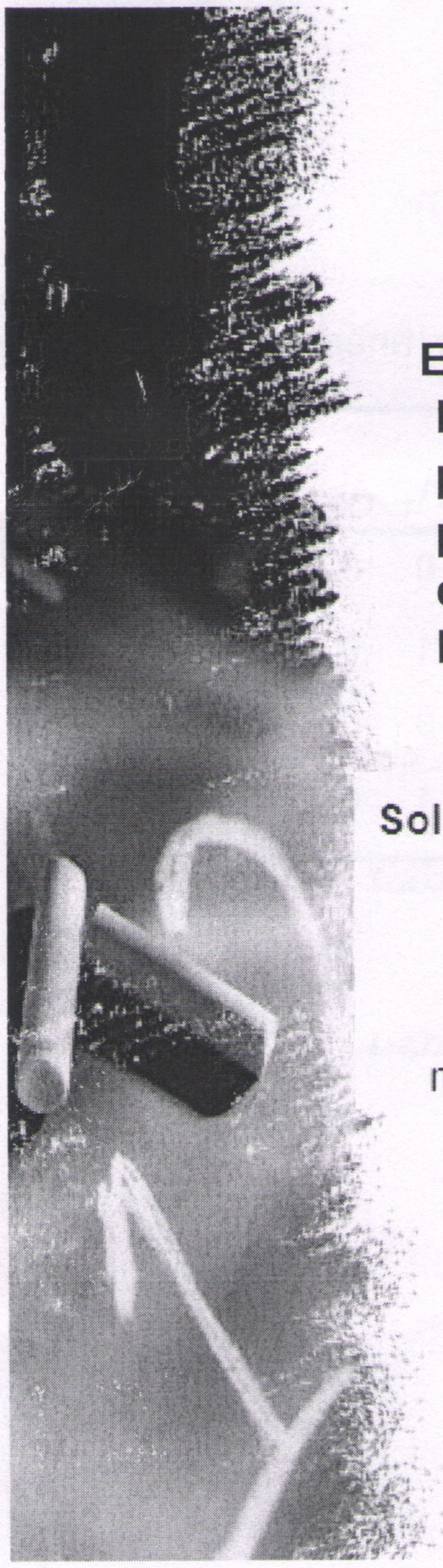
**Solution.** We will first decide the codes and store them in a look up table as shown below :

| Numbers to be displayed | PA7 dp | PA6 a | PA5 b | PA4 c | PA3 d | PA2 e | PA1 f | PA0 Code g |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 = CF |
| 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 = 92 |
| 3 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 = 86 |
| 4 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 = CC |
| 5 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 = A4 |




A2
A1
IOWR
IORD
Reset
A1
A0
WR
RD
D0–D7
A7
A6
A5
A4
A3
A0
CS
PA6
PA5
PA4
PA3
PA2
PA1
PA0
PA7
PB0
PB1
PB2
PB3
PB4
74LS244
Buffer
a
b
c
d
e
f
g
dp

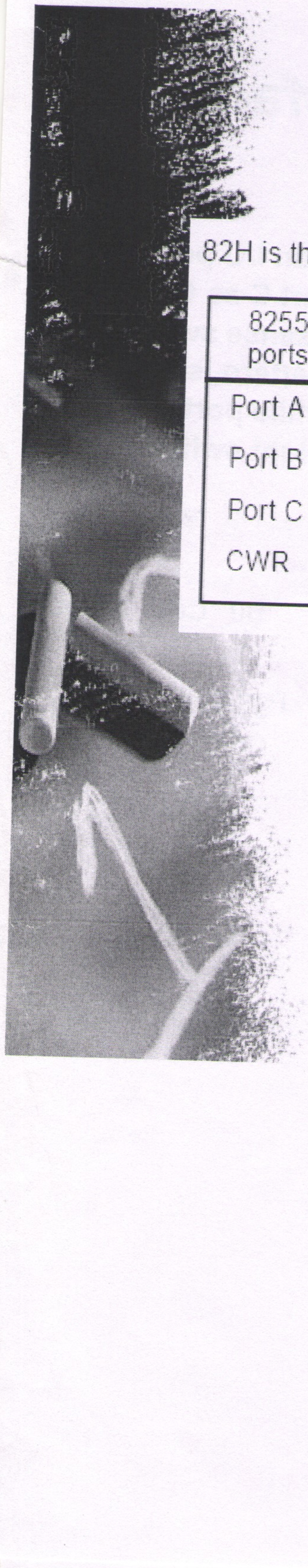


# I/O Interfacing ( LED's Interfaced with 8086)

**Example 1:- Interface an 8255 chip with 8086 to work as an I/O port. Initialize port A as output port, Port B as I/P port and Port C as O/P port. Port A address should be 0740H. Write an ALP to sense switch positions SW0–SW7 connected at port B. The sensed pattern is to be displayed on port A, to which 8 LED's are connected, while port C lower displays number of on switches out of the total eight switches ?**

**Solution.** The control word is decided as given as follows :

| B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | Control word |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | = 82 H |
| I/O mode | Port A in mode 0 | | Port A, O/P | Port C, O/P | Port B, mode 0 | Port B, I/P | Port C, O/P | |



82H is the control word. The control word format for BSR mode is as shown ahead :

| 8255 ports | I/O Address lines $A_{15}$ | $A_{14}$ | $A_{13}$ | $A_{12}$ | $A_{11}$ | $A_{10}$ | $A_9$ | $A_8$ | $A_7$ | $A_6$ | $A_5$ | $A_4$ | $A_3$ | $A_2$ | $A_1$ | $A_0$ | Hex port address |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Port A | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0740H |
| Port B | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0742H |
| Port C | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0744H |
| CWR | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0746H |