LABORATORY MANUAL

EE0310 – MICROPROCESSOR & MICROCONTROLLER LAB

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
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INTRODUCTION TO MICROPROCESSOR 8085

Aim

To study the microprocessor 8085

Architecture of 8085 Microprocessor

a) General purpose register

It is an 8 bit register i.e. B,C,D,E,H,L. The combination of 8 bit register is known as register pair, which can hold 16 bit data. The HL pair is used to act as memory pointer is accessible to program.

b) Accumulator

It is an 8 bit register which hold one of the data to be processed by ALU and stored the result of the operation.

c) Program counter (PC)

It is a 16 bit pointer which maintain the address of a byte entered to line stack.

d) Stack pointer (Sp)

It is a 16 bit special purpose register which is used to hold line memory address for line next instruction to be executed.

e) Arithmetic and logical unit

It carries out arithmetic and logical operation by 8 bit address it uses the accumulator content as input the ALU result is stored back into accumulator.

f) Temporary register

It is an 8 bit register associated with ALU hold data, entering an operation, used by the microprocessor and not accessible to programs.

g) Flags

Flag register is a group of fire, individual flip flops line content of line flag register will change after execution of arithmetic and logic operation. The line states flags are

i) Carry flag (C)
ii) Parity flag (P)
iii) Zero flag (Z)
iv) Auxiliary carry flag (AC)
v) Sign flag (S)

h) Timing and control unit

Synchronous all microprocessor, operation with the clock and generator and control signal from it necessary to communicate between controller and peripherals.

i) Instruction register and decoder

Instruction is fetched from line memory and stored in line instruction register decoder the stored information.

j) Register Array

These are used to store 8 bit data during execution of some instruction.

PIN Description

Address Bus

1. The pins $A_o - A_{15}$ denote the address bus.
2. They are used for most significant bit

Address / Data Bus

1. $AD_0 - AD_7$ constitutes the address / Data bus
2. These pins are used for least significant bit

ALE : (Address Latch Enable)

1. The signal goes high during the first clock cycle and enables the lower order address bits.

IO / M

1. This distinguishes whether the address is for memory or input.
2. When this pins go high, the address is for an I/O device.

$S_0 - S_1$

S_0 and S_1 are status signal which provides different status and functions.

RD

1. This is an active low signal
2. This signal is used to control READ operation of the microprocessor.

WR

1. WR is also an active low signal
2. Controls the write operation of the microprocessor.

HOLD

1. This indicates if any other device is requesting the use of address and data bus.

HLDA

1. HLDA is the acknowledgement signal for HOLD
2. It indicates whether the hold signal is received or not.

INTR

1. INTE is an interrupt request signal
2. IT can be enabled or disabled by using software

INTA

1. Whenever the microprocessor receives interrupt signal
2. It has to be acknowledged.

RST 5.5, 6.5, 7.5

1. These are nothing but the restart interrupts
2. They insert an internal restart junction automatically.

TRAP

1. Trap is the only non-maskable interrupt
2. It cannot be enabled (or) disabled using program.

RESET IN

1. This pin resets the program counter to 0 to 1 and results interrupt enable and HLDA flip flops.

X_1, X_2

These are the terminals which are connected to external oscillator to produce the necessary and suitable clock operation.

SID

This pin provides serial input data

SOD

This pin provides serial output data

V_{CC} and V_{SS}

1. V_{CC} is +5V supply pin
2. V_{SS} is ground pin

Specifications

1. Processors

Intel 8085 at E144 MHz clock

2. Memory

Monitor RAM:	0000 – IFFF
EPROM Expansion:	2000 – 3FFF's
	0000 – FFF
System RAM:	4000 – 5FFF
Monitor data area	4100 – 5FFF
RAM Expansion	6000 – BFFF

3. Input / Output

Parallel: A8 TTL input timer with 2 number of 32-55 only input timer available in μ-85 EBI.

Serial: Only one number RS 232-C, Compatible, crucial interface using 8281A

Timer: 3 channel -16 bit programmable units, using 8253 channel '0' used for no band late. Clock generator. Channel '1' is used for single stopping used program.

Display: 6 digit – 7 segment LED display with filter 4 digit for adder display and 2 digit for data display.

Key board: 21 keys, soft keyboard including common keys and hexa decimal keys.
RES: Reset keys allow to terminate any present activity and retain to μ - 85 its on initialize state.

INT: Maskable interrupt connect to CPU's RST 7.5 interrupt

DEC: Decrement the adder by 1

EXEC: Execute line particular value after selecting address through go command.

NEXT: Increment the address by 1 and then display its content.

