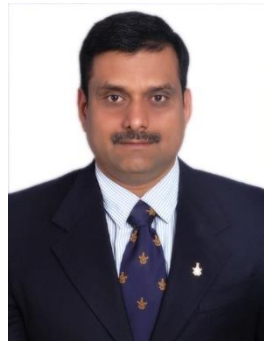




# **MPI Tutorial-13**

## **8255A PPI/8254 Timer & 8259A PIC**

**By Dr. Sanjay Vidhyadharan**



# Problem-1

Write a control word to configure port A as input port in mode 0 and port B in mode 1 as output port for 8255A.

# Problem-1

Write a control word to configure port A as input port in mode 0 and port B in mode 1 as output port for 8255A..

Solution:

D7	D6	D5	D4	D3	D2	D1	D0
1	0	0	1	0	1	0	0

D7=1; I/O Mode.

D6=0 and D5=0; Port A is in Mode 0.

D4=1; Port A is input port

D3=0; Port C (Upper).

D2=1; Port B is in Mode 1.

D1=0; Port B is output Port.

D0=0; Port C (Lower)

The control word is 94H.

D0 and D3 are low if port C is used as output or if unused.

## Problem-2

A control word is given CDH. Explain the conditions of ports of 8255A.

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Solution:

D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	0	1	1	0	1

D7=1; I/O Mode.

D6=1 and D5=0; Port A is in Mode 2.

D4=0; Port A is output port

D3=1; Port C (Upper) is input port.

D2=1; Port B is in Mode 1.

D1=0; Port B is output Port.

D0=1; Port C (Lower) is input port.

## Problem-3

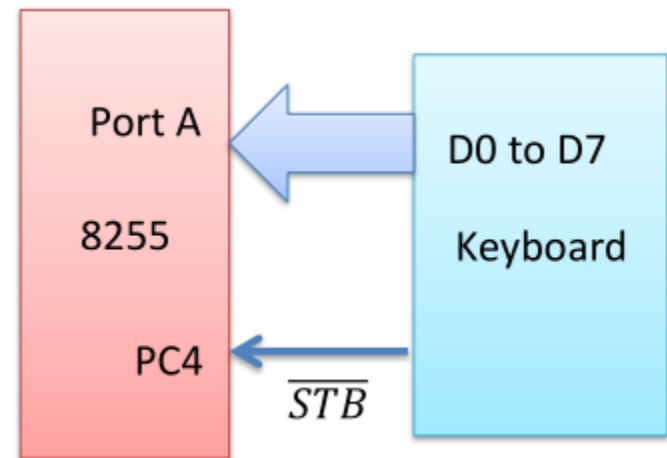
Write an 8086 assembly language procedure to read an ASCII character from a keyboard via PORT A of an 8255 PPI when PORT C bit PC4 is strobed low. Assume a base address of 20H.

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Write an 8086 assembly language procedure to read an ASCII character from a keyboard via PORT A of an 8255 PPI when PORT C bit PC4 is strobed low. Assume a base address of 20H.

