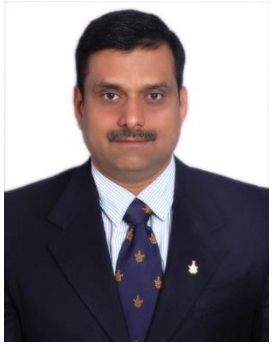
MPI Tutorial-13

8255A PPI/8254 Timer & 8259A PIC

By Dr. Sanjay Vidhyadharan



Problem-1

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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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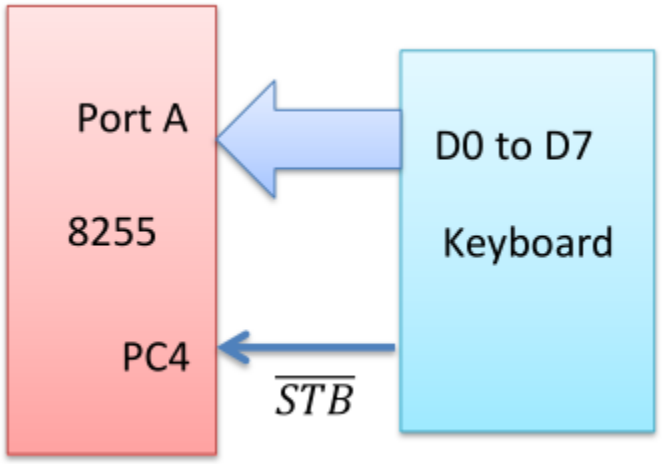
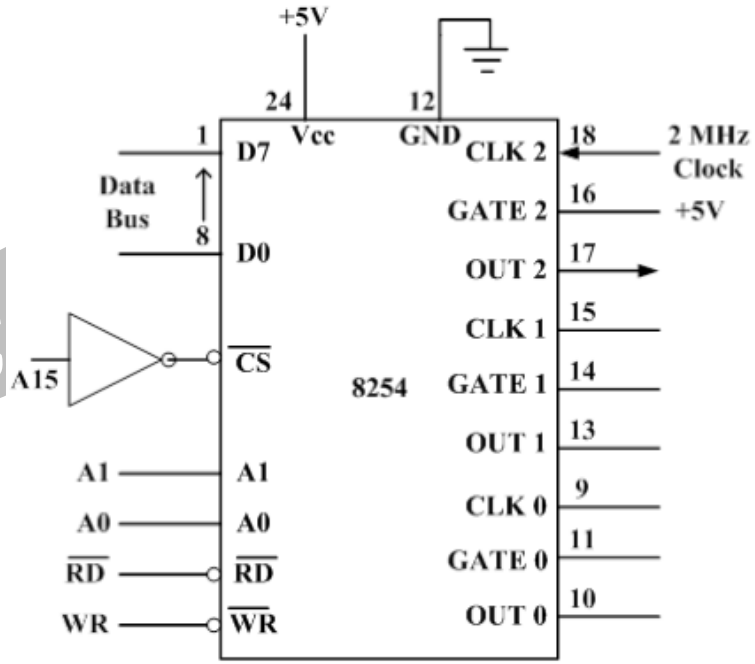
Solution:

```
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

(a) Identify the port address of the control register and counter 2 in figure.
(b) 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.
(c) 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=$(50,000)_{10}$ = 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
```

Problem-4

Problem 1 (Continued)

Solution (c)

Clock frequency, $f_c = 2$ MHz

Time period of each clock cycle,

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

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

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

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

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

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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, $f_c = 2$ MHz

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

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.

