(1)

SOLUTION

QP Code- 34957 **Total Marks-80**

Q.1 c)

Intel 4004	4 bit (2300 PMOS transistors)	1971
Intel 8080 8085	8 bit (NMOS) 8 bit	1974
Intel 8088 8086	16 bit 16 bit	1978
Intel 80186 80286	16 bit 16 bit	1982
Intel 80386	32 bit (275000 transistors)	1985
Intel 80486 SX DX	32 bit 32 bit (built in floating point unit)	1989
Intel 80586 I MMX Celeron II III IV	64 bit	1993 1997 1999 2000
Z-80 (Zilog)	8 bit	1976
Motorola Power PC 601 602 603	32-bit	1993 1995

d)

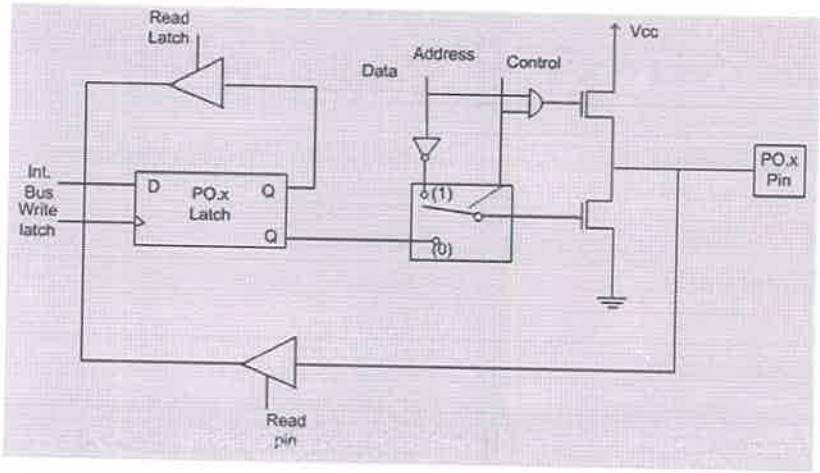
```
ORG 0000H ;                 Set program counter 0000H
MOV DPTR, #1000H ;          Copy address 1000H to DPTR
CLR A ;                     Clear A
MOV R6, #0AH ;              Load 0AH to R6
again: MOVX @DPTR,A ;       Clear RAM location pointed by DPTR
INC DPTR ;                  Increment DPTR
DJNZ R6, again ;            Loop until counter R6=0
END
```

Q.2 a)

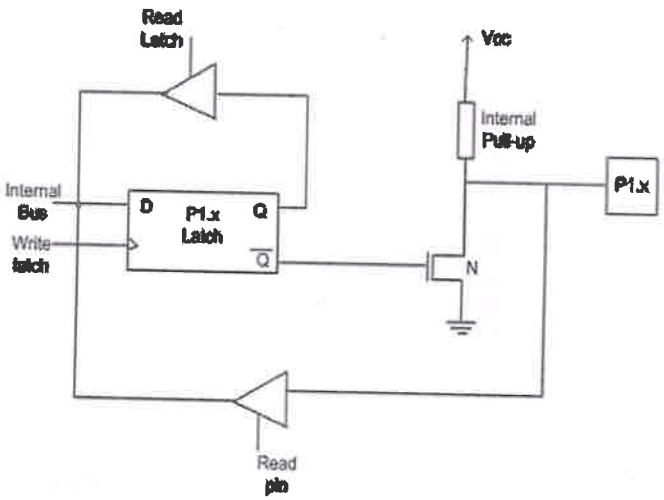
```
ORG 0000H ;                 Set program counter 00 OH
MOV A, 70H ;                Load the contents of memory location 70h into A
MOV B, 71H ;                Load the contents of memory location 71H into B
MUL AB ;                    Perform multiplication
MOV 52H,A ;                 Save the least significant byte of the result in location 52H
MOV 53H,B ;                 Save the most significant byte of the result in location 53
END
```

