

**Q 1. PROBLEM STATEMENT:** Write a program which will display a flashing “CSE 00” in the display. The flashing rate should be 0.5 sec

Contents of memory locations used:

2000-15; 2001-0E; 2002-0C; 2003-0E; 2004-00; 2005-00

Label	Mnemonics		Comments
	Opcode	Operand	
START	LXI	H, 2000(H)	The content of the 4 consecutive memory locations starting from 2000(H) will be shown in the address field & 2 locations for data field starting from 2004(H)
	MVI	A, 00 (H)	
	CALL	UPDTFIELD	
	LXI	H, 2004(H)	
	MVI	A, 01(H)	
	CALL	UPDTFIELD	
	LXI	D, FFFF(H)	The content will be shown for some time for giving the delay & blnkdisplay will be shown after that.
	CALL	DELAY	
	CALL	BLNKDSPL	
	LXI	D, FFFF(H)	
END	CALL	DELAY	Displays will continue.
	JMP	START	

No. of bytes = 34

**Q 2. PROBLEM STATEMENT:** Write a program to generate a rotating display of “COCA COLA”. There will be two separate programs to rotate the display in the left & the right directions respectively. Choose either of them by pressing a key ‘A’ or ‘B’.

By default “COCA COLA” will rotate in left direction. Press ‘A’ for left rotation & press ‘B’ for right rotation.

Before execution the following memory places are filled as follows

2300-15; 2301- 15; 2302- 15; 2303-15;2304-15; 2305-0C; 2306-00; 2307-0C; 2308-0A; 2309-15; 230A-0C; 230B-00; 230C-11; 230D-A; 230E-15; 230F-15; 2310-15; 2311-15; 2312-15;

Label	Mnemonics		Comment
	Opcode	Operand	
Start	MVI SIM EI	A,0BH	Enable Rst 5.5 interrupt
Cleft	LXI MVI	H,2300H C,0EH	Set counter & set starting display location.
Left	CALL LDA CPI JZ INR DCR JNZ JMP	COMMON1 20FEH 0BH CRIGHT L C LEFT CLEFT	Detect the pressed key & if B is pressed go to Right rotation routine Adjust display location. Decrement counter
CRIGHT:	MVI SUB JZ MOV JMP	A,0EH C RIGHT C,A SRIGHT	Adjust the counter for Right rotation & if A become zero, goto RIGHT
RIGHT:	LXI MVI	H,230DH C,0EH	Set counter & set starting display location.
SRIGHT:	CALL LDA CPI JZ DCR DCR JNZ JMP	COMMON1 20FEH 0AH LEFT L C SRIGHT RIGHT	Detect the pressed key & if A is pressed go to Left rotation routine Adjust display location. Decrement counter
End			
COMMON1:	PUSH PUSH MVI CALL POP PUSH INR INR INR INR MVI CALL LXI CALL POP POP RET	B H A,00H 02B7H H H L L L L A,01H 02B7H D,FFFFH 05F1H H B	B & H reg pair is saved Address field is updated according to H-L pair. H-L pair is restored & saved back L is incremented 4 times to adjust the display Data field is updated according to H-L pair. Delay routine H-L & B-C pairs are loaded back

No. of bytes = 89

**Q 3. PROBLEM STATEMENT:** Write a program which will count & display decimal numbers from 00 to 99. the counting should stop on pressing VECT INT key & the counting should resume on pressing of any key other than the VECT INT key.

