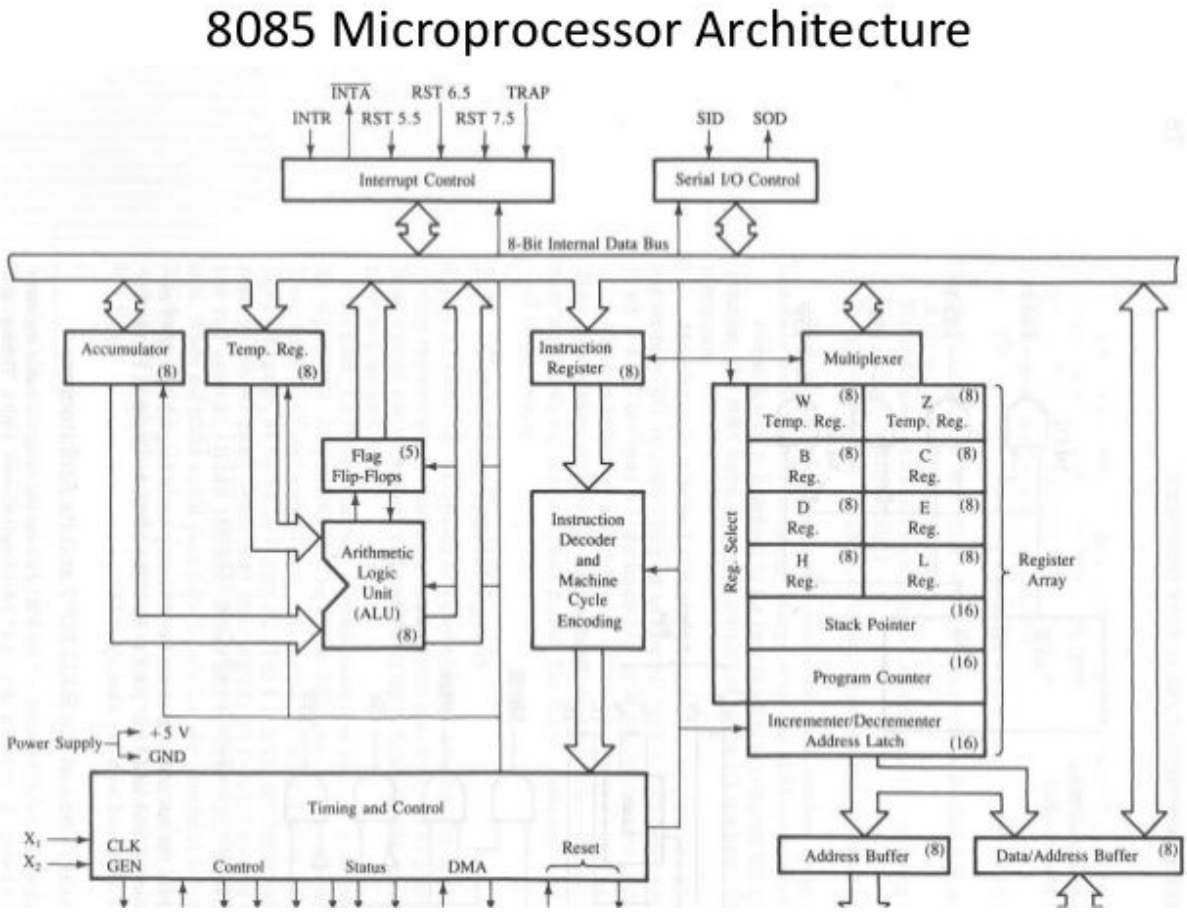
EE2003 : Computer Organisation

REPORT

Assignment 2



Introduction

The assignment has been implemented in 2 ways. The assignment cannot be implemented using only 1 nested subroutine and an 8-bit register loop in each subroutine as even if we give 255 (or 0xFF) to the registers, the required time delay cannot be achieved. The clock frequency given is **5MHz** and the required Time Delay is **288.5ms**.

Implementation A : Using 3 subroutines

Instruction		T-states
LXI SP,0FFFH		10
JMP start		10
DELAY3:	PUSH PSW	12
MVI B,02H		7
LOOP3:	DCR B	4
	JNZ LOOP3	10/7
	POP PSW	10
	RET	10
DELAY2:	PUSH PSW	12
MVI E,0EAH		7
LOOP2:	CALL DELAY3	18
	DCR E	4
	JNZ LOOP2	10/7
	POP PSW	10
	RET	10
DELAY1:	PUSH PSW	12
MVI D,40H		7
LOOP1a:	CALL DELAY2	18
	DCR D	4

	JNZ LOOP1a	10/7
	MVI D,19H	7
LOOP1b:	DCR D	4
	JNZ LOOP1b	10/7
	POP PSW	10
	RET	10
start:	MVI A,00H	7
ADI 0FEH		7
ADI 01H		7
LXI B,1234H		10
LXI D,5678H		10
LXI H,0ABCDH		10
CALL DELAY1		18
hlt		>=5

Calculation of Time Delay :

Time period = T = 1/f = ⅛ micro seconds = 0.2 micro seconds

Time to execute instructions outside the loops = (10+10+7+7+7+18+12+7+10+10+10)*T