02

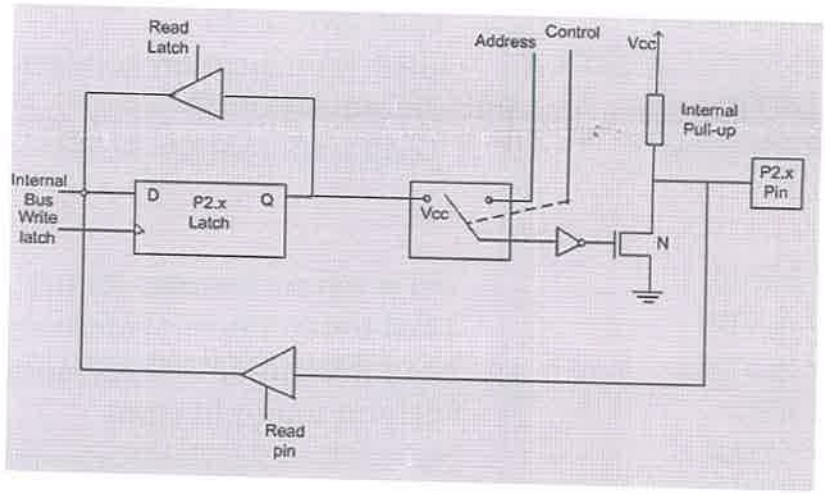
b) Port 0 structure-



Port 1 structure-

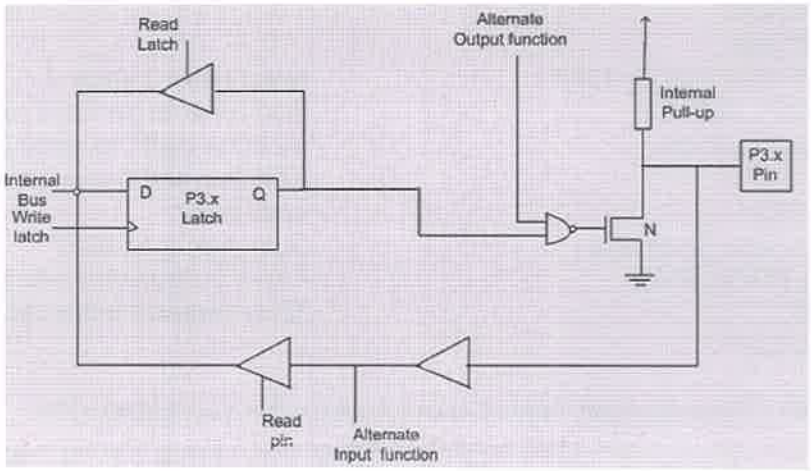


Port 2 structure-



03

Port 3 structure-



Alternate functions of Port-3 pins are -

P3.0	RxD
P3.1	TxD
P3.2	$\overline{INT0}$
P3.3	$\overline{INT1}$
P3.4	T0
P3.5	T1
P3.6	$\overline{WR}$
P3.7	$\overline{RD}$

Q.3 b) The period of the square wave is
T = 1/(2 kHz) = 500 µs.
Each half pulse = 250 µs.
The value n for 250 µs is: 250 µs /1 µs = 250
65536 - 250 = FF06H.
TL = 06H and TH = 0FFH.

```
MOV TMOD,#10 ;          Timer 1, mode 1
AGAIN: MOV TL1,#06H ;   TL0 = 06H
MOV TH1,#0FFH ;         TH0 = FFH
SETB TR1 ;              Start timer 1
BACK: JNB TF1,BACK ;    Stay until timer rolls over
CLR TR1 ;               Stop timer 1
CPL P1.5 ;              Complement P1.5 to get Hi, Lo
CLR TF1 ;               Clear timer flag 1
SJMP AGAIN ;            Reload timer
```

