QN 1. Store 8-bit data in memory

Statement: **Store the data byte 32H into memory location 4000H.**

Program 1:

MVI A, 52H : Store 32H in the accumulator

STA 4000H : Copy accumulator contents at address 4000H

HLT : Terminate program execution

Program 2:

LXI H 4000H : Load HL with 4000H

MVI M, 32H : Store 32H in memory location pointed by HL register pair (4000H)

HLT : Terminate program execution

Note: The result of both programs will be the same. In program 1 direct addressing instruction is used, whereas in program 2 indirect addressing instructions is used.

QN 2. Exchange the contents of memory locations

Statement: **Exchange the contents of memory locations 2000H and 4000H.**

Program 1:

LDA 2000H : Get the contents of memory location 2000H into accumulator

MOV B, A : Save the contents into B register

LDA 4000H : Get the contents of memory location 4000Hinto accumulator

STA 2000H : Store the contents of accumulator at address 2000H

MOV A, B : Get the saved contents back into A register

STA 4000H : Store the contents of accumulator at address 4000H

Program 2:

LXI H 2000H : Initialize HL register pair as a pointer to memory location 2000H.

LXI D 4000H : Initialize DE register pair as a pointer to memory location 4000H.

MOV B, M : Get the contents of memory location 2000H into B register.

LDAX D : Get the contents of memory location 4000H into A register.

MOV M, A : Store the contents of A register into memory location 2000H.

MOV A, B : Copy the contents of B register into accumulator.

STAX D : Store the contents of A register into memory location 4000H.

HLT : Terminate program execution.

Note: In Program 1, direct addressing instructions are used, whereas in Program 2, indirect addressing instructions are used.

QN 3. Add two 8-bit numbers

Statement: **Add the contents of memory locations 4000H and 4001H and place the result in memory location 4002H.**

Sample problem

(4000H) = 14H

(4001H) = 89H

Result = 14H + 89H = 9DH

Source program

LXI H 4000H : HL points 4000H

MOV A, M : Get first operand

INX H : HL points 4001H

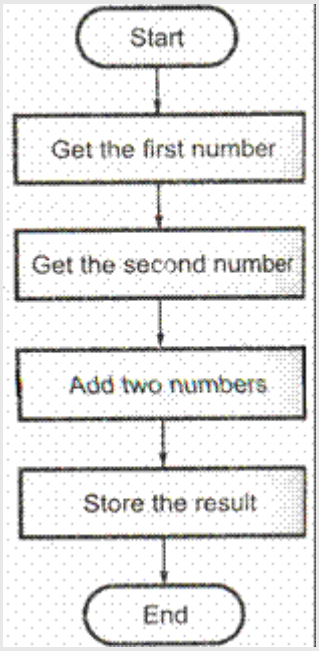
ADD M : Add second operand

INX H : HL points 4002H

MOV M, A : Store result at 4002H

HLT : Terminate program execution

Flowchart



Note: In Program 1, direct addressing instructions are used, whereas in Program 2, indirect addressing instructions are used.

QN 1. Add two 16-bit numbers

Statement: **Add the 16-bit number in memory locations 4000H and 4001H to the 16-bit number in memory locations 4002H and 4003H. The most significant eight bits of the two numbers to be added are in memory locations 4001H and 4003H. Store the result in memory locations 4004H and 4005H with the most significant byte in memory location 4005H.**

Program - 5.a: Add two 16-bit numbers - Source Program 1

Sample problem:

(4000H) = 15H

(4001H) = 1CH

(4002H) = B7H

(4003H) = 5AH

Result = 1C15 + 5AB7H = 76CCH

(4004H) = CCH

(4005H) = 76H

Source Program 1:

LHLD 4000H : Get first I6-bit number in HL

XCHG : Save first I6-bit number in DE

LHLD 4002H : Get second I6-bit number in HL

MOV A, E : Get lower byte of the first number

ADD L : Add lower byte of the second number

MOV L, A : Store result in L register

MOV A, D : Get higher byte of the first number

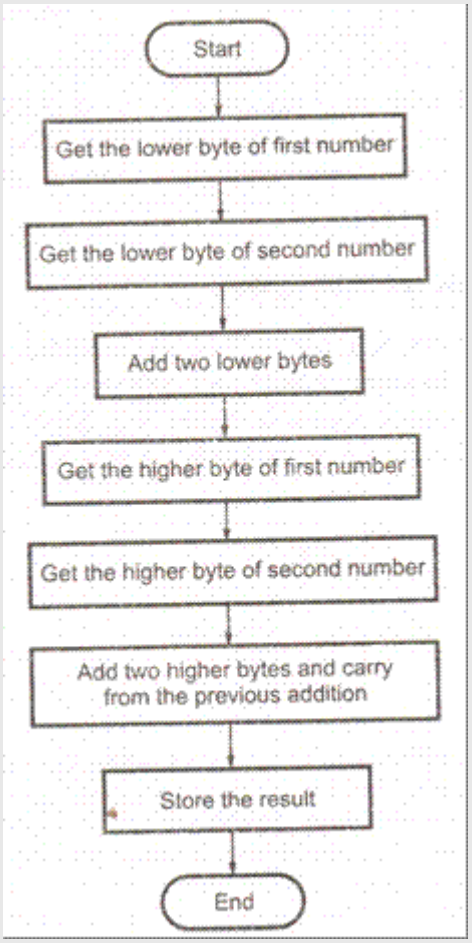
ADC H : Add higher byte of the second number with CARRY

MOV H, A : Store result in H register

SHLD 4004H : Store I6-bit result in memory locations 4004H and 4005H.

HLT : Terminate program execution

Flowchart



Program - 5b: Add two 16-bit numbers - Source Program 2

Source program 2:

LHLD 4000H : Get first I6-bit number

XCHG : Save first I6-bit number in DE

LHLD 4002H : Get second I6-bit number in HL

DAD D : Add DE and HL

SHLD 4004H : Store I6-bit result in memory locations 4004H and 4005H.

HLT : Terminate program execution

NOTE: In program 1, eight bit addition instructions are used (ADD and ADC) and addition is performed in two steps. First lower byte addition using ADD instruction and then higher byte addition using ADC instruction.In program 2, 16-bit addition instruction (DAD) is used.

QN 1. Subtract two 8-bit numbers

Statement: **Subtract the contents of memory location 4001H from the memory location 2000H and place the result in memory location 4002H.**

Program - 4: Subtract two 8-bit numbers

Sample problem:

(4000H) = 51H

(4001H) = 19H

Result = 51H - 19H = 38H

Source program:

LXI H, 4000H : HL points 4000H

MOV A, M : Get first operand

INX H : HL points 4001H

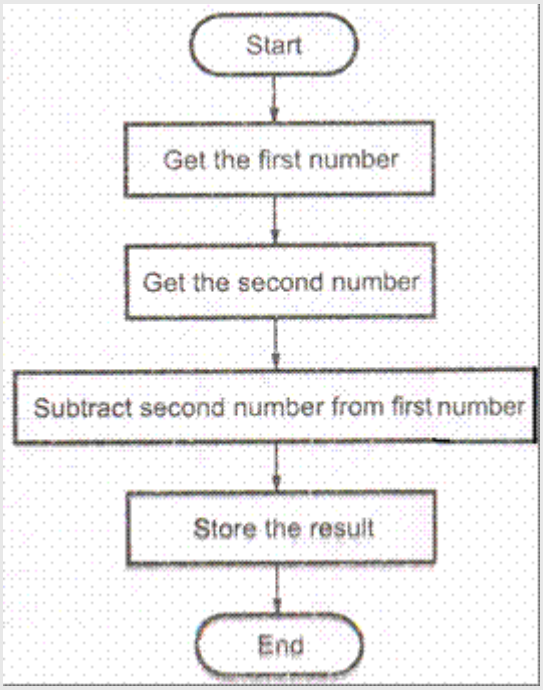
SUB M : Subtract second operand

INX H : HL points 4002H

MOV M, A : Store result at 4002H.