= 21.6 micro seconds

Time to execute Delay3 = t3*0.2

= (12+7+2*(4+10) -3 +10 + 10)*T

= 12.8 micro seconds

Time to execute Delay2 = t2*0.2

= ((12+7+ 234*(18+ t3 +4+10)-3+10+10)*T

= 4500 micro seconds

Time to execute Delay1 = ((12+7+ 64*(18+ t2 +4+10)-3+7+25*(4+10)-3+10+10)*T

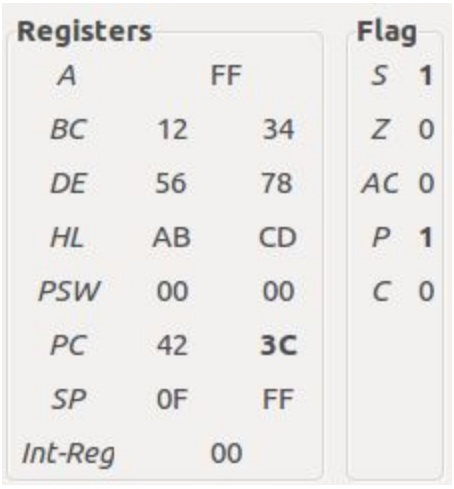
= 288487.6 micro seconds

Total time = Time to execute instructions outside the loops + Time to execute Delay1

= 288.5 ms

The register values were found using trial and error method.

The values of registers and flag before calling subroutine:



Registers			Flag	
A	FF		S	1
BC	12	34	Z	0
DE	56	78	AC	0
HL	AB	CD	P	1
PSW	00	00	C	0
PC	42	**3C**		
SP	0F	FF		
Int-Reg	00			

The values of registers and flag after program execution :

Registers			Flag	
A	FF		S	1
BC	00	34	Z	0
DE	00	00	AC	0
HL	AB	CD	P	1
PSW	00	00	C	0
PC	42	40		
SP	0F	FF		
Int-Reg	00			

NOTE : The registers BC have not been pushed to stack before using the subroutine and hence their values are changed.

Implementation A : Using 2 subroutines

Instruction		T-states
LXI SP,0FFFH		10
JMP start		10
DELAY2:	PUSH PSW	12
MVI E,0FFH		7
LOOP2:	DCR E	4
	JNZ LOOP2	10/7
	POP PSW	10
	RET	10
DELAY1:	PUSH PSW	12
MVI D,0FFH		7
LOOP1a:	CALL DELAY2	18
	DCR D	4
	JNZ LOOP1a	10/7
	MVI D,8DH	7
LOOP1b:	CALL DELAY2	18
	DCR D	4
	JNZ LOOP1b	10/7

MVI D,7DH	7
LOOP1c: DCR D	4
JNZ LOOP1c	10/7
POP PSW	10
RET	10
start: MVI A,00H	7
ADI 0FEH	7
ADI 01H	7
LXI B,1234H	10
LXI D,5678H	10
LXI H,0ABCDH	10
CALL DELAY1	18
hlt	>=5

Calculation of Time Delay :

Time period = T = 1/f = ⅕ micro seconds = 0.2 micro seconds

Time to execute instructions outside the loops = (10+10+7+7+7+18+12+7+10+10+10)*T

= 21.6 micro seconds

Time to execute Delay2 = t2*0.2

= (12+7+255*(4+10) -3 +10 + 10)*T

= 721.2 micro seconds

Time to execute Delay1 = (12+7+ (255+141)*(18+ t2 +4+10)-3-3+7+7+125*(4+10)-3+10+10)*T

= 288488.4 micro seconds

Total time = Time to execute instructions outside the loops + Time to execute Delay1

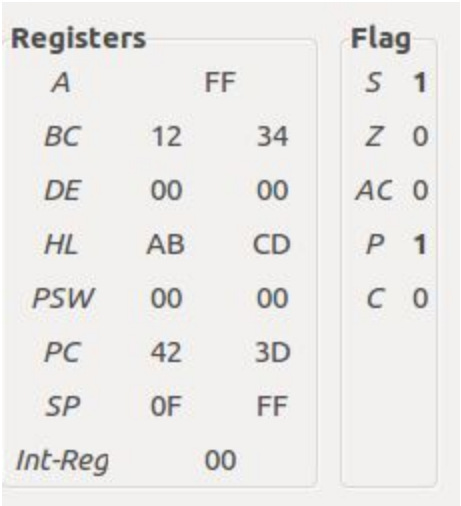
= 288.5 ms

The register values were found using trial and error method.

The values of registers and flag before calling subroutine:

Registers			Flag	
A	FF		*S*	**1**
BC	12	34	*Z*	0
DE	56	78	*AC*	0
HL	AB	CD	*P*	**1**
PSW	00	00	*C*	0
PC	42	**39**		
SP	0F	FF		
Int-Reg	00			

The values of registers and flag after program execution :



Registers			Flag	
A	FF		*S*	**1**
BC	12	34	*Z*	0
DE	00	00	*AC*	0
HL	AB	CD	*P*	**1**
PSW	00	00	*C*	0
PC	42	3D		
SP	0F	FF		
Int-Reg	00			