Q.4 a)

```
ORG 0000H
LJMP START
ORG 0030H
START: MOV TMOD, #20H ;        select timer 1 mode 2
MOV TH1, #0FAH ;               load count to get baud rate of 4800
MOV SCON, #50H ;               initialize UART in mode 2
                ;              8 bit data and 1 stop bit
SETB TR1 ;                     start timer
AGAIN: MOV SBUF, #'A' ;        load char 'A' in SBUF
BACK: JNB TI, BACK ;           Check for transmit interrupt flag
CLR TI ;                       Clear transmit interrupt flag
SJMP AGAIN
END
```

b) **TMOD : Timer/Counter Mode Control Register (Not Bit Addressable)**

GATE	C/T	M1	M0	GATE	C/T	M1	M0
TIMER 1				TIMER 0			

GATE When TRx (in TCON) is set and GATE = 1, TIMER/COUNTERx will run only while INTx pin is high (hardware control). When GATE = 0, TIMER/COUNTERx will run only while TRx = 1 (software control).

C/T Timer or Counter selector. Cleared for Timer operation (input from internal system clock). Set for Counter operation (input from Tx input pin).

M1 Mode selector bit (NOTE 1).

M0 Mode selector bit (NOTE 1).

Note 1 :

M1	M0	OPERATING MODE	
0	0	0	13-bit Timer
0	1	1	16-bit Timer/Counter
1	0	2	8-bit Auto-Reload Timer/Counter
1	1	3	(Timer 0) TL0 is an 8-bit Timer/Counter controlled by the standard Timer 0 control bits. TH0 is an 8-bit Timer and is controlled by Timer 1 control bits.
1	1	3	(Timer 1) Timer/Counter 1 stopped

TCON Register

TCON : Timer/Counter Control Register (Bit Addressable)

TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0

TF1 TCON.7 Timer 1 overflow flag. Set by hardware when the Timer/Counter 1 overflows. Cleared by hardware as processor vectors to the interrupt service routine.

TR1 TCON.6 Timer 1 run control bit. Set/cleared by software to turn Timer/Counter ON/OFF.

TF0 TCON.5 Timer 0 overflow flag. Set by hardware when the Timer/Counter 0 overflows. Cleared by hardware as processor vectors to the service routine.

TR0 TCON.4 Timer 0 run control bit. Set/cleared by software to turn Timer/Counter 0 ON/OFF.

IE1 TCON.3 External Interrupt 1 edge flag. Set by hardware when External interrupt edge is detected. Cleared by hardware when interrupt is processed.

