

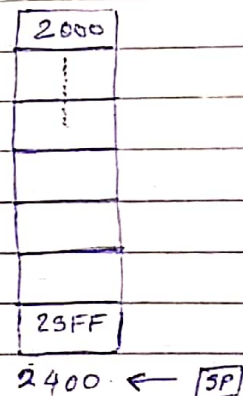
Stack & Subroutine :-

Points to remember about stack in 8085 μ p.

1. The stack in an 8085 microcomputer system can be described as a set of memory locations in the R/W memory, specified by a program in a main program.

2. $LXI\ SP, 16\ bit$ \rightarrow is the instruction for loading the Stack Pointer value.

The program initializes the stack pointer register at location $2400H$, one location beyond the user memory. This procedure is valid because the initialized location is never used for storing information. (Memory Address Space)



3. For storing information the instruction used here \rightarrow

- a. $PUSH\ B$
 - b. $PUSH\ D$
 - c. $PUSH\ H$
 - d. $PUSH\ PSW$
- } Copies the content of specified Register location into to Stack.

$PUSH\ B$

B	C
01	02

$PSW \rightarrow$ Program Status Word that is Content of $AC +$ Content of flags.

23FE	02
23FF	01

 $\leftarrow SP$

$[SP]$

* Pushing Operation — At first SP decreases by one position ($23FF$) & Content of Register B will be written. Then again SP decreases by one position ($23FE$) & Content of Register C will be written.

Finally SP will hold at location ($23FE$)_H.

4. For retrieving the information from stack the instructions used are :

- a. POP B
- b. POP D
- c. POP H
- d. POP PSW.

The content of SP will be copied to specify register pair.

POP PSW

(1) AC Flag Initial Condition

(1) $SP \leftarrow 23FE$ Memory location [SP points this mem. location]

After POP operation,

AC Flag

[01 | 02]

SP will be at location $(2400)_H$

23FE	02
23FF	01
2400	$\leftarrow SP$

* Content of memory location of 23FE & 23FF will not be changed automatically. It will change if some data is overwritten

Problem

Explain the content of SP location during execution of the following ~ Program.

Mem. Add.	Mnemonics
2000	LXI SP, 2400 H
2003	LXI H, 2050 H
2006	LXI B, 2280 H
2009	MOV A, M.
200A	PUSH H
200B	PUSH B
200C	PUSH PSW

Ans.

During PUSH operation:-

'SP location'

Initial.	2400
PUSH H	23FF
	23FE
PUSH B	23FD
	23FC
PUSH PSW	23FB
	23FA

Mem. Content	Mem. Add.
	2000
	2050
Flag	23FA
A	23FB
80	23FC
22	23FD
50	23FE
21	23FF
	2400 $\leftarrow SP$

201F POP PSW
2020 POP H
2021 POP B

Register	Content
A	(Data)
B	22
D	xx
H	21
SP	2400

During POP operation :-

Stack Contents	Content of Reg. after POP operation	Stack Pointer location
23FA (Flag) } POP PSW 23FB (A)	(A) Flag	23FA Initial Condition
23FC 80 } POP H 23FD 22 }	A F 22 80 H L	23FC After 1st POP
23FE 50 } POP B 23FF 21 }	21 50 B C	23FE After 2nd POP
		2400 After 3rd POP operation

Subroutine →

⊗ Prog 1 Memory location 2050H and 2051H contain 3FH and 42H respectively and register pair DE contains 856FH. Write instructions to exchange the contents of DE with the contents of the memory locations.

Ans. Before instruction

D	85	6F	E
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Memory	
3F	2050
42	2051

Instructions :

ADDRESS	Opcode	operand	Machine Code (Hex)
2000	LHLD	2050H	2A 50
2001			H 42 3F L
2002			20
2003	XCHG	—	EB H 85 6F L
			D 42 3F E
2004	SHLD	2050	12 50
2005			2050 6F
2006			2051 85
2007	HLT		76

PLANNER DIARY

* Prog 2 Registers BC contain 2793 H. & registers DE contain 3182 H. Write instructions to add these two 16 bit numbers, and place the sum in memory locations 2050 H & 2051 H.

Ans: Before Instructions: B 27 93 C
D 31 82 E

Instructions:

Address	opcode	Operand	Machine Code (Hex)
2000	MOV	A, C	AC \rightarrow 93 H
2001	ADD	E	E \rightarrow 82 H +
2002	MOV	L, A	Carry 1 / 15 H \therefore AC \leftarrow 15 H
2003	MOV	A, B	
2004	ADC**	D	AC \rightarrow 27 H
2005	MOV	H, A	D \rightarrow 31 H + 01 H carry 59 H \therefore AC \leftarrow 59 H.
\therefore Final. H 59 15 L			

** ADC D - Add register D with Accumulator With Carry.

Now Practice same program using 'DAD' instruction.