HLT : Terminate program execution

Flowchart



QN 1. Add contents of two memory locations

Statement: **Add the contents of memory locations 40001H and 4001H and place the result in the memory locations 4002Hand 4003H.**

Sample problem:

(4000H) = 7FH

(400lH) = 89H

Result = 7FH + 89H = lO8H

(4002H) = 08H

(4003H) = 0lH

Source program:

```
LXI H, 4000H :HL Points 4000H
MOV A, M :Get first operand
INX H :HL Points 4001H
ADD M :Add second operand
```

INX H :HL Points 4002H

MOV M, A :Store the lower byte of result at 4002H

MVIA, 00 :Initialize higher byte result with 00H

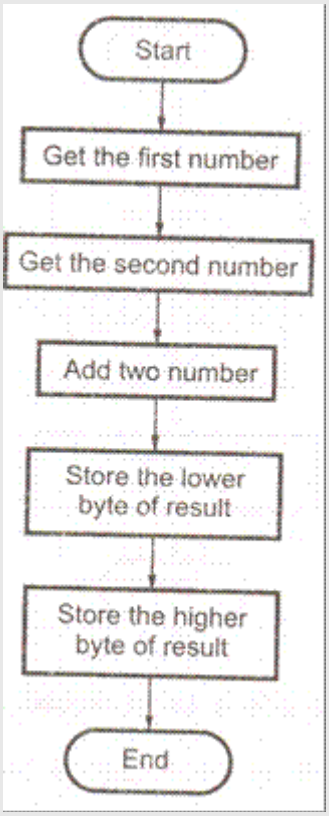
ADC A :Add carry in the high byte result

INX H :HL Points 4003H

MOV M, A :Store the higher byte of result at 4003H

HLT :Terminate program execution

Flowchart



QN 1. Subtract two 16-bit numbers

Statement: **Subtract the 16-bit number in memory locations 4002H and 4003H from the 16-bit number in memory locations 4000H and 4001H. The most significant eight bits of the two numbers are in memory locations 4001H and 4003H. Store the result in memory locations 4004H and 4005H with the most significant byte in memory location 4005H.**

Sample problem:

***(*4000H) = 19H**

(400IH) = 6AH

(4004H) = I5H (4003H) = 5CH

Result = 6A19H - 5C15H = OE04H

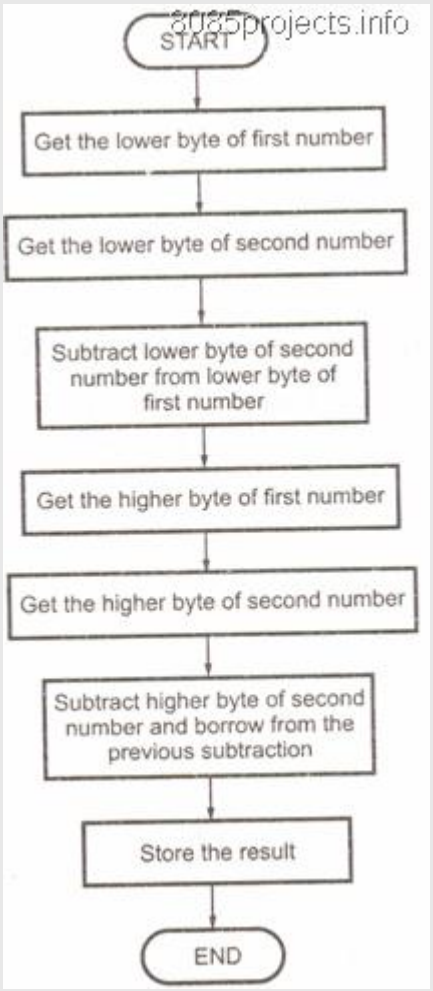
(4004H) = 04H

(4005H) = OEH

Source program:

```
LHLD 4000H : Get first 16-bit number in HL

XCHG : Save first 16-bit number in DE

LHLD 4002H : Get second 16-bit number in HL

MOV A, E : Get lower byte of the first number

SUB L : Subtract lower byte of the second number

MOV L, A : Store the result in L register

MOV A, D : Get higher byte of the first number

SBB H : Subtract higher byte of second number with borrow

MOV H, A : Store l6-bit result in memory locations 4004H and 4005H.

SHLD 4004H : Store l6-bit result in memory locations 4004H and 4005H.

HLT : Terminate program execution.
```

Flowchart



QN 1. Finding one's complement of a number

Statement: **Find the l's complement of the number stored at memory location 4400H and store the complemented number at memory location 4300H.**

Sample problem:

(4400H) = 55H

Result = (4300B) = AAB

Source program:

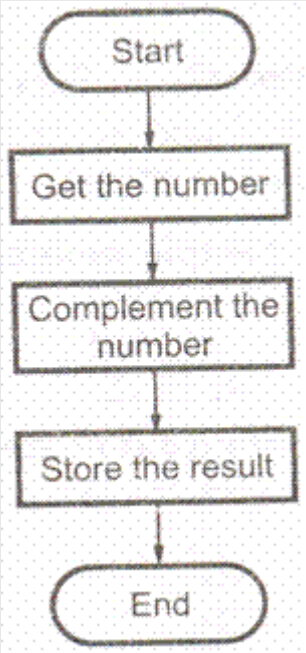
LDA 4400B : Get the number

CMA : Complement number

STA 4300H : Store the result

HLT : Terminate program execution

Flowchart



QN 1. Finding Two's complement of a number

Statement: **Find the 2's complement of the number stored at memory location 4200H and store the complemented number at memory location 4300H.**

Sample problem:

(4200H) = 55H

Result = (4300H) = AAH + 1 = ABH

Source program:

LDA 4200H : Get the number

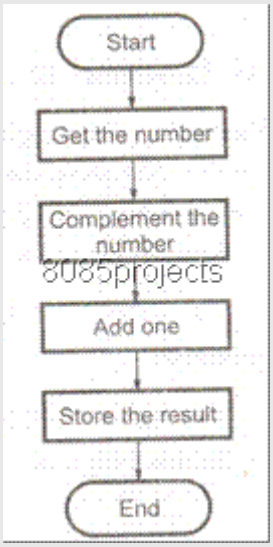
CMA : Complement the number

ADI, 01 H : Add one in the number

STA 4300H : Store the result

HLT : Terminate program execution

Flowchart



QN 1. Pack the unpacked BCD numbers

Statement: **Pack the two unpacked BCD numbers stored in memory locations 4200H and 4201H and store result in memory location 4300H. Assume the least significant digit is stored at 4200H.**

Sample problem:

(4200H) = 04

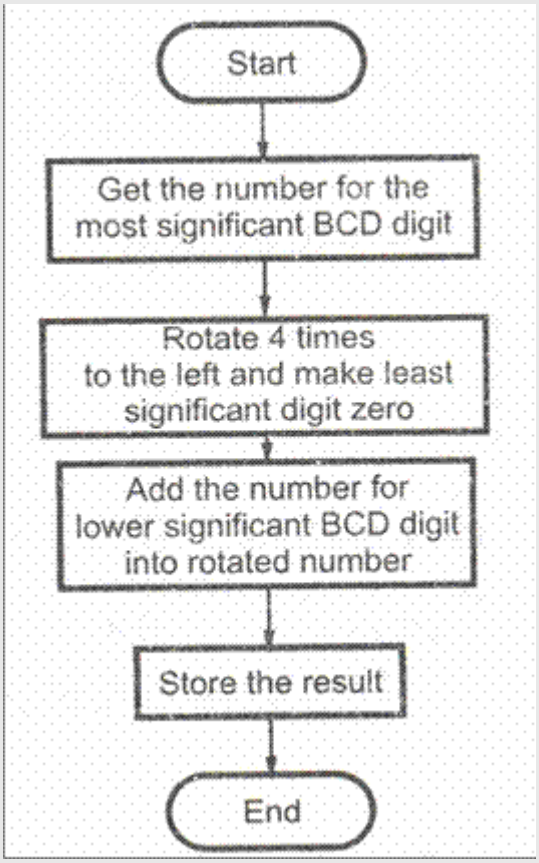
(4201H) = 09

Result = (4300H) = 94

Source program:

- *LDA 4201H : Get the Most significant BCD digit*
- *RLC*
- *RLC*
- *RLC*
- *RLC : Adjust the position of the second digit (09 is changed to 90)*
- *ANI FOH : Make least significant BCD digit zero*
- *MOV C, A : store the partial result*
- *LDA 4200H : Get the lower BCD digit*
- *ADD C : Add lower BCD digit*
- *STA 4300H : Store the result*
- *HLT : Terminate program execution*

Flowchart



QN 1. Unpack a BCD number

Statement: **Two digit BCD number is stored in memory location 4200H. Unpack the BCD number and store the two digits in memory locations 4300H and 4301H such that memory location 4300H will have lower BCD digit.**

Sample problem:

(4200H) = 58

Result = (4300H) = 08 and

(4301H) = 05

Source program:

LDA 4200H : Get the packed BCD number

ANI FOH : Mask lower nibble

RRC

RRC

RRC

RRC : Adjust higher BCD digit as a lower digit

STA 4301H : Store the partial result

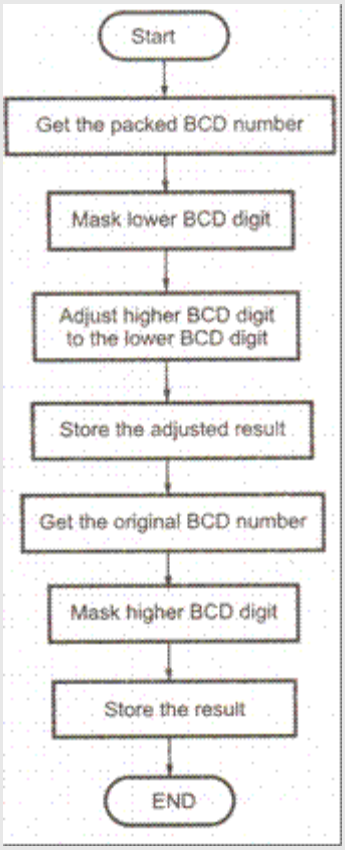
LDA 4200H : .Get the original BCD number

ANI OFH : Mask higher nibble

STA 4201H : Store the result

HLT : Terminate program execution

Flowchart



QN 1. Execution format of instructions

Statement: **Read the program given below and state the contents of all registers after the execution of each instruction in sequence.**

Main program:

4000H LXI SP, 27FFH

4003H LXI H, 2000H

4006H LXI B, 1020H

4009H CALL SUB

400CH HLT

Subroutine program:

4100H SUB: PUSH B

4101H PUSH H

4102H LXI B, 4080H

4105H LXI H, 4090H

4108H SHLD 2200H

4109H DAD B

410CH POP H

410DH POP B

410EH RET

Note:

The table given gives the instruction sequence and the contents of all register and stack after execution of each instruction.