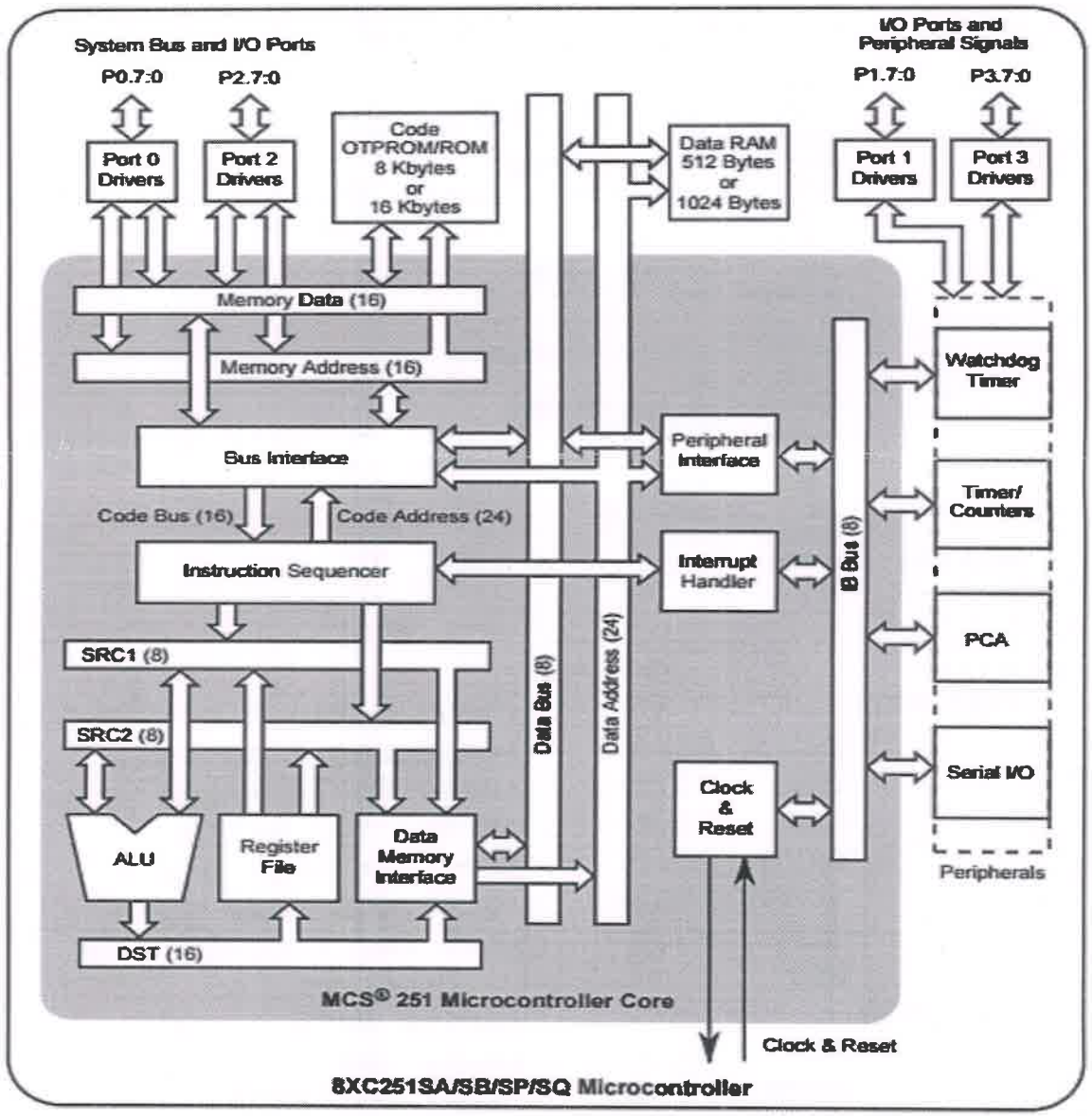
IT1 TCON.2 Interrupt 1 type control bit. Set/cleared by software to specify falling edge/flow level triggered External Interrupt.

IE0 TCON.1 External Interrupt 0 edge flag. Set by hardware when External Interrupt edge detected. Cleared by hardware when interrupt is processed.

IT0 TCON.0 Interrupt 0 type control bit. Set/cleared by software to specify falling edge/low level triggered External Interrupt.

05

Q.5 a)


System Bus and I/O Ports
P0.7:0
P2.7:0
I/O Ports and Peripheral Signals
P1.7:0
P3.7:0
Port 0 Drivers
Port 2 Drivers
Code OTPROM/ROM 8 Kbytes or 16 Kbytes
Data RAM 512 Bytes or 1024 Bytes
Port 1 Drivers
Port 3 Drivers
Memory Data (16)
Memory Address (16)
Bus Interface
Peripheral Interface
Watchdog Timer
Timer/ Counters
Code Bus (16)
Code Address (24)
Instruction Sequencer
Interrupt Handler
SFR Bus (8)
PCA
SRC1 (8)
SRC2 (8)
Data Bus (8)
Data Address (24)
Serial I/O
Clock & Reset
ALU
Register File
Data Memory Interface
Peripherals
DST (16)
MCS® 251 Microcontroller Core
Clock & Reset
8XC251SA/SB/SP/SQ Microcontroller

06

b)