Label	Mnemonics		Comment
	Opcode	Operand	
	LXI	SP, 2FFFF(H)	Initialize the stack pointer.
START	SUB PUSH	A PSW	Clear the acc.
THERE	MVI SIM POP DI	A, 0B(H)  PSW	Load bit pattern to enable RST 7.5.& enable it. Check whether it is pending.
NEXT	PUSH CALL LXI CALL POP ADI DAA PUSH EI JMP	PSW UPDT DATA D, FFFF(H) DELAY PSW 01(H) PSW THERE	If RST 7.5 is not set then disable the interrupt & add 01(H) with the acc & display the decimal equivalent on the data field. Back to the EI mode.& jump to THERE to see if RST 7.5 key is pressed.
20CE(H)	JMP	2200(H)	If RST 7.5 is set then jump to 2200(H) loc.
2200(H)	LXI CALL MVI SIM EI POP JMP	D, 00FF(H) DELAY A, 1E(H)  D LOOP	Give the corresponding delay & override the status of RST 7.5 F/F. Execute the infinite loop until RST 5.5 is enabled.
LOOP			
20FE(H)	JMP	2210(H)	If RST 5.5 is enabled go to 2210(H) mem loc.
2210(H)	POP JMP	D THERE	Jump to THERE & Resume the execution.

No. of bytes = 53

**Q 4. PROBLEM STATEMENT:** Write a program to always display the moving average of the last four HEX digits entered through the keyboard. (Use the data field for displaying the fractional part)

THIS PROG WILL TAKE THE HEX KEY CODE & OUTPUT THE BCD MOVING AVERAGE

Before execution the following memory places are filled as follows  
2300-00; then 01, 02, 09 upto 2309. ; after that 10 in 230A, 11, 12, 13, 14, upto 15 in 230F, to map the bcd number. Then at 2301-00, 2301-25, 2302-50, 2302-75 for decimal part

Label	Mnemonics		Comment
	Opcode	Operand	
START	ORG	2100H	SP is initialized
	LXI	SP,2FFFH	
	MVI	A,0EH	
	SIM		
	EI		Masking pattern is set & rst 5.5 interrupt is enabled.
	CALL	02E7H	
	MOV	H,A	Readkbd function is used & the data are stored in the reg
	CALL	02E7H	
	MOV	L,A	
	PUSH	H	
	CALL	02E7H	
	MOV	D,A	
	CALL	02E7H	
	MOV	E,A	
	JMP	AVG	
LOOP	CALL	02E7H	The loop shows the moving average
	POP	D	
	MOV	E,A	
AVG	POP	H	Four nos are added & the nos are shifted
	ADD	D	
	ADD	H	
	ADD	L	
	MOV	H,L	
	MOV	L,D	
	MOV	D,E	
	PUSH	H	
	PUSH	D	
	LXI	H,0000H	
DIVIDE	SBI	04H	The lookup table is used & appropriate value is mapped
	JMP	MULTI	
	INX	H	
	CPI	04H	
	JNC	DIVIDE	

	MVI MOV MVI PUSH	H,23H L,M H,00H H	
DECIMAL	ADI MOV MVI MOV	10H L,A H,23H A,M	The lookup table address is specified & it is used appropriately
DISPLAY	CALL POP MVI CALL JMP	036EH H B,01H 0363H LOOP	The updtdata & updt address fns are used & the decimal part is displayed by this loop.
MULTI	ADI PUSH JMP	04H H DECIMAL	This loop is used to make integer portion zero when added value is less than 4
END			

No. of bytes = 91

**Q 5. PROBLEM STATEMENT:** Design a software combinational lock so that at the start of the program the data field displays “C”(closed). If the correct code 987 is entered through the keyboard the display changes to “O”(open). If any wrong code is entered it permanently displays “E”(error) till the system is reset.

Before execution the following memory places are filled as follows  
2000-15; 2001-0C; 2002-15; 2003-00; 2004-15; 2005-0E