Problem-6

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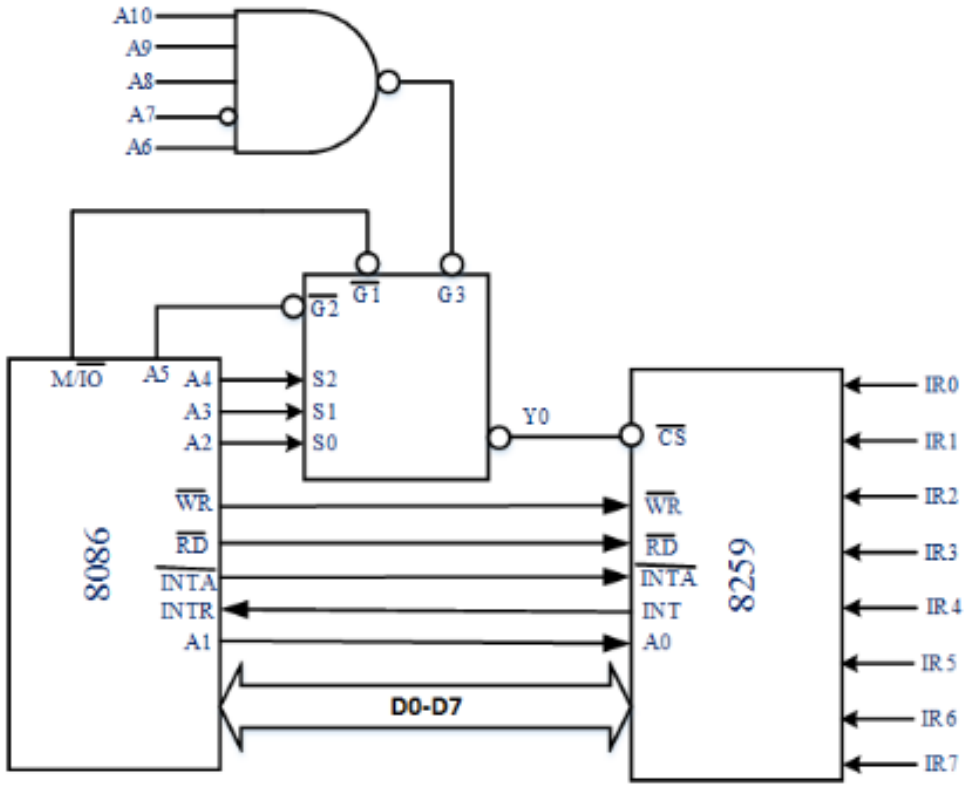

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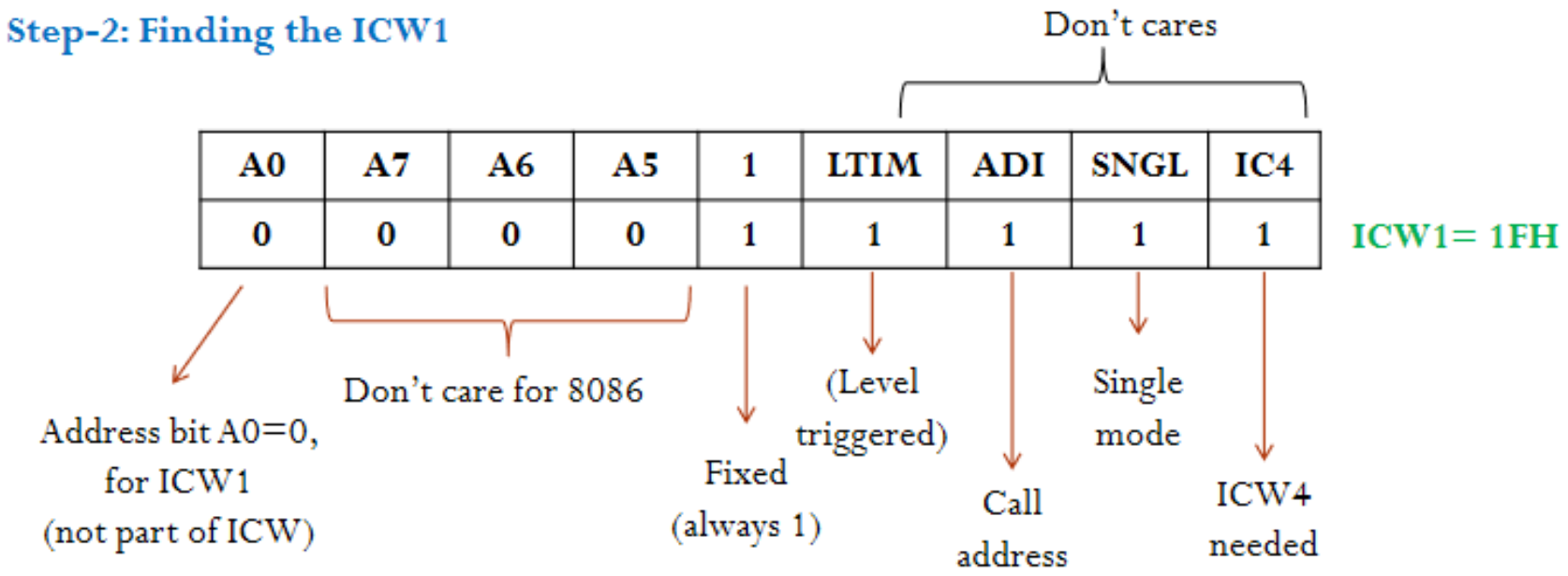