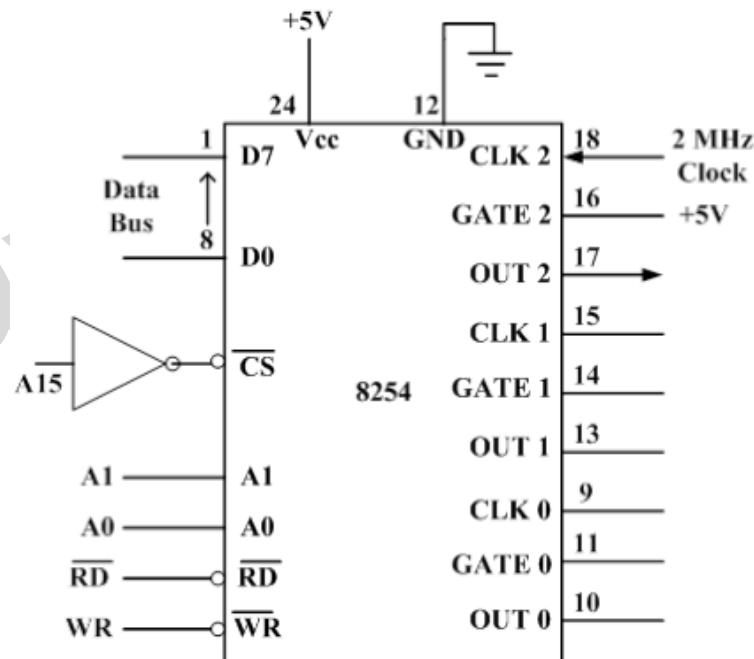
Solution:

```
PORTA EQU 20H
PORTC EQU 24H
CONTROL EQU 26H
READ PROC NEAR
MOV AL, 98H ; 1001 1000
OUT CONTROL, AL ; Initialize PORTS
READ1:
IN AL, PORTC ; Is Strobe PC4 Low?
TEST AL, 10H ; 0001 0000
JNZ READ1
IN AL, PORTA ; Read ASCII Character
RET
READ ENDP
```



# Problem-4

- Identify the port address of the control register and counter 2 in figure.
- Write a subroutine to initialize counter 2 in mode 0 with a count of 50,000. The subroutine should also include reading counts on the fly; when count reaches zero, it should return to the main program.
- Write a main program to display seconds by calling the subroutine as many times as necessary.





# Problem-4

**Solution (a):**

A15	A14	A13	A12	A11.....A5	A4	A3	A2	A1	A0	Address	
1	0	0	0	.....	0	0	0	0	0	8000H	Counter 0
1	0	0	0	.....	0	0	0	0	1	8001H	Counter 1
1	0	0	0	.....	0	0	0	1	0	8002H	Counter 2
1	0	0	0	.....	0	0	0	1	1	8003H	Control Register

Address of counter 2 = 8002H

Address of control register = 8003H

# Problem-4

## Solution (b):

We have to initialize counter 2 in Mode0.

Count=(50,000)<sub>10</sub> = C350H

Control Word to initialize counter 2 in mode0 and to load 16-bit count:

1	0	1	1	0	0	0	0	B0H
Counter 2		Load 16 bit count		Mode 0			Count in binary	Control Word

To read count 2 on the fly counter latch command is:

1	0	0	0	0	0	0	0	80H
Counter 2		Counter latch command		Don't care				Counter latch command

# Problem-4

**Solution (b)**

**Subroutine:**

```
COUNTER PROC NEAR
    CNT2 EQU 8002H
    CNTR EQU 8003H
    MOV AL, B0H
    OUT CNTR, AL
    MOV AL, 50H
    OUT CNTR2, AL
    MOV AL, C3H
    OUT CNTR2, AL
    READ: MOV AL, 80H
          OUT CNTR, AL
          IN AL, CNT2
          MOV DL, AL
          IN AL, CNT2
          OR AL, DL
          JNZ READ
          RET
COUNTER ENDP
```

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# Problem-4

## Problem 1 (Continued)

### Solution (c)

Clock frequency,  $f_c = 2 \text{ MHz}$

Time period of each clock cycle,

$$t_c = \frac{1}{2 \times 10^6} = 5 \times 10^{-7} \text{ sec}$$

Every time subroutine is called then,  $50000 \times 5 \times 10^{-7} = 25 \text{ ms}$  is counted.

To count 1 sec subroutine needed to be called,  $\left(\frac{1s}{25ms}\right) = 40 \text{ times} = 28H \text{ times}$

### Main Program:

Assuming segment registers are already initialized.

```
MOV BL, 00H
```

```
SECOND: MOV CL, 28H
```

```
WAIT: CALL COUNTER
```

```
    DEC CL
```

```
    JNZ WAIT
```

```
MOV AL, BL
```

```
( ADD AL, 01
```

```
DAA
```

```
OUT 25H, AL ; assuming 8 bit port 25H
```

```
MOV BL, AL
```

```
JMP SECOND
```

```
HLT
```

# Problem-5

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Write instructions to generate a pulse in every 50 us later from counter 0.  
Consider the figure of problem 4.