TABLE

Sr. No.	Instructions	Registers contents in Hex									Memory locations (addresses are in HEX)
		A	B	C	D	E	H	L	SP	PC	
1	LXI SP ,27FF	X	X	X	X	X	X	X	27FF	*4003*	
2	LXI H,2000	X	X	X	X	X	*20*	00	27FF	4006	
3	LXI 8,1020	X	10	20	X	X	20	00	27FF	4009	
4	CALL SUB	X	10	20	X	X	*20*	00	27FO	4100	(27FE -- 40, 27FD –0C)
5	PUSH B	X	10	20	X	X	20	00	27FB	4101	(27Fe – *10*, 27FB – 20)
6	PUSH H	X	10	20	X	X	20	00	27F9	4102	(27FA -- 20, 27F9 – 00)
7	LXI B,4080	X	40	80	X	X	20	00	27F9	4105	
8	LXI H,4090	X	*40*	*80*	X	X	40	90	27F9	4108	
9	DAD B	X	40	80	X	X	81	10	27F9	4109	
10	SHLD 2200	X	40	80	X	X	81	10	27F9	410C	(2200 --10, 2201 – 81)
11	POP H	X	40	*80*	X	X	*20*	*00*	27FB	4100	
12	POP B	X	*10*	20	X	X	20	00	27FD	410E	
13	RET	X	10	20	X	X	*20*	00	27FF	400C	
14	HLT	X	10	20	X	X	20	00	27FF	4000	

QN 1. Right shift, bit of data(8 bit and 16 bit)

Statement: **Write a program to shift an eight bit data four bits right. Assume data is in register C.**

Sample problem:

(4200H) = 58

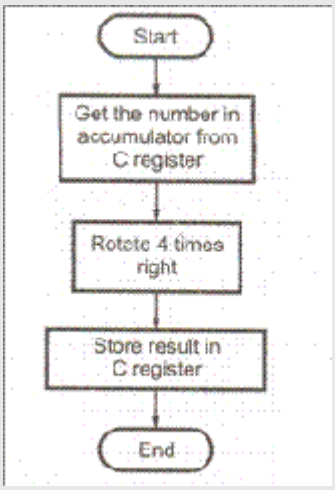
Result = (4300H) = 08 and

(4301H) = 05

Source program 1:

- ***MOV A, C***
- ***RAR***
- ***RAR***
- ***RAR***
- ***RAR***
- ***MOV C, A***
- ***HLT***

Flowchart for Source program1

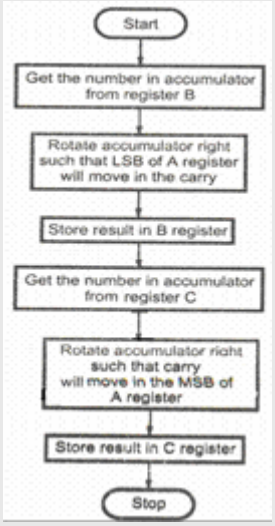


Statement: **Write a program to shift a 16 bit data, 1 bit right. Assume that data is in BC register pair.**

Source program 2

Flowchart for Source program1

- ***MOV A, B***
- ***RAR***
- ***MOV B, A***
- ***MOV A, C***
- ***RAR***
- ***MOV C, A***
- ***HLT***



QN 1. Left Shifting of a 16-bit data

Statement: **Program to shift a 16-bit data 1 bit left. Assume data is in the HL register**

Source Program

```
HL= 1025 =0001  0000  0010  0101

                HL = 0001  0000  0010  0101
              +HL = 0001  0000  0010  0101
             ------------------------------------
           Result = 0010  0000  0100  1010
```

Alter the contents of flag register in 8085

Statement: **Write a set of instructions to alter the contents of flag register in 8085.**

- ***PUSH PSW: Save flags on stack***
- ***POP H: Retrieve flags in 'L'***
- ***MOV A, L :Flags in accumulator***
- ***CMA:Complement accumulator***
- ***MOV L, A:Accumulator in 'L'***
- ***PUSH H:Save on stack***
- ***POP PSW:Back to flag register***
- ***HLT:Terminate program execution***

QN 1. Calculate the sum of series of numbers

Statement: **Calculate the sum of series of numbers. The length of the series is in memory location 4200H and the series begins from memory location 4201H.**

a. Consider the sum to be 8 bit number. So, ignore carries. Store the sum at memory location 4300H.

b. Consider the sum to be 16 bit number. Store the sum at memory locations 4300H and 4301H.

Sample problem 1:

4200H = 04H

4201H = 10H

4202H = 45H

4203H = 33H

4204H = 22H

Result = 10 +41 + 30 + 12 = H

4300H = H

Source program 1:

LDA 4200H

MOV C, A : Initialize counter

SUB A : sum = 0

LXI H, 420lH : Initialize pointer

BACK: ADD M : SUM = SUM + data

INX H : increment pointer

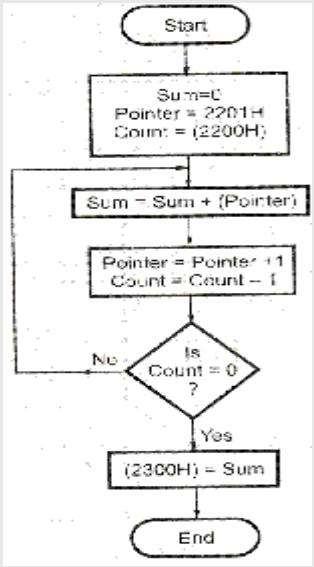
DCR C : Decrement counter

JNZ BACK : if counter 0 repeat

STA 4300H : Store sum

HLT : Terminate program execution

Flowchart for Source program1



Sample problem 2:

4200H = 04H

420lH = 9AH

4202H = 52H

4203H = 89H

4204H = 3EH

Result = 9AH + 52H + 89H + 3EH = H

4300H = B3H Lower byte

4301H = 0lH Higher byte

Source program 2

```
LDA 4200H
MOV C, A : Initialize counter
LXI H, 4201H : Initialize pointer
SUB A :Sum low = 0
MOV B, A : Sum high = 0
BACK: ADD M : Sum = sum + data
JNC SKIP
INR B : Add carry to MSB of SUM
SKIP: INX H : Increment pointer
DCR C : Decrement counter
JNZ BACK : Check if counter 0 repeat
STA 4300H : Store lower byte
MOV A, B
STA 4301H : Store higher byte
HLT :Terminate program execution
```

QN 1. Multiply two 8-bit numbers

Statement: **Multiply two 8-bit numbers stored in memory locations 2200H and 2201H by repetitive addition and store the result in memory locations 2300H and 2301H.**

Sample problem 1:

(2200H) = 03H

(2201H) = B2H

Result = B2H + B2H + B2H = 216H

= 216H

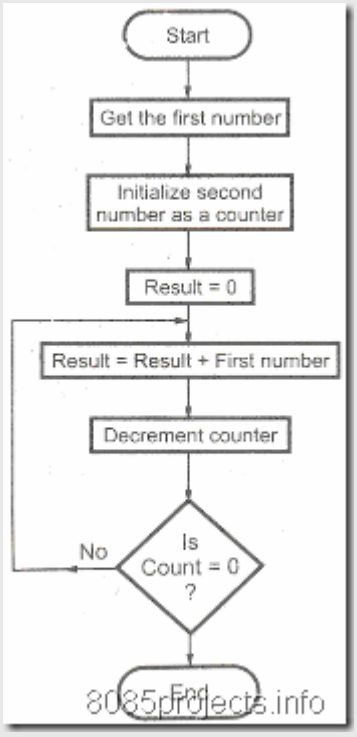
(2300H) = 16H

(2301H) = 02H

Source program :

- ***LDA 2200H***
- ***MOV E, A***
- ***MVI D, 00 : Get the first number in DE register pair***
- ***LDA 2201H***
- ***MOV C, A : Initialize counter***
- ***LX I H, 0000 H : Result = 0***
- ***BACK: DAD D : Result = result + first number***
- ***DCR C : Decrement count***
- ***JNZ BACK : If count 0 repeat***
- ***SHLD 2300H : Store result***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Divide a 16 bit number by a 8-bit number

Statement: **Divide 16 bit number stored in memory locations 2200H and 2201H by the 8 bit number stored at memory location 2202H. Store the quotient in memory locations 2300H and 2301H and remainder in memory locations 2302H and 2303H.**

Sample problem 1:

(2200H) = 60H

(2201H) = A0H

(2202H) = l2H

Result = A060H/12H = 8E8H Quotient and 10H remainder

(2300H) = E8H

(2301H) = 08H

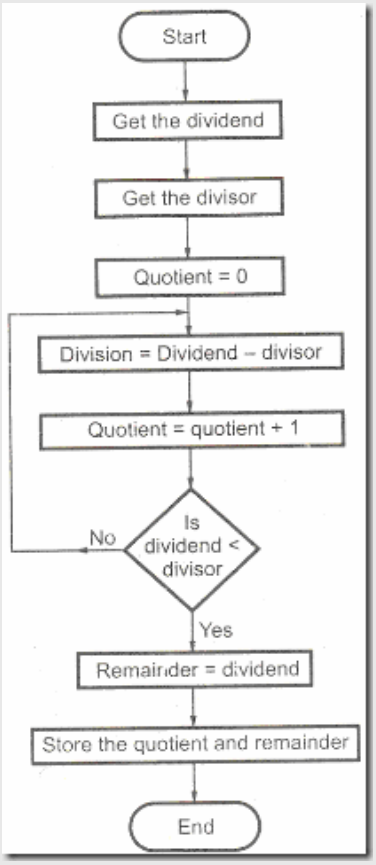
(2302H= 10H

(2303H) 00H

Source program :

- ***LHLD 2200H : Get the dividend***
- ***LDA 2202H : Get the divisor***
- ***MOV C, A***
- ***LXI D, 0000H : Quotient = 0***
- ***BACK: MOV A, L***
- ***SUB C : Subtract divisor***
- ***MOV L, A : Save partial result***
- ***JNC SKIP : if CY 1 jump***
- ***DCR H : Subtract borrow of previous subtraction***
- ***SKIP: INX D : Increment quotient***
- ***MOV A, H***
- ***CPI, 00 : Check if dividend < divisor***
- ***JNZ BACK : if no repeat***
- ***MOV A, L***
- ***CMP C***
- ***JNC BACK***
- ***SHLD 2302H : Store the remainder***
- ***XCHG***
- ***SHLD 2300H : Store the quotient***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Find the negative numbers in a block of data.

Statement: **Find the number of negative elements (most significant bit 1) in a block of data. The length of the block is in memory location 2200H and the block itself begins in memory location 2201H. Store the number of negative elements in memory location 2300H**

Sample problem 1:

(2200H) = 04H

(2201H) = 56H

(2202H) = A9H

(2203H) = 73H

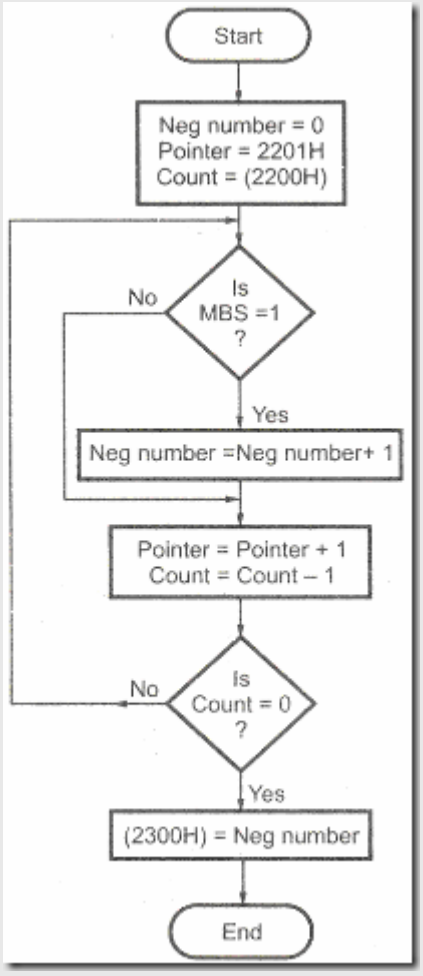
(2204H) = 82H

Result = 02 since 2202H and 2204H contain numbers with a MSB of 1.

Source program :

- ***LDA 2200H***
- ***MOV C, A : Initialize count***
- ***MVI B, 00 : Negative number = 0***
- ***LXI H, 2201H : Initialize pointer***
- ***BACK: MOV A, M : Get the number***
- ***ANI 80H : Check for MSB***
- ***JZ SKIP : If MSB = 1***
- ***INR B : Increment negative number count***
- ***SKIP: INX H : Increment pointer***
- ***DCR C : Decrement count***
- ***JNZ BACK : If count 0 repeat***
- ***MOV A, B***
- ***STA 2300H : Store the result***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Find the largest of given numbers

Statement: **Find the largest number in a block of data. The length of the block is in memory location 2200H and the block itself starts from memory location 2201H.**

Store the maximum number in memory location 2300H. Assume that the numbers in the block are all 8 bit unsigned binary numbers.

Sample problem 1:

(2200H) = 04

(2201H) = 34H

(2202H) = A9H

(2203H) = 78H

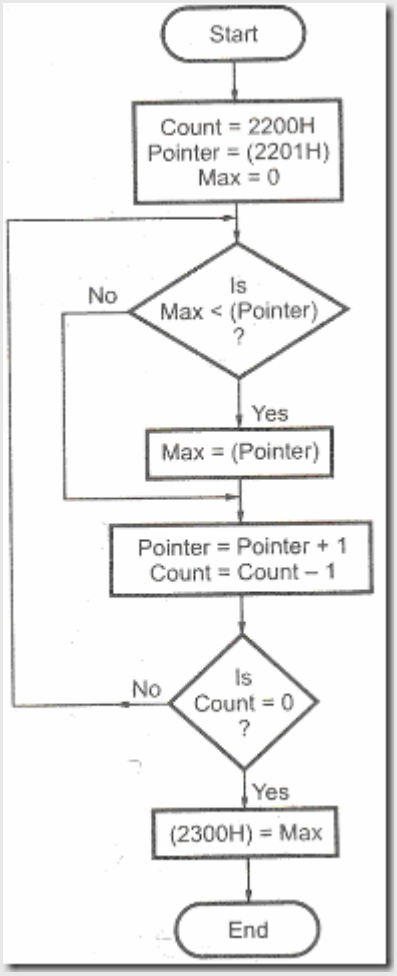
(2204H) =56H

Result = (2202H) = A9H

Source program :

- ***LDA 2200H***
- ***MOV C, A : Initialize counter***
- ***XRA A : Maximum = Minimum possible value = 0***
- ***LXI H, 2201H : Initialize pointer***
- ***BACK: CMP M : Is number> maximum***
- ***JNC SKIP : Yes, replace maximum***
- ***MOV A, M***
- ***SKIP: INX H***
- ***DCR C***
- ***JNZ BACK***
- ***STA 2300H : Store maximum number***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Count number of one's in a number

Statement: **Write a program to count number of l's in the contents of D register and store the count in the B register.**

Sample problem 1:

(2200H) = 04

(2201H) = 34H

(2202H) = A9H

(2203H) = 78H

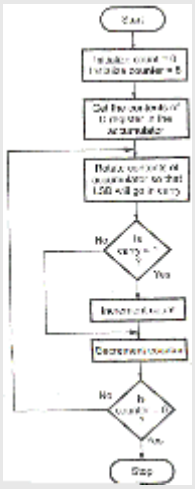
(2204H) =56H

Result = (2202H) = A9H

Source program :

- ***MVI B, 00H***
- ***MVI C, 08H***
- ***MOV A, D***
- ***BACK: RAR***
- ***JNC SKIP***
- ***INR B***
- ***SKIP: DCR C***
- ***JNZ BACK***
- ***HLT***

Flowchart for program



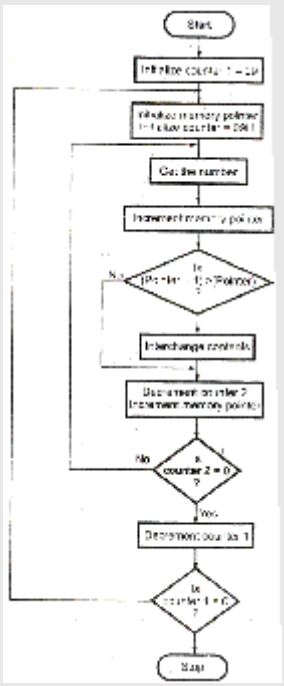
QN 1. Arrange in ascending order

Statement: **Write a program to sort given 10 numbers from memory location 2200H in the ascending order.**

Source program :

- ***MVI B, 09 : Initialize counter***
- ***START : LXI H, 2200H: Initialize memory pointer***
- ***MVI C, 09H : Initialize counter 2***
- ***BACK: MOV A, M : Get the number***
- ***INX H : Increment memory pointer***
- ***CMP M : Compare number with next number***
- ***JC SKIP : If less, don't interchange***
- ***JZ SKIP : If equal, don't interchange***
- ***MOV D, M***
- ***MOV M, A***
- ***DCX H***
- ***MOV M, D***
- ***INX H : Interchange two numbers***
- ***SKIP:DCR C : Decrement counter 2***
- ***JNZ BACK : If not zero, repeat***
- ***DCR B : Decrement counter 1***
- ***JNZ START***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Calculate the sum of series of even numbers

Statement: **Calculate the sum of series of even numbers from the list of numbers. The length of the list is in memory location 2200H and the series itself begins from memory location 2201H. Assume the sum to be 8 bit number so you can ignore carries and store the sum at memory location 2210H.**

Sample problem 1:

2200H= 4H

2201H= 20H

2202H= l5H

2203H= l3H

2204H= 22H

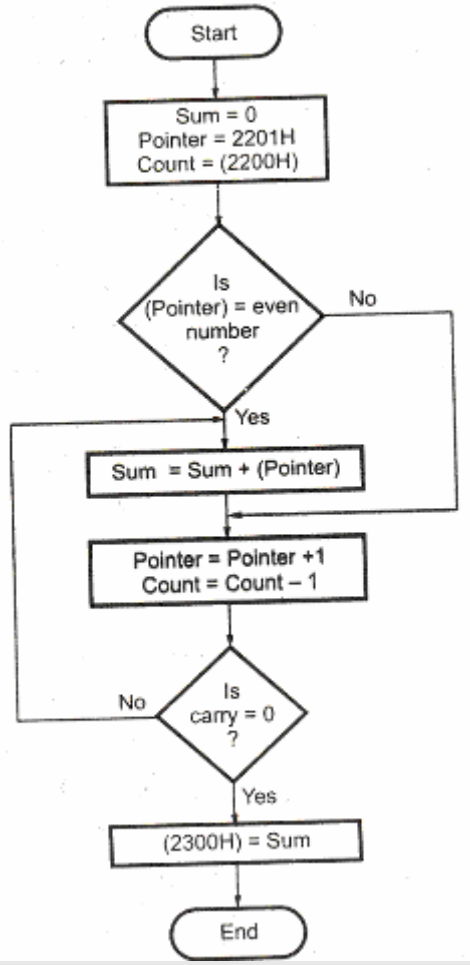
Result 22l0H= 20 + 22 = 42H

= 42H

Source program :

- ***LDA 2200H***
- ***MOV C, A : Initialize counter***
- ***MVI B, 00H : sum = 0***
- ***LXI H, 2201H : Initialize pointer***
- ***BACK: MOV A, M : Get the number***
- ***ANI 0lH : Mask Bit l to Bit7***
- ***JNZ SKIP : Don't add if number is ODD***
- ***MOV A, B : Get the sum***
- ***ADD M : SUM = SUM + data***
- ***MOV B, A : Store result in B register***
- ***SKIP: INX H : increment pointer***
- ***DCR C : Decrement counter***
- ***JNZ BACK : if counter 0 repeat***
- ***STA 2210H : store sum***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. Calculate the sum of series of odd numbers

Statement: **Calculate the sum of series of odd numbers from the list of numbers. The length of the list is in memory location 2200H and the series itself begins from memory location 2201H. Assume the sum to be 16-bit. Store the sum at memory locations 2300H and 2301H.**

Sample problem 1:

2200H = 4H

2201H= 9AH

2202H= 52H

2203H= 89H

2204H= 3FH

Result = 89H + 3FH = C8H

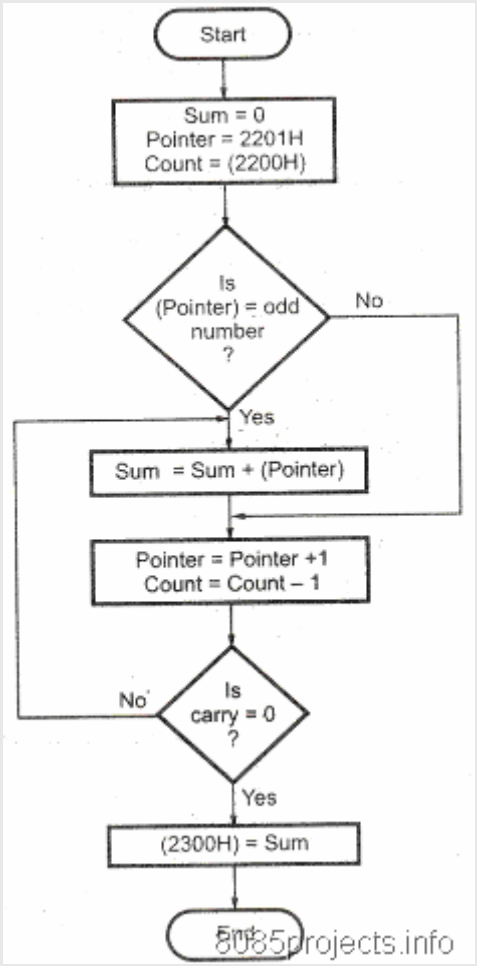
2300H= H Lower byte

2301H = H Higher byte

Source program :

- *LDA 2200H*
- *MOV C, A : Initialize counter*
- *LXI H, 2201H : Initialize pointer*
- *MVI E, 00 : Sum low = 0*
- *MOV D, E : Sum high = 0*
- *BACK: MOV A, M : Get the number*
- *ANI 0lH : Mask Bit 1 to Bit7*
- *JZ SKIP : Don't add if number is even*
- *MOV A, E : Get the lower byte of sum*
- *ADD M : Sum = sum + data*
- *MOV E, A : Store result in E register*
- *JNC SKIP*
- *INR D : Add carry to MSB of SUM*
- *SKIP: INX H : Increment pointer*

Flowchart for program



QN 1. Find the square of given number

Statement: **Find the square of the given numbers from memory location 6100H and store the result from memory location 7000H.**

Sample problem 1:

2200H = 4H

2201H= 9AH

2202H= 52H

2203H= 89H

2204H= 3FH

Result = 89H + 3FH = C8H

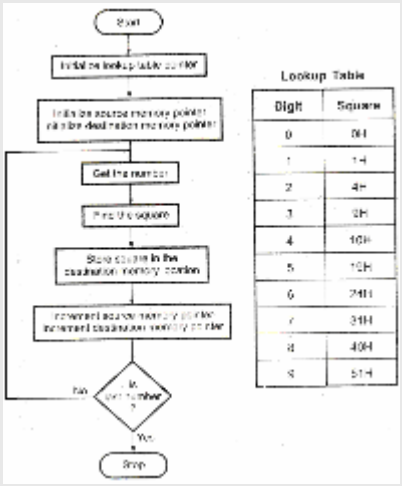
2300H= H Lower byte

2301H = H Higher byte

Source program :

- *LXI H, 6200H : Initialize lookup table pointer*
- *LXI D, 6100H : Initialize source memory pointer*
- *LXI B, 7000H : Initialize destination memory pointer*
- *BACK: LDAX D : Get the number*
- *MOV L, A : A point to the square*
- *MOV A, M : Get the square*
- *STAX B : Store the result at destination memory location*
- *INX D : Increment source memory pointer*
- *INX B : Increment destination memory pointer*
- *MOV A, C*
- *CPI 05H : Check for last number*
- *JNZ BACK : If not repeat*
- *HLT : Terminate program execution*

Flowchart for program



QN 1. Add two decimal numbers of 6 digit each

Statement: **Two decimal numbers six digits each, are stored in BCD package form. Each number occupies a sequence of byte in the memory. The starting address of first number is 6000H Write an assembly language program that adds these two numbers and stores the sum in the same format starting from memory location 6200H.**

Source program :

Flowchart for program

- *LXI H, 6000H : Initialize pointer l to first number*
- *LXI D, 6l00H : Initialize pointer2 to second number*
- *LXI B, 6200H : Initialize pointer3 to result*
- *STC*
- *CMC : Carry = 0*
- *BACK: LDAX D : Get the digit*
- *ADD M : Add two digits*
- *DAA : Adjust for decimal*
- *STAX.B : Store the result*
- *INX H : Increment pointer 1*

- *INX D : Increment pointer2*
- *INX B : Increment result pointer*
- *MOV A, L*
- *CPI 06H : Check for last digit*
- *JNZ BACK : If not last digit repeat*
- *HLT : Terminate program execution*

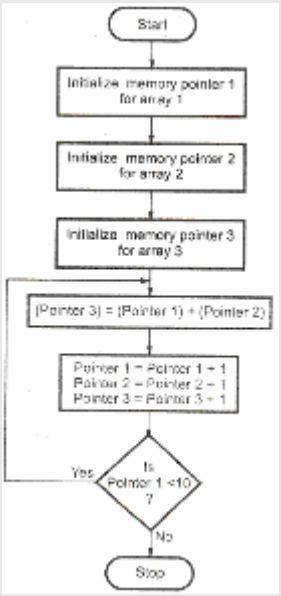
QN 1. Add each element of array with the elements of another array

Statement: **Two decimal numbers six digits each, are stored in BCD package form. Each number occupies a sequence of byte in the memory. The starting address of first number is 6000H Write an assembly language program that adds these two numbers and stores the sum in the same format starting from memory location 6200H.**

Source program :

- *LXI H, 6000H : Initialize pointer l to first number*
- *LXI D, 6l00H : Initialize pointer2 to second number*
- *LXI B, 6200H : Initialize pointer3 to result*
- *STC*
- *CMC : Carry = 0*
- *BACK: LDAX D : Get the digit*
- *ADD M : Add two digits*
- *DAA : Adjust for decimal*
- *STAX.B : Store the result*
- *INX H : Increment pointer 1*
- *INX D : Increment pointer2*
- *INX B : Increment result pointer*
- *MOV A, L*
- *CPI 06H : Check for last digit*
- *JNZ BACK : If not last digit repeat*
- *HLT : Terminate program execution*

Flowchart for program



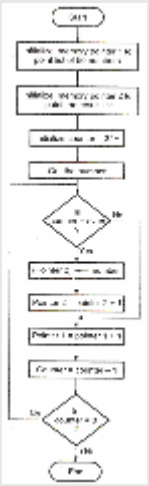
QN 1. Separate even numbers from given numbers

Statement: **Write an assembly language program to separate even numbers from the given list of 50 numbers and store them in the another list starting from 2300H. Assume starting address of 50 number list is 2200H.**

Source program :

- *LXI H, 2200H : Initialize memory pointer l*
- *LXI D, 2300H : Initialize memory pointer2*
- *MVI C, 32H : Initialize counter*
- *BACK:MOV A, M : Get the number*
- *ANI 0lH : Check for even number*
- *JNZ SKIP : If ODD, don't store*
- *MOV A, M : Get the number*
- *STAX D : Store the number in result list*
- *INX D : Increment pointer 2*
- *SKIP: INX H : Increment pointer l*
- *DCR C : Decrement counter*
- *JNZ BACK : If not zero, repeat*
- *HLT : Stop*

Flowchart for program



QN 1. Transfer contents to overlapping memory blocks

Statement: **Write assembly language program with proper comments for the following:**

A block of data consisting of 256 bytes is stored in memory starting at 3000H. This block is to be shifted (relocated) in memory from 3050H onwards. Do not shift the block or part of the block anywhere else in the memory.