Key Functions:

E 0 SUB	i. Hex entry key '0' ii. Substituting memory content where "next" key is paused immediately after 1, take used to st cutting address. iii. Register key 'E'
RD 1 REG	i) Hex code entry (1) ii) Register key 'D'
C 2 TN	i) Hex code entry '2' ii) Retricre data from data 'memory' to data top iii) Register key 'C'
B 3 TR	i) Hex code entry '3' ii) Retricre data from memory to top iii) Register key 'B'
F 4 BLOC	i) Hex key entry 'C' ii) Block search from byte iii) Register key 'F'
A 5 FILL	i) Hex key entry '5' ii) Fill block of RAM memory with desired data iii) Register key 'A'
L 6 SER	i) Hex key entry '6' ii) TN/Tl used for sending (or) receiving iii) Register key 'H'
H 7 F_2	i) Hex key entry '7' ii) Register key 'H'

I 8 G_0	i) ii)	Register key ‘S’ Register key ‘I’
PL 9 SNG	i) ii) iii)	Hex key entry ‘A’ Function key F_3 Register key “ph”
A PH F_3	i) ii)	Hex key entry “y” Signal step program (instruction by instruction)
C SH MOV	i) ii) iii)	Hex key entry “c” Much a block of memory from a linear block Register key “S_H”
D CMP	i) ii)	Hex key D Compare 2 memory block
B SL BC	i) ii) iii)	Hex key entry ‘B’ Check a block from flame Register key “SPL”
E INS	i) ii)	Hex key ‘E’ Insert by test into memory (RAM)
F DEL	i) ii)	Hex key ‘F’ Delete byte from memory RAM

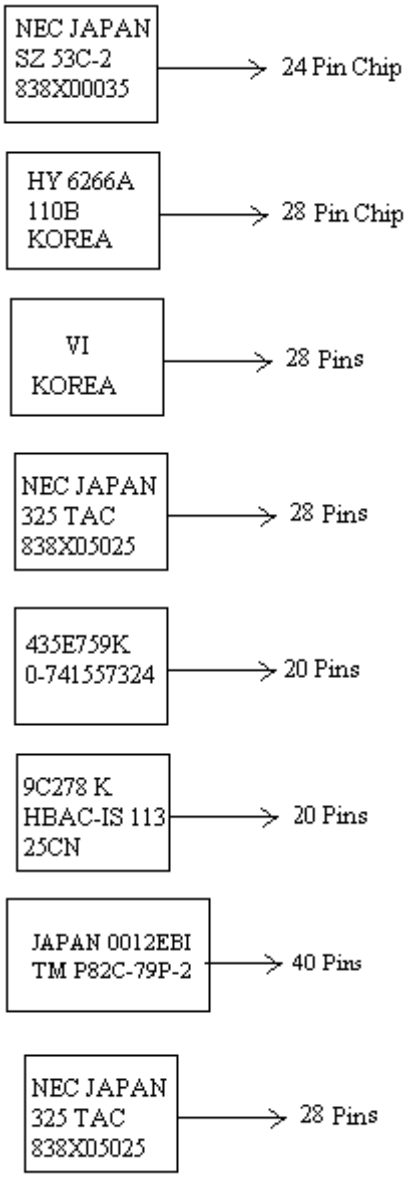
System Power Consumption

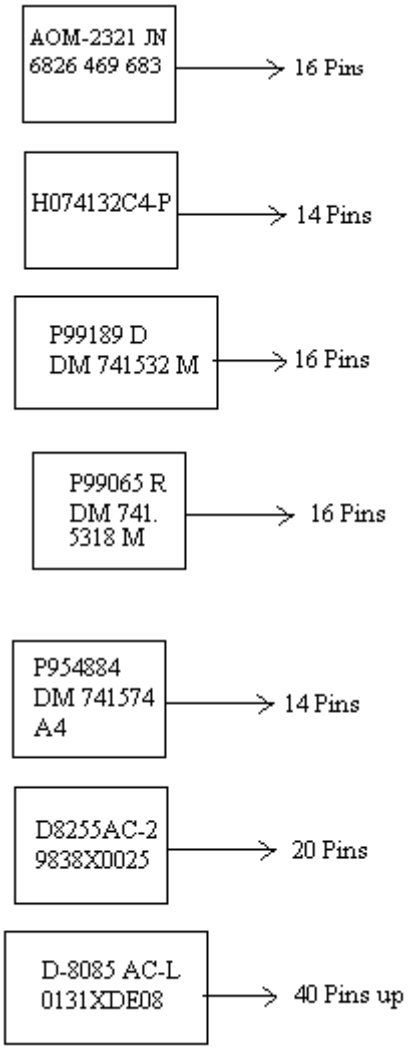
Micro BSEB2	MICRO SSEB
+5V @ 1Amp	+5V@ 800 mA
+12V @ 200 mA	
- 12V @ 100 mA	

