**Homework4 solutions**

27. T = 1.2usec

F = 1/T = 833.333KHz

System frequency = 833.333KHz\*12 = 10MHz

28. F = 18MHz

F =18MHZ/12 =1.5MHz

T = 1/F =1/1.5MHz

T = 0.666usec

29. F = 12MHz

F =12MHZ/12 =1MHz

T = 1/F =1/1MHz

T = 1usec

30. F = 25MHz

F =25MHZ/12 = 2.08MHz

T = 1/F =1/2.08MHz

T = 0.48usec

31. True, both take 3 machine cycles

32. F = 11.0592MHz

F =11.0592MHZ/12 = 921.6KHz

T = 1/F = 1/921.6KHZ

T = 1.085usec

DELAY:MOV R3,#150 1 machine cycle

HERE:NOP 1 machine cycle

NOP 1 machine cycle

NOP 1 machine cycle

DJNZ R3,HERE 2 machine cycle

RET 2 3 machine cycle

The time delay of the HERE loop is [150(2+1+1+1)]\*1.085usec=0.813msec

Now for the instruction outside the loop (RET instruction has 3 machine cycles

as per manufacturer`s datasheet for DS89C240), (2+1)\*1.085usec = 3.25usec

Total=0.813ms + 3.25usec = 0.8162msec

33. F = 16MHz

F =16MHZ/12 = 1.33333MHz

T = 1/F = 1/1.33333MHZ

T = 0.75usec

DELAY:MOV R3,#200 1 machine cycle

HERE:NOP 1 machine cycle

NOP 1 machine cycle

NOP 1 machine cycle

DJNZ R3,HERE 2 machine cycle

RET 3 machine cycle

The time delay of the HERE loop is [200(2+1+1+1)]\*0.75usec=0.75msec

Now for the instruction outside the loop (RET instruction has 3 machine cycles

as per manufacturer`s datasheet for DS89C240) (2+1)\*0.75usec = 2.25usec

Now 0.75ms + 2.25usec = 0.75225msec

34. F = 11.0592MHz

F =11.0592MHZ/12 = 921.6KHz

T = 1/F = 1/921.6KHZ

T = 1.085usec

DELAY:MOV R5,#100 1 machine cycle

BACK: MOV R2,#200 1 machine cycle

AGAIN:MOV R3,#250 1 machine cycle

HERE:NOP 1 machine cycle

NOP 1 machine cycle

DJNZ R3,HERE 2 machine cycle

DJNZ R2,AGAIN 2 machine cycle

DJNZ R5,BACK 2 machine cycle

RET 3 machine cycle

The time delay of the HERE loop is [250(2+1+1)]\*1.085usec=1.085msec. The time delay of the AGAIN loop it repeats 200 times so, 1.085msec\*200 = 0.217 + (3\*200\*1.085usec) = 0.2176s(over head for MOVR3,#200 and DJNZR2, AGAIN instructions) The time delay of the BACK loop, it is repeated 100 times so

0.2176\*100=21.76sec + (3\*100\*1.085usec)(over head for MOVR2,#200 and DJNZR5, BACK )

Time Delay = 22.0855sec

35 F = 16MHz

F =16MHZ/12 = 1.33333MHz

T = 1/F = 1/1.33333MHZ

T = 0.75usec

DELAY:MOV R2,#150 1 machine cycle

AGAIN:MOV R3,#250 1 machine cycle

HERE:NOP 1 machine cycle

NOP 1 machine cycle

NOP 1 machine cycle

DJNZ R3,HERE 2 machine cycle

DJNZ R2,AGAIN 2 machine cycle

RET 3 machine cycle

The time delay of the HERE loop is [250(2+1+1+1+1)]\*0.75usec=1.5msec

The time delay of the AGAIN loop it repeats 250 times so,

1.5msec\*250 = 0.375 + (3\*250\*0.75usec) = 0.3755s(over head for MOVR3,#200

and DJNZR2, AGAIN instructions)

Now for the instruction outside the loop (RET instruction has 3 machine cycles

as per manufacturer`s datasheet for DS89C240) (2+1)\*0.75usec = 2.25usec

Now 0.3755625s + 2.25usec = 0.37556475s

**Problems 54-58**

54.

MOV C,ACC.7 ; copy the 7th bit of ACC to carry

JNC EXIT ; check to see if it is high

MOV DPTR, #400H ; Load the address of message

LCALL DISPLAY ; Display the message

SJMP EXIT ;get out

EXIT:

; data to be displayed on LCD

 ORG 400H

MSG: DB ‘’ ACC has a Negative Number”

55.

MOV C,B.7 ; copy the 7th bit of B to carry

JC EXIT ; check to see if it is low

MOV DPTR, #400H ; Load the address of message

LCALL DISPLAY ; Display the message

SJMP EXIT ;get out

EXIT:

; data to be displayed on LCD

 ORG 400H

MSG: DB ‘’B has a Positive Number”

56.(A)

MOV R1,#10H ; load R1 with value 10H

MOV A,#0FFH ; load Acc with value 0FFH

MOV R0,#20H; ; load R0 with value 20H

LOOP:MOV @R0,A ; set current R0 using Acc value

 INC R0 ; Increment R0

 DJNZ R1,LOOP

 (B)

SETB20H ; set B using address bytes 20H to 2FH

SETB 21H

SETB 22H

SETB 23H

SETB 24H

SETB 25H

SETB 26H

SETB 27H

SETB 28H

SETB 29H

SETB 2AH

SETB 2BH

SETB 2CH

SETB 2DH

SETB 2EH

SETB 2FH

END

57.

MOV B,#08H ;store 08H in Reg b

DIV AB ; divide A by B

CJNE B#00H,HERE ; if remainder! =00h, jump to HERE

SJMP L1 ; jump to L1

HERE: MOV R0,A ; move Acc to R0

L1: END

58.

MOV R0,#00H ; Initialize R0 with value 00H

MOV R1,#08H ; Initialize R1 with value 08H

MOV A,R2 ; Copy the content in R2 to Acc

BACK: RRC A ; Rotate Right A to check number of zeros

JC HERE ; if carry is 1, jump to HERE

INC R0 ;Increment R0 If Zero exists

HERE:DJNZ R1,BACK ; Decrement and loop to BACK until nonzero

END

28 and 29:

1. CY=1, Jump happens
2. CY=0, Jump happens
3. CY=0, Jump does not happen
4. CY=0, Jump does not happen
5. CY=1, Jump happens
6. CY=0, Jump does not happen