Two blocks (3000 - 30FF and 3050 - 314F) are overlapping. Therefore it is necessary to transfer last byte first and first byte last.

Source Program:

- *MVI C, FFH : Initialize counter*
- *LX I H, 30FFH : Initialize source memory pointer 3l4FH*
- *LXI D, 314FH : Initialize destination memory pointer*
- *BACK: MOV A, M : Get byte from source memory block*
- *STAX D : Store byte in the destination memory block*
- *DCX H : Decrement source memory pointer*
- *DCX : Decrement destination memory pointer*
- *DCR C : Decrement counter*
- *JNZ BACK : If counter 0 repeat*
- *HLT : Stop execution*

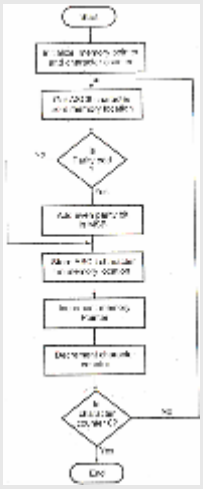
QN 1. Add parity bit to 7-bit ASCII characters

Statement: **Add even parity to a string of 7-bit ASCII characters. The length of the string is in memory location 2040H and the string itself begins in memory location 2041H. Place even parity in the most significant bit of each character.**

Source program :

- *LXI H, 2040H*
- *MOV C ,M : Counter for character*
- *REPEAT:INX H : Memory pointer to character*
- *MOV A,M : Character in accumulator*
- *ORA A : ORing with itself to check parity.*
- *JPO PAREVEN : If odd parity place*
- *ORI 80H even parity in D7 (80).*
- *PAREVEN:MOV M , A : Store converted even parity character.*
- *DCR C : Decrement counter.*
- *JNZ REPEAT : If not zero go for next character.*
- *HLT : Terminate program execution*

Flowchart for program



QN 1. Find the number of negative, zero and positive numbers

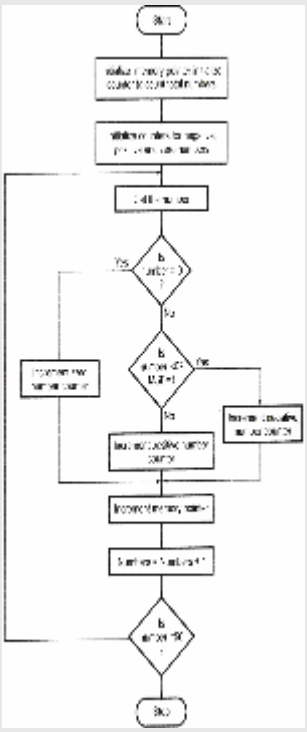
Statement: **A list of 50 numbers is stored in memory, starting at 6000H. Find number of negative, zero and positive numbers from this list and store these results in memory locations 7000H, 7001H, and 7002H respectively.**

Source program :

- *LXI H, 6000H : Initialize memory pointer*
- *MVI C, 00H : Initialize number counter*
- *MVI B, 00H : Initialize negative number counter*
- *MVI E, 00H : Initialize zero number counter*
- *BEGIN:MOV A, M : Get the number*
- *CPI 00H : If number = 0*
- *JZ ZERONUM : Goto zeronum*
- *ANI 80H : If MSB of number = 1i.e. if*
- *JNZ NEGNUM number is negative goto NEGNUM*
- *INR D : otherwise increment positive number counter*
- *JMP LAST*
- *ZERONUM:INR E : Increment zero number counter*
- *JMP LAST*

Flowchart for program

- *NEGNUM:INR B : Increment negative number counter*
- *LAST:INX H : Increment memory pointer*
- *INR C : Increment number counter*
- *MOV A, C*
- *CPI 32H : If number counter = 5010 then*
- *JNZ BEGIN : Store otherwise check next number*
- *LXI H, 7000 : Initialize memory pointer.*
- *MOV M, B : Store negative number.*
- *INX H*
- *MOV M, E : Store zero number.*
- *INX H*
- *MOV M, D : Store positive number.*
- *HLT : Terminate execution*



QN 1. Multiply two eight bit numbers with shift and add method

Statement: **Multiply the 8-bit unsigned number in memory location 2200H by the 8-bit unsigned number in memory location 2201H. Store the 8 least significant bits of the result in memory location 2300H and the 8 most significant bits in memory location 2301H.**

Sample problem:

(2200) = 1100 (0CH)

(2201) = 0101 (05H)

Multiplicand = 1100 (1210)

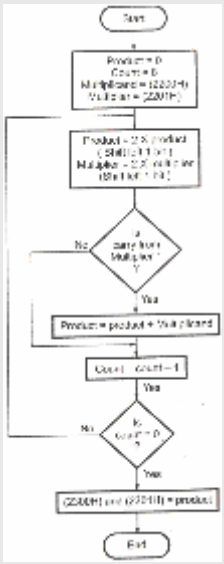
Multiplier = 0101 (510)

Result = 12 x 5 = (6010)

Source program : **Flowchart for program**

- *LXI H, 2200 : Initialize the memory pointer*
- *MOV E, M : Get multiplicand*
- *MVI D, 00H : Extend to 16-bits*
- *INX H : Increment memory pointer*
- *MOV A, M : Get multiplier*
- *LXI H, 0000 : Product = 0*

- *MVI B, 08H : Initialize counter with count 8*
- *MULT: DAD H : Product = product x 2*
- *RAL*
- *JNC SKIP : Is carry from multiplier 1 ?*
- *DAD D : Yes, Product =Product + Multiplicand*
- *SKIP: DCR B : Is counter = zero*
- *JNZ MULT : no, repeat*
- *SHLD 2300H : Store the result*
- *HLT : End of program*



QN 1. Divide 16-bit number with 8-bit number using shifting technique

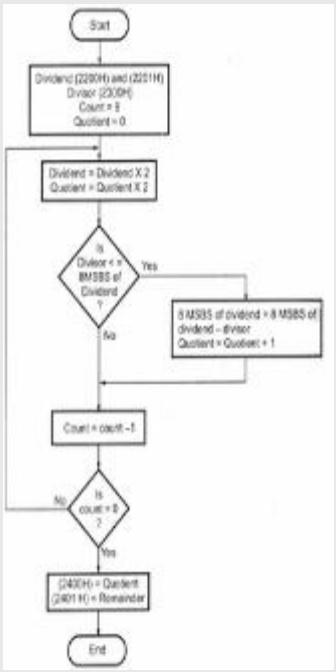
Statement: **Divide the 16-bit unsigned number in memory locations 2200H and 2201H (most significant bits in 2201H) by the B-bit unsigned number in memory location 2300H store the quotient in memory location 2400H and remainder in 2401H.**

Assumption: The most significant bits of both the divisor and dividend are zero.

Source program :

- *MVI E, 00 : Quotient = 0*
- *LHLD 2200H : Get dividend*
- *LDA 2300 : Get divisor*
- *MOV B, A : Store divisor*
- *MVI C, 08 : Count = 8*
- *NEXT: DAD H : Dividend = Dividend x 2*
- *MOV A, E*
- *RLC*
- *MOV E, A : Quotient = Quotient x 2*
- *MOV A, H*
- *SUB B : Is most significant byte of Dividend > divisor*
- *JC SKIP : No, go to Next step*
- *MOV H, A : Yes, subtract divisor*
- *INR E : and Quotient = Quotient + 1*
- *SKIP:DCR C : Count = Count - 1*
- *JNZ NEXT : Is count =0 repeat*
- *MOV A, E*
- *STA 2401H : Store Quotient*
- *Mov A, H*
- *STA 2410H : Store remainder*

Flowchart for program



- *HLT : End of program.*

QN 1. Sub routine to perform the task of DAA

Statement: **Assume the DAA instruction is not present. Write a sub routine which will perform the same task as DAA.**

Sample Problem:

Execution of DAA instruction:

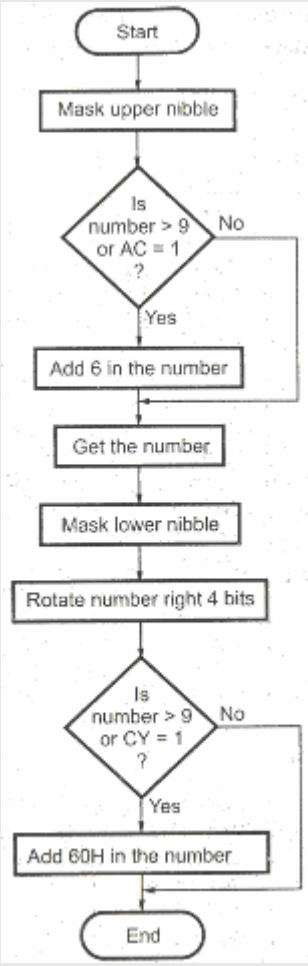
1. If the value of the low order four bits (03-00) in the accumulator is greater than 9 or if auxiliary carry flag is set, the instruction adds 6 '(06) to the low-order four bits.