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# Problem-5

Write instructions to generate a pulse in every 50 us later from counter 0. Consider the figure of problem 4.

## Solution

To generate a pulse in every 50 us later, we should initialize counter0 in mode 2. Gate0 should be high.

### Count:

Clock frequency,  $f_c = 2 \text{ MHz}$

Needed count,  $N = \frac{\text{pulse time}}{\text{clock period}} = 100 = 64H$

### Control Word

0	0	0	1	0	1	0	0	14H
Counter 0		Load least significant byte only		Mode 2		Count in binary		Control Word

### Instructions:

```
CNT0 EQU 8000H
CNTR EQU 8003H
MOV AL, 14H
```

```
OUT CNTR, AL
MOV AL, 64H
OUT CNT0, AL
```



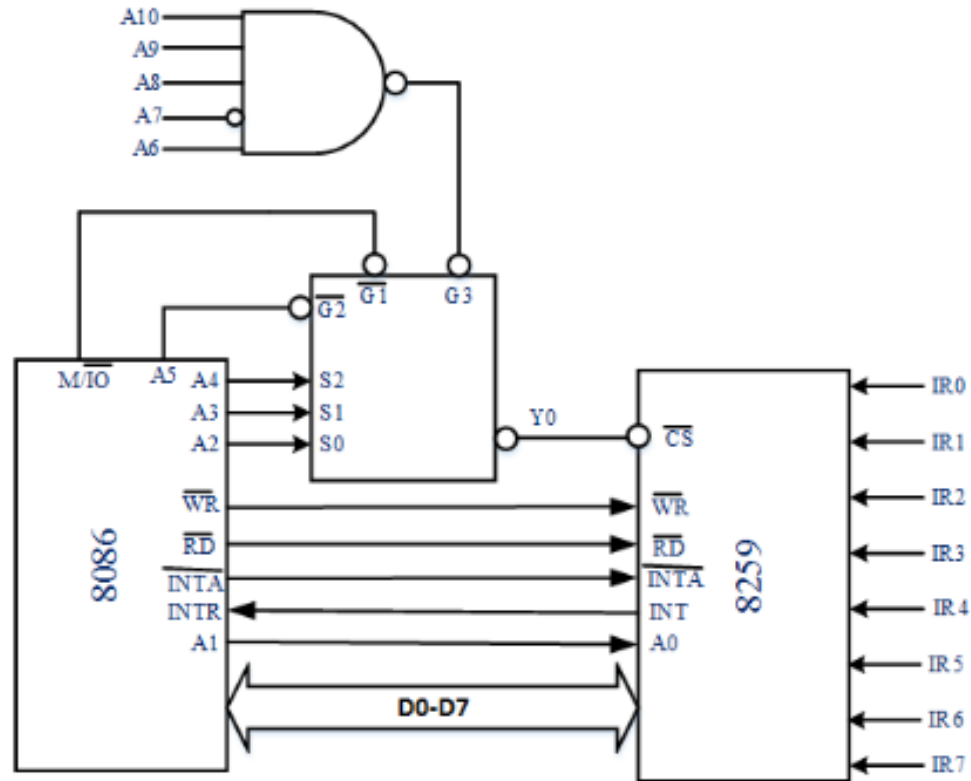
## Problem-6

Show 8259A interfacing connections with 8086 at the address 074x. Write an ALP to initialize the 8259A in single level triggered mode non buffered on special fully nested mode. Then set the 8259A to operate with IR6 masked and specific EOI mode.