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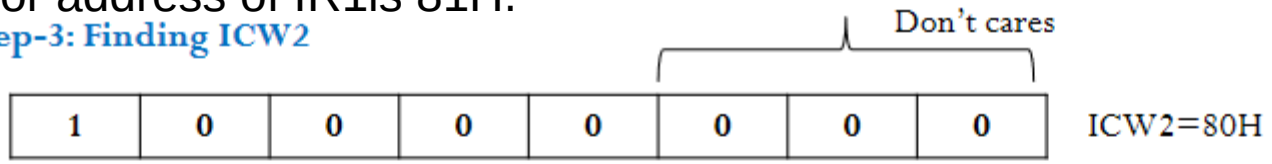
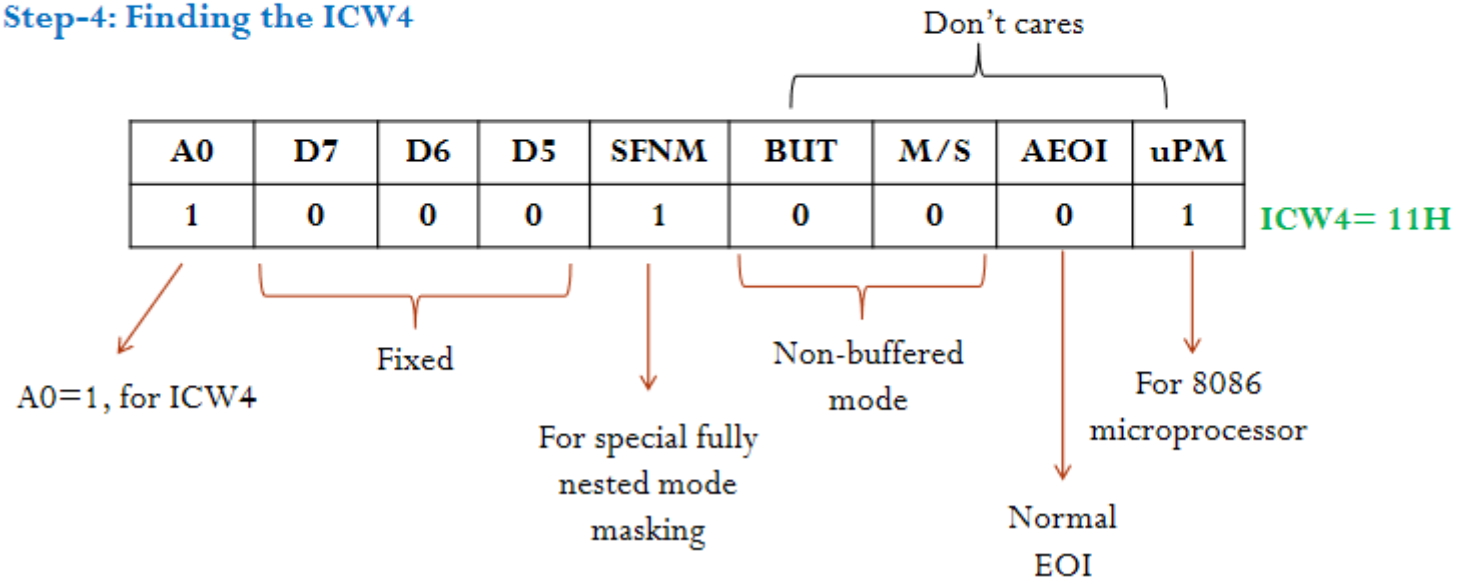
Step-3: Finding ICW2



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

Step-4: Finding the ICW4



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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