2. If the value of the high-order four bits (07-04) in the accumulator is greater than 9 or if carry flag is set, the instruction adds 6(06) to the high-order four bits.

Source program :

- *LXI SP, 27FFH : Initialize stack pointer*
- *MOV E, A : Store the contents of accumulator*
- *ANI 0FH : Mask upper nibble*
- *CPI 0A H : Check if number is greater than 9*
- *JC SKIP : if no go to skip*
- *MOV A, E : Get the number*
- *ADI 06H : Add 6 in the number*
- *JMP SECOND : Go for second check*
- *SKIP: PUSH PSW : Store accumulator and flag contents in stack*
- *POP B : Get the contents of accumulator in B register and flag register contents in C register*
- *MOV A, C : Get flag register contents in accumulator*
- *ANI 10H : Check for bit 4*
- *JZ SECOND : if zero, go for second check*
- *MOV A, E : Get the number*
- *ADI 06 : Add 6 in the number*
- *SECOND: MOV E, A : Store the contents of accumulator*
- *ANI FOH : Mask lower nibble*
- *RRC*
- *RRC*
- *RRC*
- *RRC : Rotate number 4 bit right*
- *CPI 0AH : Check if number is greater*

Flowchart for program



than 9

- *JC SKIPl : if no go to skip 1*
- *MOV A, E : Get the number*
- *ADI 60 H : Add 60 H in the number*
- *JMP LAST : Go to last*
- *SKIP1: JNC LAST : if carry flag = 0 go to last*
- *MOV A, E : Get the number*
- *ADI 60 H : Add 60 H in the number*
- *LAST: HLT*

QN 1. Program to generate Fibonacci number

Statement: **Write an assembly language program to generate fibonacci number.**

Source program :

- *MVI D, COUNT : Initialize counter*
- *MVI B, 00 : Initialize variable to store previous number*
- *MVI C, 01 : Initialize variable to store current number*
- *MOV A, B :[Add two numbers]*
- *BACK: ADD C :[Add two numbers]*
- *MOV B, C : Current number is now previous number*
- *MOV C, A : Save result as a new current number*
- *DCR D : Decrement count*
- *JNZ BACK : if count 0 go to BACK*
- *HLT: Stop.*

QN 1. Generate a delay of 0.4 seconds

Statement: **Write a program to generate a delay of 0.4 sec if the crystal frequency is 5 MHz.**

Calculation: In 8085, the operating frequency is half of the crystal frequency,

ie.Operating frequency = 5/2 = 2.5 MHz

Time for one T -state =

Number of T-states required = 1 x 106

Source program :

- *LXI B, count : 16 - bit count*
- *BACK: DCX B : Decrement count*
- *MOV A, C*
- *ORA B : Logically OR Band C*

- *JNZ BACK : If result is not zero repeat*

QN 1. Arrange in Descending order

Statement: **Arrange an array of 8 bit unsigned no in descending order**

- *START:MVI B, 00 ; Flag = 0*
- *LXI H, 4150 ; Count = length of array*
- *MOV C, M*
- *DCR C ; No. of pair = count -1*
- *INX H ; Point to start of array*
- *LOOP:MOV A, M ; Get kth element*
- *INX H*
- *CMP M ; Compare to (K+1) th element*
- *JNC LOOP 1 ; No interchange if kth >= (k+1) th*
- *MOV D, M ; Interchange if out of order*
- *MOV M, A ;*
- *DCR H*
- *MOV M, D*
- *INX H*
- *MVI B, 01H ; Flag=1*
- *LOOP 1:DCR C ; count down*
- *JNZ LOOP ;*
- *DCR B ; is flag = 1?*
- *JZ START ; do another sort, if yes*
- *HLT ; If flag = 0, step execution*

QN 1. Data transfer from one memory block to other memory block.

Statement: **Transfer ten bytes of data from one memory to another memory block. Source memory block starts from memory location 2200H where as destination memory block starts from memory location 2300H.**

- *LXI H, 4150 : Initialize memory pointer*
- *MVI B, 08 : count for 8-bit*
- *MVI A, 54*
- *LOOP : RRC*
- *JC LOOP1*
- *MVI M, 00 : store zero it no carry*
- *JMP COMMON*
- *LOOP2: MVI M, 01 : store one if there is a carry*
- *COMMON: INX H*
- *DCR B : check for carry*
- *JNZ LOOP*
- *HLT : Terminate the program*

QN 1. Find the factorial of a number

Statement: **Program to calculate the factorial of a number between 0 to 8**

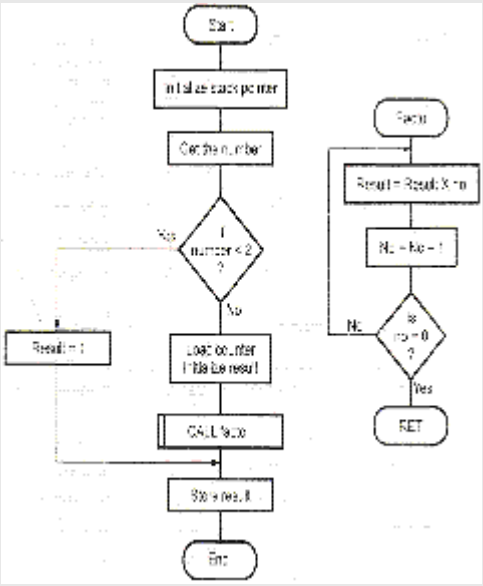
Source program :

- *LXI SP, 27FFH ; Initialize stack pointer*
- *LDA 2200H ; Get the number*
- *CPI 02H ; Check if number is greater than 1*
- *JC LAST*
- *MVI D, 00H ; Load number as a result*
- *MOV E, A*
- *DCR A*
- *MOV C,A ; Load counter one less than number*
- *CALL FACTO ; Call subroutine FACTO*
- *XCHG ; Get the result in HL*
- *SHLD 2201H ; Store result in the memory*
- *JMP END*
- *LAST: LXI H, 000lH ; Store result = 01*
- *END: SHLD 2201H*
- *HLT*

Subroutine Program:

- *FACTO:LXI H, 0000H*
- *MOV B, C ; Load counter*
- *BACK: DAD D*
- *DCR B*
- *JNZ BACK ; Multiply by successive addition*
- *XCHG ; Store result in DE*
- *DCR C ; Decrement counter*
- *CNZ FACTO ; Call subroutine FACTO*
- *RET ; Return to main program*

Flowchart for program



QN 1. Split a HEX data into two nibbles and store it

Statement: **Write a simple program to Split a HEX data into two nibbles and store it in memory**

Source program :

- *LXI H, 4200H : Set pointer data for array*
- *MOV B,M : Get the data in B-reg*
- *MOV A,B : Copy the data to A-reg*
- *ANI OFH : Mask the upper nibble*
- *INX H : Increment address as 4201*
- *MOV M,A : Store the lower nibble in memory*
- *MOV A,B : Get the data in A-reg*
- *ANI FOH : Bring the upper nibble to lower nibble position*
- *RRC*
- *RRC*
- *RRC*
- *RRC*
- *INX H*
- *MOV M,A : Store the upper nibble in memory*
- *HLT : Terminate program execution*

QN 1. Add two 4-digit BCD numbers

Statement: **Add two 4 digit BCD numbers in HL and DE register pairs and store result in memory locations, 2300H and 2301H. Ignore carry after 16 bit.**

Sample Problem:

(HL) =3629

Flowchart for Program

(DE) =4738

Step 1 : 29 + 38 = 61 and auxiliary carry flag = 1

:.add 06

61 + 06 = 67

Step 2 : **36 + 47 + 0 (carry of LSB) = 7D**

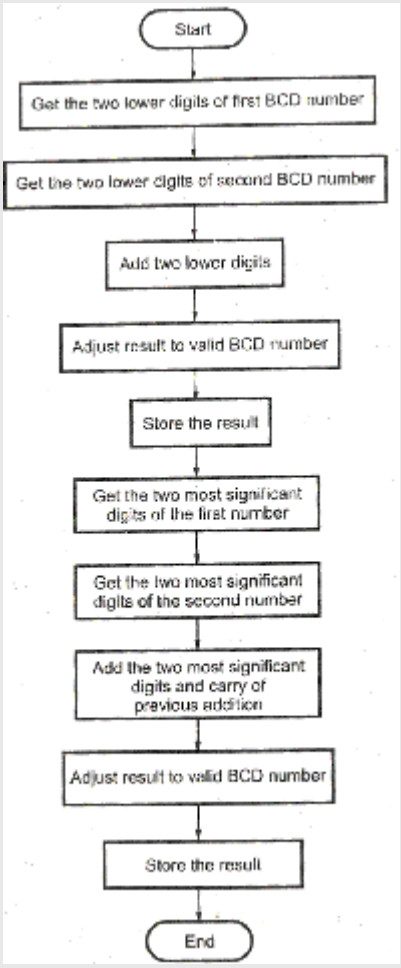
Lower nibble of addition is greater than 9, so add 6.