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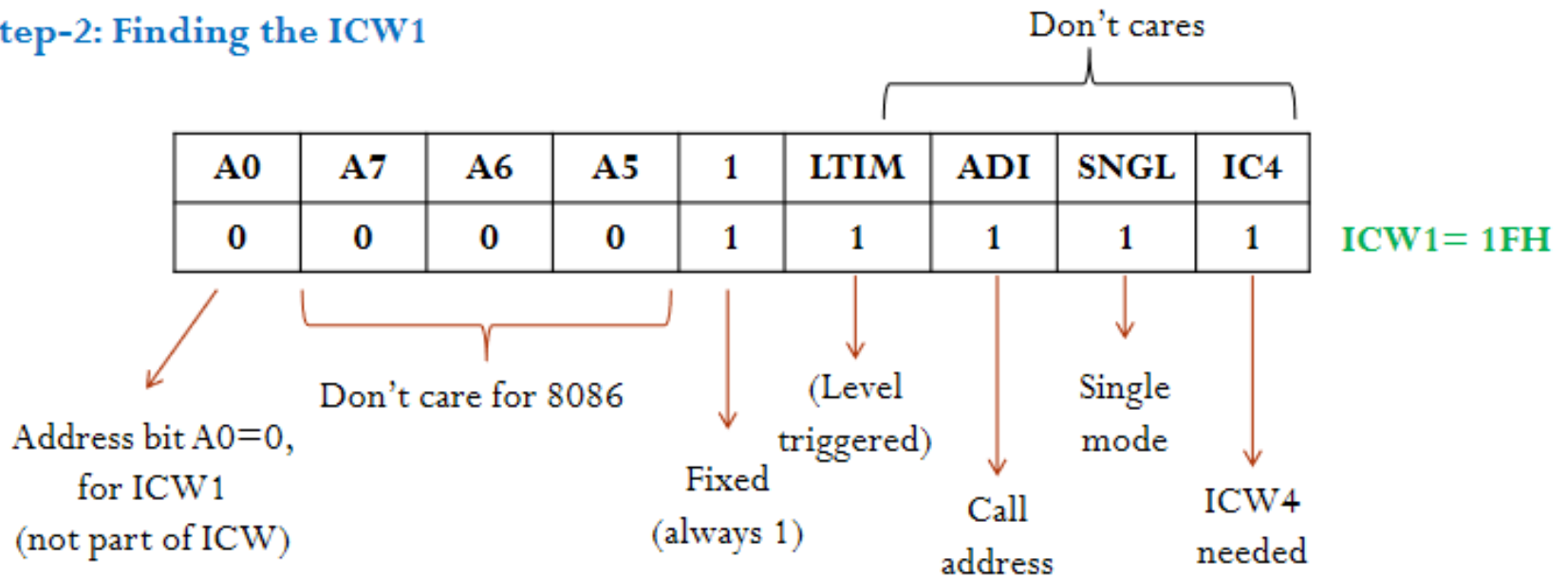




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Show 8259A interfacing connections with 8086 at the address 074x. Write an ALP to initialize the 8259A in single level triggered mode non buffered on special fully nested mode. Then set the 8259A to operate with IR6 masked and specific EOI mode. Vector address of IR1 is 81H.