* Prog 3 Registers BC contain 8538 H and registers DE contain 62A5 H.

Write instructions to subtract the contents of DE from the contents of BC and place the result in BC.

Before Instruction B 85 38 C
D 62 A5 E

Ans: Instructions:

Address	opcode	Operand	Machine Code (Hex)
2000	MOV	A, C	AC \leftarrow 38
2001	SUB	E	E \leftarrow A5
2002	MOV	C, A	1 / 9. 3
2003	MOV	A, B	AC \leftarrow 85
2004	SBB*	D	D \leftarrow 62
2005	MOV	B, A	Carry - 23 Borrow - 01 22 H.
2006	HLT		\therefore AC \leftarrow 22 H
\therefore Final B 22 93 C			0000 (3) 1010 (A) 1 / 1001 (9) \therefore AC \leftarrow 93 H

* SBB - Subtract register (D) from Accumulator with carry/Borrow.

Programming of 8085 up:

- Data Fetching & Writing can be accomplished by (a) LDA-STA (b) LHLD-SHLB (c) LXI, MOV M, A, MOV A, M...

Prob. Addition of two 8 bit no. and SUM \rightarrow 16 bits.

Addition of two 8^{or} bit no. and Store result & Carry to two different Address locations

Prob. Subtraction of two 8 bit no. (Justify the result)
Take two cases +ve & -ve result.

Prob. Decimal Addition of two 8 bit no. and sum 16 bit in decimal.

LXI H 2050	\rightarrow Address of Data in H-L pair	<table border="1"><tr><td>Data 1</td><td>2050</td></tr><tr><td>Data 2</td><td>2051</td></tr></table>	Data 1	2050	Data 2	2051
Data 1	2050					
Data 2	2051					
MVI C, 00	\rightarrow Carry register - 00 ₁₁ .					
MOV A, M	\rightarrow $AC \leftarrow [M]$					
INX H	\rightarrow $H-L = H-L+1$					
ADD M	\rightarrow $[AC] + [M] = [AC]$					
DAA	\rightarrow Decimal Adjust					
JNC AHEAD	\rightarrow Is Carry? No, go to level AHEAD.					
INR C	\rightarrow YES INCREASE C register					
AHEAD: STA 200D	\rightarrow Store result					
MOV A, C	\rightarrow move $[A] \leftarrow$ Carry $[C]$					
STA 2501	\rightarrow store result.					
HLT.						

Here result is 16 bit. Content of

2501	2500
Result	Result

Now, Ex: 'DAA' - Decimal Adjust - Accumulator

- It will add '06' to LSB if AC is = 1 or contents of LSB A > F.
- It will add '60' to MSB if $\overset{\text{flag}}{CY} = 1$ or contents of MSB A > F.

\therefore Accumulator Content:

MSB	+	LSB
4 bits		4 bits

Immediate
 Now DAA only used after the ADDITION INSTRUCTION - ONLY.

So, Now take **Example 1:-**

2050 → 96D → (AC) 1001 0110 (BCD) Format.
 2051 → 69D → 0110 1001 (BCD) Format.
 DAA (AC) 1111 1111 (in Hex it is FFH).
 0110 0110

Carry → ① 0 1 1 0 0 1 0 1
 ∴ Final Result 0 1 D 6 5 D
 2501H 2500H Address location.
 ∴ final Result?
 2050H → 96D
 2051H → 69D
 2501H 2500H

NOTE: Here (AC) content after addition is FFH wher LSB & MSB both greater than 9 (or' in between A-F). So 66H added.

Example 2:-

2050 → 84D → 1000 0100 (BCD)
 2051 → 92D → 1001 0010 (BCD)

Carry → ① 0001 0110 (in Hex it is 016H)
 Now Accumulator Content is 016H LSB '6' < 9. OK but
 MSB 1 & CY = 1 (80,

'6' must be added with MSB.

Carry → ① 0001 0110
 DAA 0110 0000
 0111 0110
 ① 7 8 D
 2501H 2500H Address location.

So, final result:

2050H → 84D
 2051H → 92D
 2501H 2500H

Example 3

2050 \rightarrow 98_D \rightarrow 1001 1000 (BCD)

2051 \rightarrow 99_D \rightarrow 1001 1001 (BCD)

1001 1000 \rightarrow 31_H

Cy generated

Auxiliary Carry (generated)

Now Accumulator content is 31_H and both AC & CY flag generated so, '6' must be added with both MSB & LSB.

AC 0011 0001
0110 0110

0110 0110
1001 0111
3 7_D

2501_H

2500_H

Address/location

\therefore Final Result.

2050 \rightarrow 98_D

2051 \rightarrow 99_D

01	97
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2501

2500