7D + 06 = 83

Result = 8367

Source program :

- ***MOV A, L : Get lower 2 digits of no. 1***
- ***ADD E : Add two lower digits***
- ***DAA : Adjust result to valid BCD***
- ***STA 2300H : Store partial result***
- ***MOV A, H : Get most significant 2 digits of number***
- ***ADC D : Add two most significant digits***
- ***DAA : Adjust result to valid BCD***
- ***STA 2301H : Store partial result***
- ***HLT : Terminate program execution.***



QN 1. Subtraction of two BCD numbers

Statement: **Subtract the BCD number stored in E register from the number stored in the D register.**

Source Program:

MVI A,99H

SUB E : Find the 99's complement of subtrahend

INR A : Find 100's complement of subtrahend

ADD D : Add minuend to 100's complement of subtrahend

DAA : Adjust for BCD

HLT : Terminate program execution

Note: When two BCD numbers are subtracted, we can use DAA instruction for ajusting the result to BCD. Therefore, the subtraction of BCD number is carried

out 10's complement or 100's complement.

The 10's complement of a decimal number is equal to the 99's complement plus 1. The 99's complement of a number can be found by subtracting the number from 99.

The steps for finding 100's complement BCD subtraction are :

- **Find the 100's complement of subtrahend**
- **Add two numbers using BCD adition**

QN 1. Multiply two 2-digit BCD numbers

Statement: **Write an assembly language program to multiply 2 BCD numbers**

 ***Source Program:***

- ***MVI C, Multiplier : Load BCD multiplier***
- ***MVI B, 00 : Initialize counter***
- ***LXI H, 0000H : Result = 0000***
- ***MVI E, multiplicand : Load multiplicand***
- ***MVI D, 00H : Extend to 16-bits***
- ***BACK: DAD D : Result Result + Multiplicand***
- ***MOV A, L : Get the lower byte of the result***
- ***ADI, 00H***
- ***DAA : Adjust the lower byte of result to BCD.***
- ***MOV L, A : Store the lower byte of result***
- ***MOV A, H : Get the higher byte of the result***
- ***ACI, 00H***
- ***DAA : Adjust the higher byte of the result to BCD***
- ***MOV H, A : Store the higher byte of result.***
- ***MOV A, B : [Increment***
- ***ADI 01H : counter***
- ***DAA : adjust it to BCD and***
- ***MOV B,A : store it]***
- ***CMP C : Compare if count = multiplier***
- ***JNZ BACK : if not equal repeat***
- ***HLT : Stop***

QN 1. 2-Digit BCD to binary conversion

Statement: **Convert a 2-digit BCD number stored at memory address 2200H into its binary equivalent number and store the result in a memory location 2300H.**

Sample problem 1:

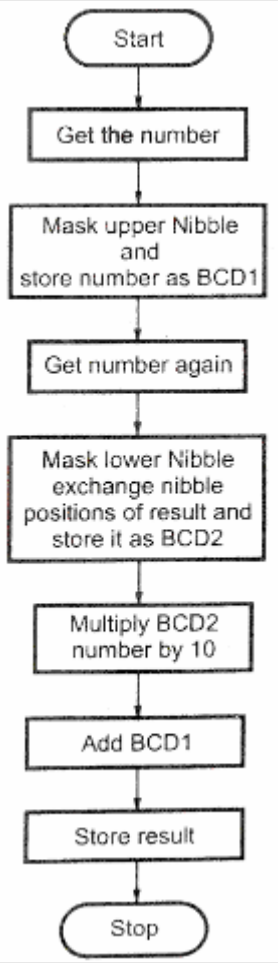
(2200H) = 67H

(2300H) = 6 x OAH + 7 = 3CH + 7 = 43H

Source program :

- ***LDA 2200H : Get the BCD number***
- ***MOV B, A : Save it***
- ***ANI OFH : Mask most significant four bits***
- ***MOV C, A : Save unpacked BCDI in C register***
- ***MOV A, B : Get BCD again***
- ***ANI FOH : Mask least significant four bits***
- ***RRC : Convert most significant four bits into unpacked BCD2***
- ***RRC***
- ***RRC***
- ***RRC***
- ***MOV B, A : Save unpacked BCD2 in B register***
- ***XRA A : Clear accumulator (sum = 0)***
- ***MVI D, 0AH : Set D as a multiplier of 10***
- ***Sum: ADD D : Add 10 until (B) = 0***
- ***DCR B : Decrement BCD2 by one***
- ***JNZ SUM : Is multiplication complete? i if not, go back and add again***
- ***ADD C : Add BCD1***
- ***STA 2300H : Store the result***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. 2-Digit BCD to binary conversion

Statement: **Convert a 2-digit BCD number stored at memory address 2200H into its binary equivalent number and store the result in a memory location 2300H.**

Sample problem 1:

(2200H) = 67H

(2300H) = 6 x OAH + 7 = 3CH + 7 = 43H

Source program :

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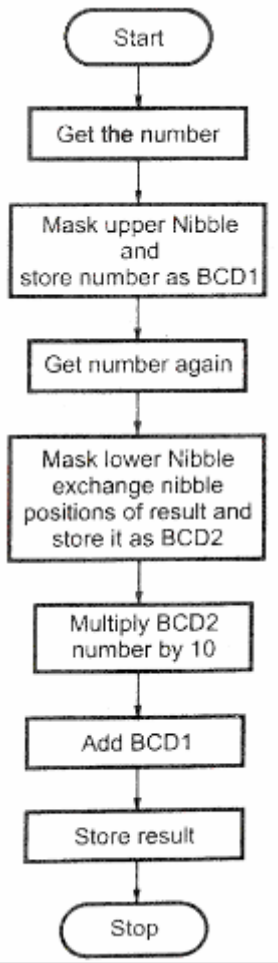
- ***MOV C, A : Save unpacked BCDI in C register***
- ***MOV A, B : Get BCD again***
- ***ANI FOH : Mask least significant four bits***
- ***RRC : Convert most significant four bits into unpacked BCD2***
- ***RRC***
- ***RRC***
- ***RRC***
- ***MOV B, A : Save unpacked BCD2 in B register***
- ***XRA A : Clear accumulator (sum = 0)***
- ***MVI D, 0AH : Set D as a multiplier of 10***
- ***Sum: ADD D : Add 10 until (B) = 0***
- ***DCR B : Decrement BCD2 by one***
- ***JNZ SUM : Is multiplication complete? i if not, go back and add again***
- ***ADD C : Add BCD1***
- ***STA 2300H : Store the result***
- ***HLT : Terminate program execution***

Flowchart for program



QN 1. HEX to Decimal conversion

Statement: **Convert the HEX number in memory to its equivalent decimal number**

Source program :

- *LXI H, 4150 ; Point to data*
- *LXI B, 0000 ; Initialize hundreds= 0, Tens=0*
- *MOV A, M ; Get hex data to A*
- *LOOP: SUI 64*
- *JC LOOP 1*
- *INR B ; hundreds= hundreds+1*
- *JMP LOOP*
- *LOOP 1: ADI 64 ; if subtracted extra, add it clear carry flag*
- *LOOP 2: SUI 0A*
- *JC LOOP 3*
- *INR C ; Tens=tens+1*
- *JMP LOOP 2*
- *LOOP 3: ADI 0A ; If subtracted extra, add it again*
- *INX H ; A = Units*
- *MOV M, B ; store hundreds*
- *MOV B, A ; Combine Tens in C &*
- *MOV A, C ; Units in A to form a*
- *RLC ; Single 8-bit number*
- *RLC*
- *RLC*
- *RLC*
- *ADD B*
- *INX H*
- *MOV M, A ; Store tens & Units*
- *HLT*

Note: In this experiment the number is converted to its equivalent decimal number using the following logic. First count the number of hundreds, the number of tens & units present in that hex number. Then add up to get the equivalent decimal number.

Converting A9 we get:

A9 /64=45 Hundreds = 01

Since 64(100 decimal) cannot be subtracted from 45 no. of hundreds = 01. Now count tens 45/0A=3B Tens = 01 Now from 09, 0A cannot be subtracted. Hence tens = 06 the decimal equivalent of A9 is 169.

QN 1. HEX to binary conversion

Statement: **Convert an 8 bit hex no to its binary form & store in memory**

Source Program:

- *LXI H, 4150 : Initialize memory pointer*
- *MVI B, 08 : count for 8-bit*
- *MVI A, 54*
- *LOOP : RRC*
- *JC LOOP1*
- *MVI M, 00 : store zero it no carry*
- *JMP COMMON*
- *LOOP2: MVI M, 01 : store one if there is a carry*
- *COMMON: INX H*
- *DCR B : check for carry*
- *JNZ LOOP*
- *HLT : Terminate the program*