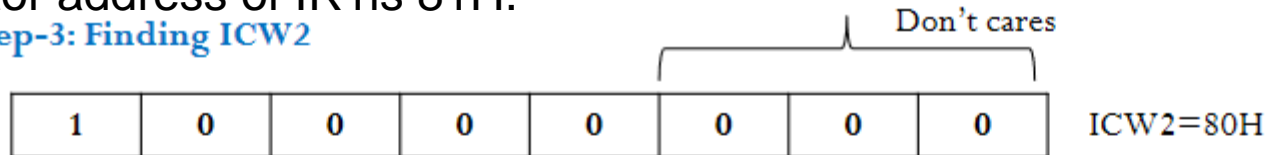
## Step-2: Finding the ICW1



# Problem-6

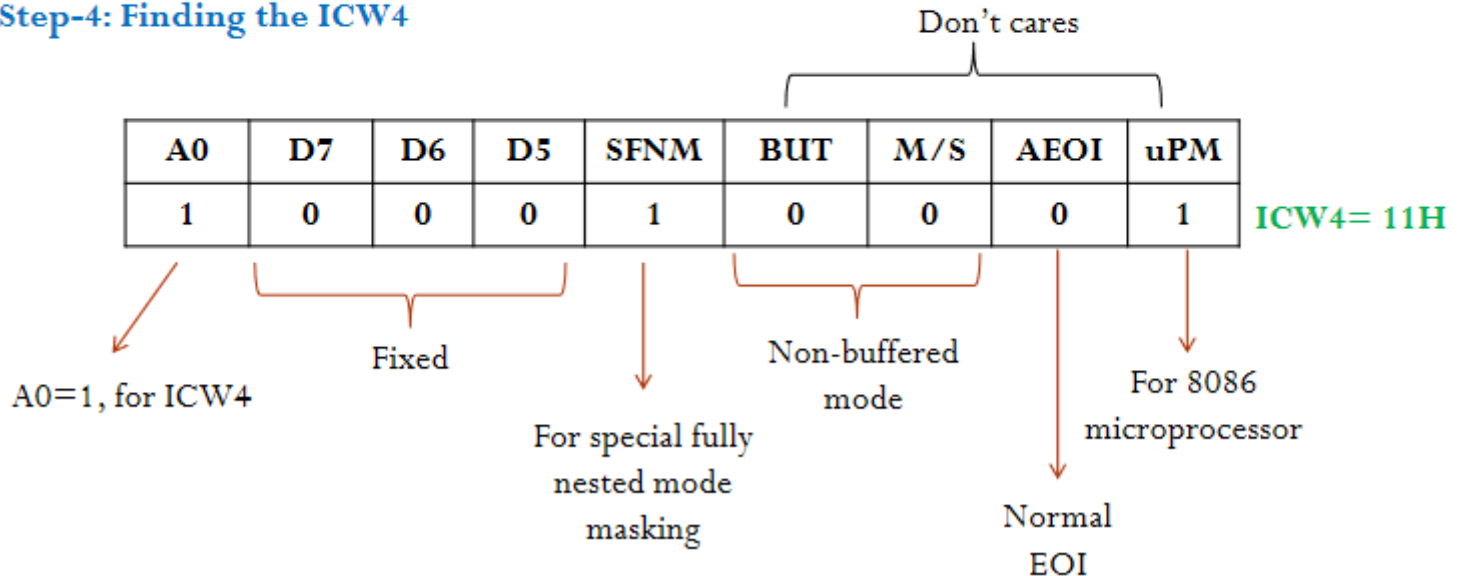
Show 8259A interfacing connections with 8086 at the address 074x. Write an ALP to initialize the 8259A in single level triggered mode non buffered on special fully nested mode. Then set the 8259A to operate with IR6 masked and specific EOI mode. Vector address of IR1 is 81H.

## Step-3: Finding ICW2



ICW3 is not needed as 8259A is set in single mode.

## Step-4: Finding the ICW4



# Problem-6

Show 8259A interfacing connections with 8086 at the address 074x. Write an ALP to initialize the 8259A in single level triggered mode non buffered on special fully nested mode. Then set the 8259A to operate with IR6 masked and specific EOI mode. Vector address of IR1 is 81H.

## Step-5: Finding OCW1

A0	D7	D6	D5	D4	D3	D2	D1	D0
1	0	1	0	1	0	0	0	0

OCW1= 40H

↓  
IR6 is masked

# Problem-6

INTERRUPT PROC NEAR

MOV AL, AFH ; Loading ICW1 to AL

MOV DX, 0740H ; Loading Address of ICW1 to DX (Variable port addressing)

OUT DX, AL ; Sending ICW1 to port (address: 0740H ) of 8259A

MOV DX, 0742H ; address of ICW2

MOV AL, 80H ; Loading ICW2 to AL which select the vector address

MOV DX, AL ; Sending ICW2 to port (address: 0742H ) of 8259A

MOV AL, 11H ; Loading ICW4 to AL

OUT DX, AL ; Sends ICW4 to 0742H

MOV AL, 40H ; Loading OCW1 to AL

OUT DX, AL ; Sends OCW1 to 0742H



**Thank You**