Power Supply Specification

MICRO SSEM
230V, AC @ 80 Hz
+5V @ 600 mA

Key Function





IC's Used

8085	-	8 bit μp
8253	-	programmable internal timer
8255	-	programmable peripheral interface
8279	-	programmable key boards / display interface
8251	-	programmable communication interface
2764	-	8 KV VV EPROM
6264	-	8K STATIC PROM
7414	-	Hex inverter
7432	-	Quad 21/p OR GATE
7409	-	Quad 21/p AND GATE
7400	-	NAND Gate
7404	-	Dual D-FF
74373	-	Octal 'D' Latch
74139	-	Dual 2 to 4 line decoder
74138	-	3 to 8 line decoder

In Enter Program into Trainer Kit

1. Press ‘RESET’ key
2. Sub (key processor represent address field)
3. Enter the address (16 bit) and digit in hex
4. Press ‘NEXT’ key
5. Enter the data
6. Again press “NEXT”
7. Again after taking the program, are use HLT instruction its Hex code
8. Press “NEXT”

How to executive program

1. Press “RESET”
2. Press “GO”
3. Enter the address location in which line program was executed
4. Press “Execute” key

Result:

Thus 8085 microprocessor was studied successfully.

ADDITION OF TWO 8-BIT NUMBERS

Aim:

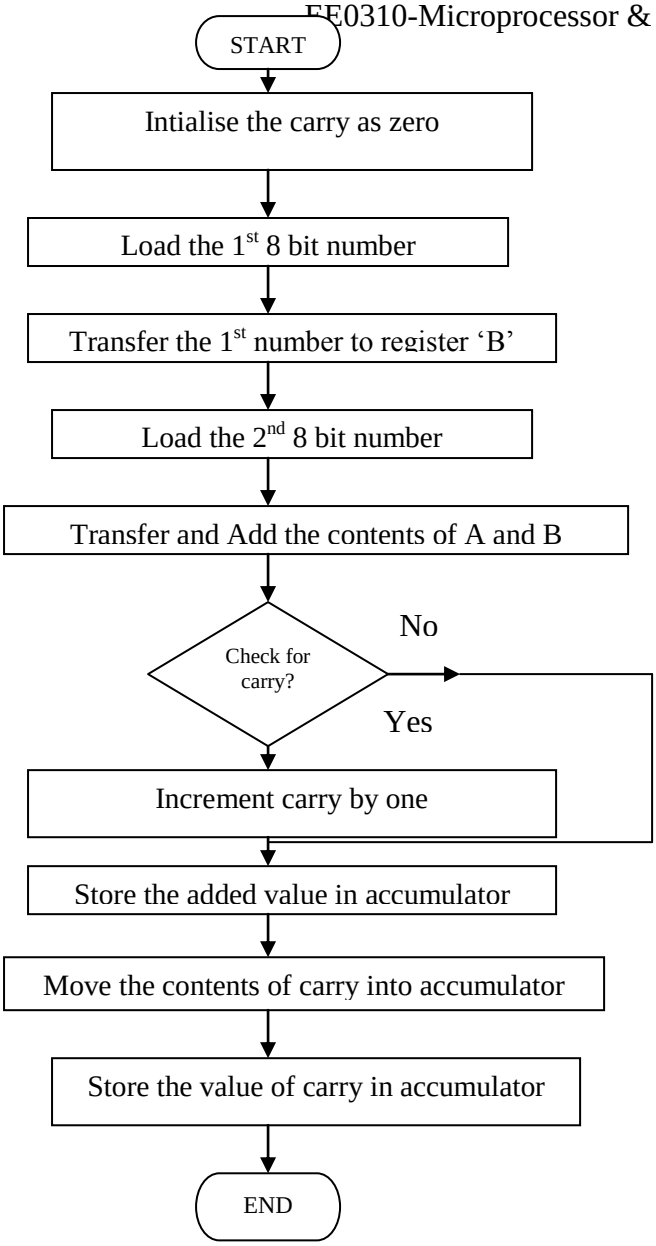
To write an assembly language for adding two 8 bit numbers by using micro processor kit.

Apparatus required:

8085 micro processor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Intialize the carry as ‘Zero’
Step 3	:	Load the first 8 bit data into the accumulator
Step 4	:	Copy the contents of accumulator into the register ‘B’
Step 5	:	Load the second 8 bit data into the accumulator.
Step 6	:	Add the 2 - 8 bit datas and check for carry.
Step 7	:	Jump on if no carry
Step 8	:	Increment carry if there is
Step 9	:	Store the added request in accumulator
Step 10	:	More the carry value to accumulator
Step 11	:	Store the carry value in accumulator
Step 12	:	Stop the program execution.