Label	Mnemonics		Comment
	Opcode	Operand	
START	LXI	SP, 2FFF(H)	It will show the content of memory locations 2000& 2001 in the data fld i.e.0C
	LXI	H, 2000(H)	
	MVI	A, 01(H)	
	CALL	UPDISPLAY	
	LXI	D, FFFF(H)	
	CALL	DELAY	
LOOP	MVI	C, 03(H)	Set the counter C to 03(H) to read the 3 key press.
	PUSH	B	Push the content of B-C reg pair to the stack & unmasked the RST5.5 interrupt & enable it.
	MVI	A, 0E(H)	
	SIM		
	EI		
	CALL	RDKBDP	
	POP	B	Read the key presses. The corresponding key codes will store to the acc. & we store these in the stack. 3 key presses are req.
	DCR	C	
	PUSH	PSW	
	JNZ	LOOP	
	POP	PSW	
	CPI	07(H)	
	JNZ	SKIP	Compare the key press with 987 .If it is not match then jump to SKIP otherwise display the content of mem loc 2002 & 2003 i.e. 00 in its data field.
	POP	JNZ	
	CPI	08(H)	
	JNZ	SKIP	
	CPI	09(H)	
	JNZ	SKIP	
	LXI	H, 2002(H)	
	MVI	A, 01(H)	
	CALL	UPDISPLAY	
	HLT		
SKIP	LXI	H, 2004(H)	Display the content of mem loc 2004 & 2005 i.e.0E in the data field.
	MVI	A, 01(H)	
	CALL	UPDATA	
	LXI	D, FFFF(H)	
	CALL	DELAY	
	HLT		

No. of bytes = 68

**Q 6. PROBLEM STATEMENT:** Make a pure software soft watch of the range 00-99 sec. the rightmost data field displays the time. Pressing “VECT INT” once starts the watch, the second time pressing stops it & the third time pressing reset it. (Disregard the time reqd for the output display routine)

Label	Mnemonics		Comment
	Opcode	Operand	
START	LXI	SP, 2FFF(H)	Display the content of the acc in the data field i.e. 00 & enable RST 7.5 interrupt. Display it until RST 7.5 key is pressed.
	SUB	A	
	STA	2000(H)	
	PUSH	PSW	
	CALL	UPDT DATA	
	LXI	D, FFFF(H)	
	CALL	DELAY	
	MVI	A, 1B(H)	
	SIM		
	EI		
LOOP	JMP	LOOP	
20CE(H)	JMP	2200(H)	
2200(H)	POP	D	Increment the acc & if it is not less than 2 , go to the loop HALT
	LDA	2000(H)	
	INR	A	
	STA	2000(H)	
	CPI	02(H)	
	JNC	HLT	
	POP	PSW	
	PUSH	PSW	
	LXI	D, FFFF(H)	
	CALL	DELAY	
COUNT	POP	PSW	Add 01(H) with the acc & display its decimal equivalent with the delay of 1/10 <sup>th</sup> of a second.
	ADI	01(H)	
	DAA		
	PUSH	PSW	
	MVI	A, 1B(H)	
	SIM		
	EI		
	JMP	COUNT	
HALT	JNZ	START	If the content of the ac is not equal to 2 , go to START & again count from the beginning. Otherwise if RST 7.5 is pressed.
	LXI	D, FFFF(H)	
	CALL	DELAY	
	MVI	A, 1B(H)	
	SIM		
HERE	EI		
	JMP	HERE	

No. of bytes = 78

**Q 7. PROBLEM STATEMENT:** Design a digital clock with 24 hours, minutes, and second display with facility of time setting. a) at the start b) any time by pressing the “ VECT INT” key.