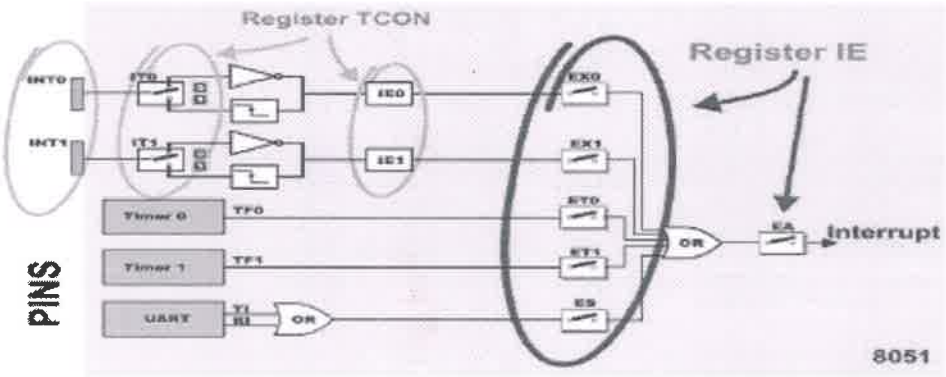
```
;Call a time delay before sending next data/command
; P1.0-P1.7=D0-D7, P2.0=RS, P2.1=R/W, P2.2=E

          ORG    0
          MOV    DPTR,#MYCOM
C1:       CLR    A
          MOVC   A,@A+DPTR
          ACALL  COMNWRT   ;call command subroutine
          ACALL  DELAY     ;give LCD some time
          INC    DPTR
          JZ     SEND_DAT
          SJMP   C1
SEND_DAT:
          MOV    DPTR,#MYDATA
D1:       CLR    A
          MOVC   A,@A+DPTR
          ACALL  DATAWRT   ;call command subroutine
          ACALL  DELAY     ;give LCD some time
          INC    DPTR
          JZ     AGAIN
          SJMP   D1
AGAIN:    SJMP   AGAIN     ;stay here
.....

.....
COMNWRT:                   ;send command to LCD
          MOV    P1,A      ;copy reg A to P1
          CLR    P2.0      ;RS=0 for command
          CLR    P2.1      ;R/W=0 for write
          SETB   P2.2      ;E=1 for high pulse
          ACALL  DELAY     ;give LCD some time
          CLR    P2.2      ;E=0 for H-to-L pulse
          RET
DATAWRT:                   ;write data to LCD
          MOV    P1,A      ;copy reg A to port 1
          SETB   P2.0      ;RS=1 for data
          CLR    P2.1      ;R/W=0 for write
          SETB   P2.2      ;E=1 for high pulse
          ACALL  DELAY     ;give LCD some time
          CLR    P2.2      ;E=0 for H-to-L pulse
          RET
DELAY:    MOV    R3,#250   ;50 or higher for fast CPUs
HERE2:    MOV    R4,#255   ;R4 = 255
HERE:     DJNZ   R4,HERE   ;stay until R4 becomes 0
          DJNZ   R3,HERE2
          RET
          ORG    300H
MYCOM:    DB     38H,0EH,01,06,84H,0 ; commands and null
MYDATA:   DB     "HELLO",0
          END
```

07

Q.6 a)

```
ORG 0000H
MOV R1,#N
MOV A,R1
MOV B,R1
MUL AB                          //SQUARE IS COMPUTED
MOV R2, B
MOV B, R1
MUL AB
MOV 50,A
MOV 51,B
MOV A,R2
MOV B, R1
MUL AB
ADD A, 51H
MOV 51H, A
MOV 52H, B
MOV A, # 00H
ADDC A, 52H
MOV 52H, A                      //CUBE IS STORED IN 52H,51H,50H
END
```

b)



	0	X	0	0	0	0	0	0	Value after Reset
IE	EA		ET2	ES	ET1	EX1	ET0	EX0	Bit name
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	

	X	X	0	0	0	0	0	0	Value after Reset
IP			PT2	PS	PT1	PX1	PT0	PX0	Bit name
	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	