START
Intialise the carry as zero
Load the 1st 8 bit number
Transfer the 1st number to register 'B'
Load the 2nd 8 bit number
Transfer and Add the contents of A and B
Check for carry?
No
Yes
Increment carry by one
Store the added value in accumulator
Move the contents of carry into accumulator
Store the value of carry in accumulator
END

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C,00	OE, 00	Initialize the carry as zero
4102		LDA 4300	3A, (00, 43)	Load the first 8 bit data
4105		MOV, B,A	47	Copy the value of 8 bit data into register B
4106		LDA 4301	3A, (01, 43)	Load the second 8 bit data into the accumulator
4109		ADD B	80	Add the hoo values
410A		JNC	D2, 0E, 41	Jump on if no carry
410D		INR C	OC	If carry is there increment it by one
410E	Loop	STA 4302	32 (02, 43)	Stone the added value in the accumulator
4111		MOV A,C	79	More the value of carry to the accumulator from register C
4112		STA 4303	32 (03, 43)	Store the value of carry in the accumulator
4115		HLT	76	Stop the program execution

Input
Without carry

Input Address	Value
4300	04
4301	02

Output

Output Address	Value
4302	06
4303	00 (carry)

With carry

Input Address	Value
4300	FF
4301	FF

Output Address	Value
4302	FE
4303	01 (carry)

Calculation 1111 1111
1111 1111
---
(1) 1111 1110
=========
F E

Result:

The assembly language program for 8 bit addition of two numbers was executed successfully by using 8085 micro processing kit.

SUBTRACTION OF TWO 8 BIT NUMBERS

Aim:

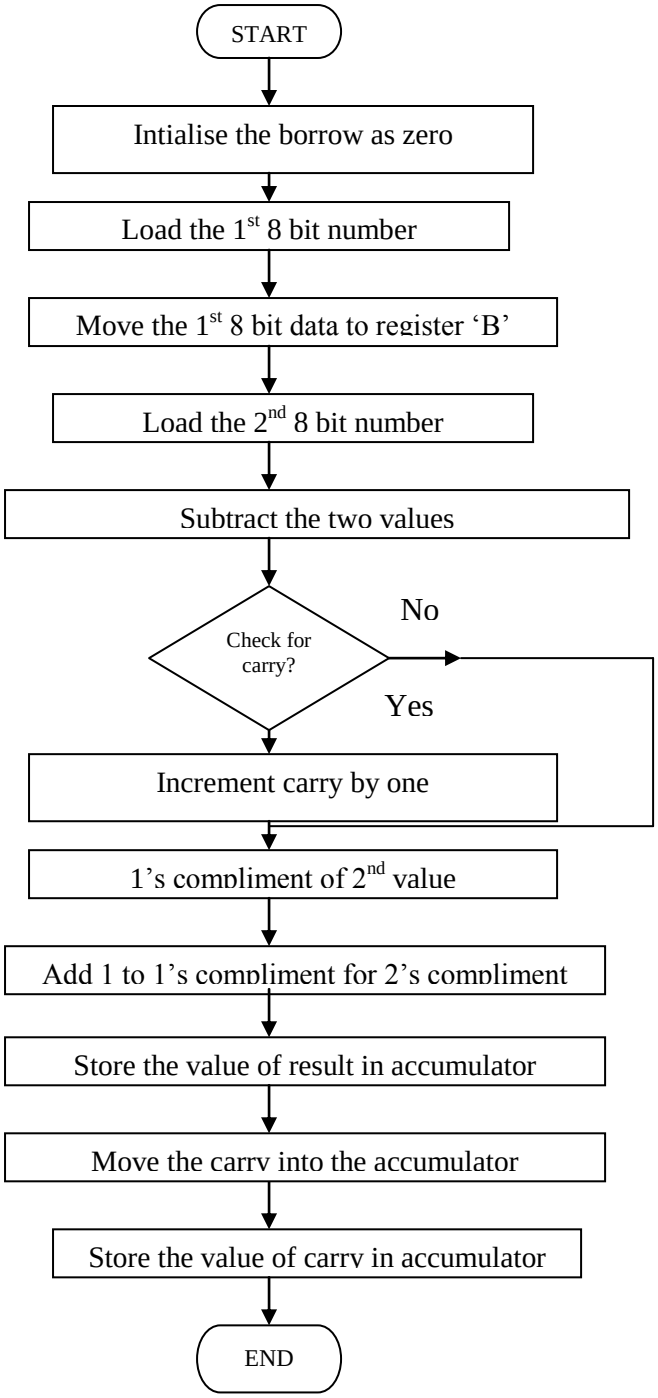
To write a assembly language program for subtracting 2 bit (8) numbers by using-8085 micro processor kit.