Label	Mnemonics		Comment
	Opcode	Operand	
Start	CALL	USER	Call for time set.
CSECOND:	POP	PSW	
	POP	H	
	PUSH	H	
	PUSH	PSW	
	MVI	A,01H	Update Data field
	CALL	0363H	according to A
SECOND:	POP	PSW	Set H-L pair
	PUSH	PSW	Update address field
	CALL	036EH	according to H-L pair
	LXI	D,FFFFH	
	CALL	05F1H	
	LXI	D,FFFFH	Delay for 1 second
	CALL	05F1H	
	POP	PSW	
	ADI	01H	Incrementing second &
	DAA		checking for 60 second
	CPI	60H	mark.
	JNC	MINUTE	Change minute, if it is 60
			sec
	PUSH	PSW	Else PSW is saved the
	JMP	SECOND	SECOND loop iscontinued
MINUTE:	SUB	A	Second is set to 0 &
	MOV	B,A	minute is incremented.
	POP	H	
	MOV	A,L	
	ADI	01H	
	DAA		
	CPI	60H	Check for 60 minute mark.
	JNC	HOUR	If 60 is reached adjust
			Hour
	MOV	L,A	
	PUSH	H	Else save the registers &
	PUSH	B	jump to CSECOND loop.
	JMP	CSECOND	
HOUR:	SUB	A	
	MOV	L,A	Minute is reset to 0.
	MOV	A,H	
	ADI	01H	
	DAA		Hour is incremented &
	CPI	24H	checked for 24 hour mark.
	MOV	H,A	
	CNC	CHANGE	If it is 24, then also reset
	PUSH	H	hour. Else continue the
	PUSH	B	counting.



End	JMP	CSECOND	
CHANGE:	SUB A		
20CEH	RET		
	JMP	2300H	
2300H(USER:)	CALL	01D7H	Blank Display
	POP	D	Pop the return address
	LXI	D,FFFFH	Delay for all the pulses for
	CALL	05F1H	Rst 7.5 to pass.
	MVI	A,1EH	Reset Rst 7.5 Flip Flop.
	SIM		
	EI		
	CALL	02E7H	Read keyboard.
	RLC		Rotate the received key In
	RLC		left direction 4 times
	RLC		
	RLC		
	PUSH	PSW	Push the received key.
	CALL	02E7H	Read keyboard.
	POP B		Adjust the hour digits
	ORA B		
	PUSH	PSW	Push the hour digits.
	CALL	02E7H	Read keyboard.
	RLC		Rotate the received key In
	RLC		left direction 4 times
	RLC		
	RLC		
	PUSH	PSW	Push the received key.
	CALL	02E7H	Read keyboard.
	POP	B	Adjust the minute digits
	ORA	B	
	POP	H	Merge with hour digits.
	MOV	L,A	
	PUSH	H	Push the hour & minute
			digits.
	CALL	02E7H	Push the received key.
	RLC		Read keyboard.
	RLC		Adjust the hour digits
	RLC		
	RLC		
	PUSH	PSW	Push the seconds digits.
	CALL	02E7H	Read keyboard.
	POP	B	Rotate the received key In
	ORA	B	left direction 4 times
	PUSH	B	
	MVI	PSW	Push the Seconds digits.
	SIM	A,0BH	Enable RST 7.5 again.
	EI		
	JMP	CSECOND	

No. of bytes = 87

**Q 8. PROBLEM STATEMENT:** Write a program to send serially the key code entered from the keyboard via SOD pin. Let the baud rate be 1.

Assuming the frame format is as following ----

1 start bit (low bit); 8 data bits; 4 stop bits (hi bits)

Label	Mnemonics		Comment
	Opcode	Operand	
Start	MVI	A,CEH	Enable Rst 5.5 interrupt & sending Hi bit through SOD pin
READ	SIM		
	EI		
READ	CALL	02E7H	Read Keyboard
	MOV	C,A	Load C register with Key value.
SERIALOUT	DI		Interrupt is disable to maintain baud rate
			Start bit is set as 0.
DATA	MVI	A,40H	8 data bits are set.
	MVI	B,08H	Set bits are send .
	SIM		Delay for 1 bit time
	LXI	D,XXXX	
	CALL	05F1H	
	MOV	A,C	Sim instruction for next bit to be send is arranged.
	RAR		
	MOV	C,A	
	MVI	A,80H	
	RAR		
	DCR	B	Decrement B
	JP	DATA	Used to send 1+8 bits.
	MVI	A,C0H	Sim instruction is arranged for 4 stop bits.
	SIM		Delay for 4 bit duration.
	LXI	D,YYYY	
	CALL	05F1H	
	EI		Enable interrupt for next keyboard read
	JMP	READ	

No. of bytes = 43