Apparatus required:

8085 micro processor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Intialize the carry as ‘Zero’
Step 3	:	Load the first 8 bit data into the accumulator
Step 4	:	Copy the contents of contents into the register ‘B’
Step 5	:	Load the second 8 bit data into the accumulator.
Step 6	:	Subtract the 2 8 bit datas and check for borrow.
Step 7	:	Jump on if no borrow
Step 8	:	Increment borrow if there is
Step 9	:	2’s compliment of accumulator is found out
Step 10	:	Store the result in the accumulator
Step 11	:	More the borrow value from ‘c’ to accumulator
Step 12	:	Store the borrow value in the accumulator
Step 13	:	Stop program execution


START
Intialise the borrow as zero
Load the 1st 8 bit number
Move the 1st 8 bit data to register 'B'
Load the 2nd 8 bit number
Subtract the two values
Check for carry?
No
Yes
Increment carry by one
1's compliment of 2nd value
Add 1 to 1's compliment for 2's compliment
Store the value of result in accumulator
Move the carry into the accumulator
Store the value of carry in accumulator
END

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C,00	OE, 00	Initialize the carry as zero
4102		LDA 4300	3A, (00, 43)	Load the first 8 bit data into the accumulator
4105		MOV, B,A	47	Copy the value into register 'B'
4106		LDA 4301	3A, (01, 43)	Load the 2nd 8 bit data into the accumulator
4109		SUB B	90	Subtract both the values
410A	Loop	INC	D2, 0E, 41	Jump on if no borrow
410D		INR C	OC	If borrow is there, increment it by one
410E	Loop	CMA	2F	Compliment of 2nd data
410F		ADI, 01	6, 01	Add one to 1's compliment of 2nd data
4111		STA 4302	32,02,43	Store the result in accumulator
4114		MOV A,C	79	Moul the value of borrow into the accumulator
4115		STA 4303	32,03,43	Store the result in accumulator
4118		HLT	76	Stop Program execution

Input
Without borrow

Input Address	Value
4300	05
4301	07

Output

Output Address	Value
4302	02
4303	00 (borrow)

With carry borrow

Input Address	Value
4300	07
4301	05

Output Address	Value
4302	02
4303	01 (borrow)

Calculation 05 – 07
07 – 0111
CMA 1000
ADJ 0.1 0001

1001
05 - 0101

1110 (-2)

Result:

The assembly language program subtraction of two 8 bit numbers was executed successfully by using 8085 micro processing kit.

ADDITION OF TWO 16 – BIT NUMBERS

Aim:

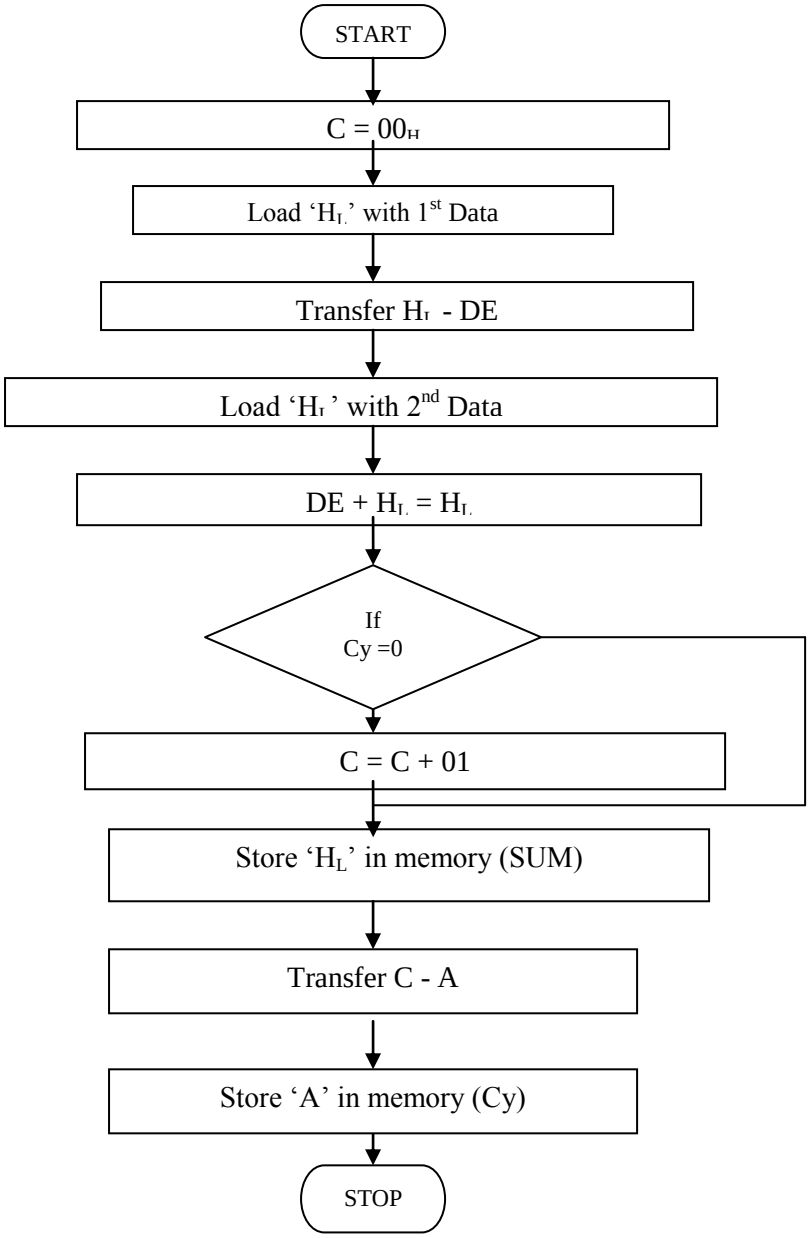
To write an assembly language program for adding two 16 bit numbers using 8085 micro processor kit.

Apparatus required:

8085 micro processor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Get the 1st 8 bit in 'C' register (LSB) and 2nd 8 bit in 'H' register (MSB) of 16 bit number.
Step 3	:	Save the 1st 16 bit in 'DE' register pair
Step 4	:	Similarly get the 2nd 16 bit number and store it in 'HL' register pair.
Step 5	:	Get the lower byte of 1st number into 'L' register
Step 6	:	Add it with lower byte of 2nd number
Step 7	:	tore the result in 'L' register
Step 8	:	Get the higher byte of 1st number into accumulator
Step 9	:	Add it with higher byte of 2nd number and carry of the lower bit addition.
Step 10	:	Store the result in 'H' register
Step 11	:	Store 16 bit addition value in 'HL' register pair
Step 12	:	Stop program execution


START
C = 00H
Load 'HL' with 1st Data
Transfer HH - DE
Load 'HH' with 2nd Data
DE + HL = HL
If
Cy =0
C = C + 01
Store 'HL' in memory (SUM)
Transfer C - A
Store 'A' in memory (Cy)
STOP

Address	Label	Mnemonics		Hex Code	Comments
4500		MVI	C,00	0E	C = 00_H
4501				00	
4502		LHLD	4800	2A	HL – 1st No.
4503				00	
4504				48	
4505		XCHG		EB	HL – DE
4506		LHLD	4802	2A	HL – 2nd No.
4507				02	
4508				48	
4509		DAD	D	19	Double addition DE + HL
450A		JNC	Ahead 450E	D2	If Cy = 0, G0 to 450E
450B				0E	
450C				45	
450D		INR	C	0C	C = C + 01
450E	AHEAD	SHLD	4804	22	HL – 4804 (sum)
450F				04	
4510				48	
4511		MOV	C,A	79	Cy – A
4512		STA	4806	32	Cy – 4806
4513				06	
4514				48	
4515		HLT		76	Stop excution

Input
Without

Input Address	Value
4800	01 (addend)
4801	04
4802	02 (augend)
4803	03 (augend)

Output

Output Address	Value
4804	03 (sum)
4805	07 (sum)
4806	00 (carry)

Calculation

```
0000  0100  0000  0001
0000  0011  0000  0010
-------------------------------
0000  0111  0000  0011
0     7     0     3
```

With carry

Input Address	Value
4800	FF (addend)
4801	DE (addend)
4802	96 (augend)
4803	DF (augend)

Output Address	Value
4804	95 (sum)
4805	BE (sum)
4806	01 (carry)

Calculation

```
1101  1110  1111  1111
1101  1111  1001  0101
--------------------------------
1011  1110  1001  0101
B     E     9     5
```

Result:

The assembly language program for addition of two 16 bit numbers was executed using 8085 micro processing kit.

SUBTRACTION OF TWO 16 – BIT NUMBERS

Aim:

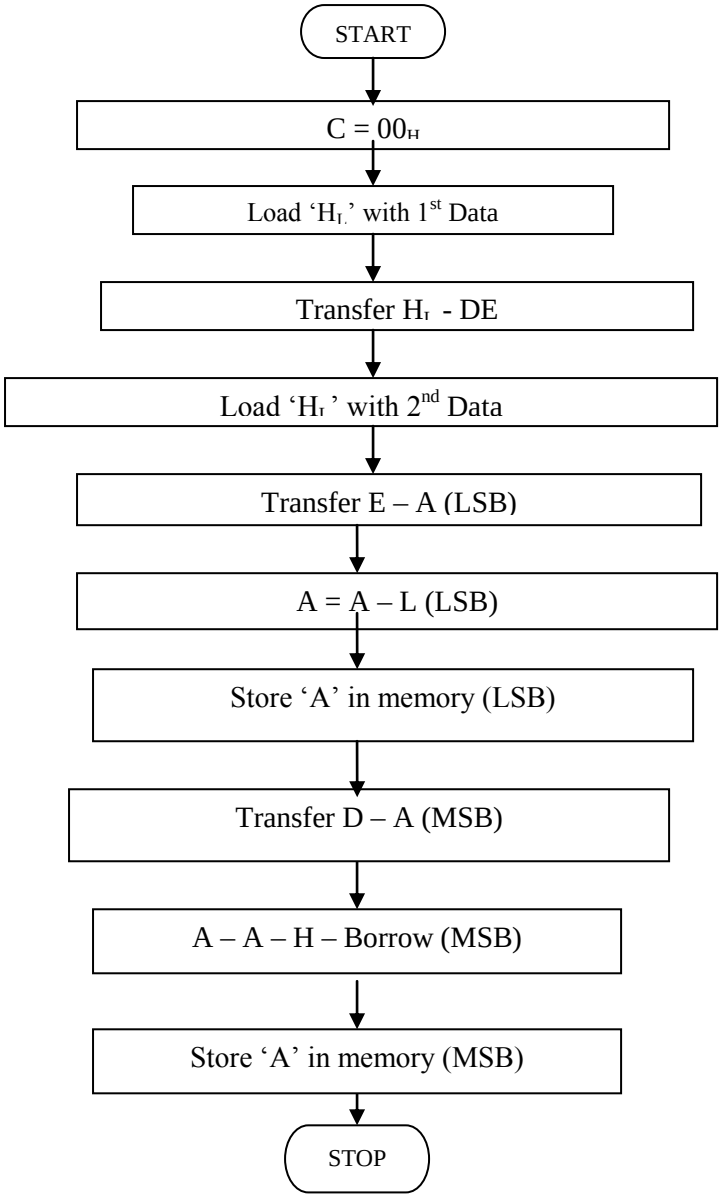
To write an assembly language program for subtracting two 16 bit numbers using 8085 microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Get the 1st 16 bit in 'HL' register pair
Step 3	:	Save the 1st 16 bit in 'DE' register pair
Step 4	:	Get the 2nd 16 bit number in 'HL' register pair
Step 5	:	Get the lower byte of 1st number
Step 6	:	Get the subtracted value of 2nd number of lower byte by subtracting it with lower byte of 1st number
Step 7	:	Store the result in 'L' register
Step 8	:	Get the higher byte of 2nd number
Step 9	:	Subtract the higher byte of 1st number from 2nd number with borrow
Step 10	:	Store the result in 'HL' register
Step 11	:	Stop the program execution


START
C = 00H
Load 'HL' with 1st Data
Transfer HI - DE
Load 'HI' with 2nd Data
Transfer E – A (LSB)
A = A – L (LSB)
Store 'A' in memory (LSB)
Transfer D – A (MSB)
A – A – H – Borrow (MSB)
Store 'A' in memory (MSB)
STOP

Address	Label	Mnemonics		Hex Code	Comments
4500		MVI	C,00	0E	C = 00_H
4501				00	
4502		LHLD	4800	2A	L – 1st No.
4503				00	
4504				48	
4505		XLHG		EB	HL – DE
4506		LHLD	4802	2A	HL – 2nd No.
4507				02	
4508				48	
4509		MOV	A,E	7B	LSB of '1' to 'A'
450A		SUB	L	95	A – A – L
450B		STA	4804	32	A – memory
450C				04	
450D				48	
450E		MOV	A,D	7A	MSB of 1 to A
450F		SBB	H	9C	A- A – H
4510		STA	4805	32	A – memory
4511				05	
4512				48	
4513		HLT		76	Stop execution

Input
Without borrow

Input Address	Value
4800	07
4801	08
4802	05
4803	06

Output

Output Address	Value
4804	02
4805	02
4807	00

With borrow

Input Address	Value
4800	05
4801	06
4802	07
4803	08

Output Address	Value
4804	02
4805	02
4806	01

Calculation

```
05  06   -   07  08

05  06   0101 0110      07  08   0111 1000
CMA      1010 1001      CMA      1000 0111
ADI      0000 0001      ACI      0000 0001
              ---------                ---------
         1010 1010                     1000 1000

05  06   +   07  08
              1010 1010
              1000 1000
              ---------
         (1)  0010 0010
              02   02
```

Result:

The assembly language program for subtraction of two 16 bit numbers was executed by using 8085 micro processing kit.

MULTIPLICATION OF TWO 8 – BIT NUMBERS

Aim:

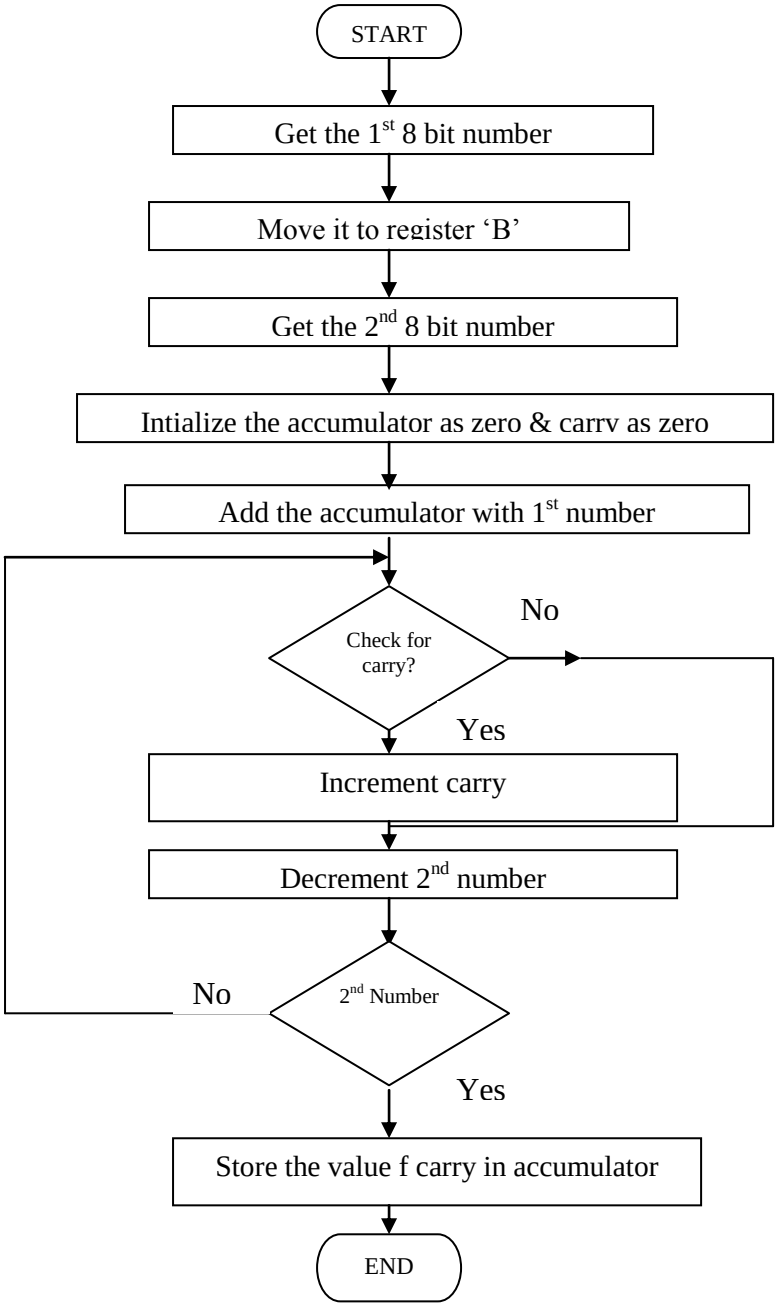
To write an assembly language for multiplying two 8 bit numbers by using 8085 micro processor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Get the 1st 8 bit numbers
Step 3	:	Move the 1st 8it number to register 'B'
Step 4	:	Get the 2nd 8 bit number
Step 5	:	Move the 2nd 8 bit number to register 'C'
Step 6	:	Intialise the accumulator as zero
Step 7	:	Intialise the carry as zero
Step 8	:	Add both register 'B' value as accumulator
Step 9	:	Jump on if no carry
Step 10	:	Increment carry by 1 if there is
Step 11	:	Decrement the 2nd value and repeat from step 8, till the 2nd value becomes zero.
Step 12	:	Store the multiplied value in accumulator
Step 13	:	Move the carry value to accumulator
Step 14	:	Store the carry value in accumulator


START
Get the 1st 8 bit number
Move it to register 'B'
Get the 2nd 8 bit number
Intialize the accumulator as zero & carrv as zero
Add the accumulator with 1st number
Check for carry?
No
Yes
Increment carry
Decrement 2nd number
2nd Number
No
Yes
Store the value f carry in accumulator
END

Address	Label	Mnemonics	Hex Code	Comments
4100		LDA 4500	3A, 00, 45	Load the first 8 bit number
4103		MOV B,A	47	Move the 1st 8 bit data to register 'B'
4104		LDA 4501	3A, 01, 45	Load the 2nd 16 it number
4107		MOV C,A	4F	Move the 2nd 8 bit data to register 'C'
4108		MVI A, 00	3E, 00	Intialise the accumulator as zero
410A		MVI D, 00	16, 00	Intialise the carry as zero
410C		ADD B	80	Add the contents of 'B' and accumulator
410D		INC	D2 11, 41	Jump if no carry
4110		INR D	14	Increment carry if there is
4111		DCR C	OD	Decrement the value 'C'
4112		JNZ	C2 0C, 41	Jump if number zero
4115		STA 4502	32 02, 45	Store the result in accumulator
4118		MOV A,D	7A	Move the carry into accumulator
4119		STA 4503	32,03,45	Store the result in accumulator
411C		HLT	76	Stop the program execution

Input

Input Address	Value
4500	04
4501	02

Output

Output Address	Value
4502	08
4503	00

Result:

The assembly language program for multiplication of two 8 bit numbers was executed using 8085 micro processing kit.

DIVISION OF TWO 8 – BIT NUMBERS

Aim:

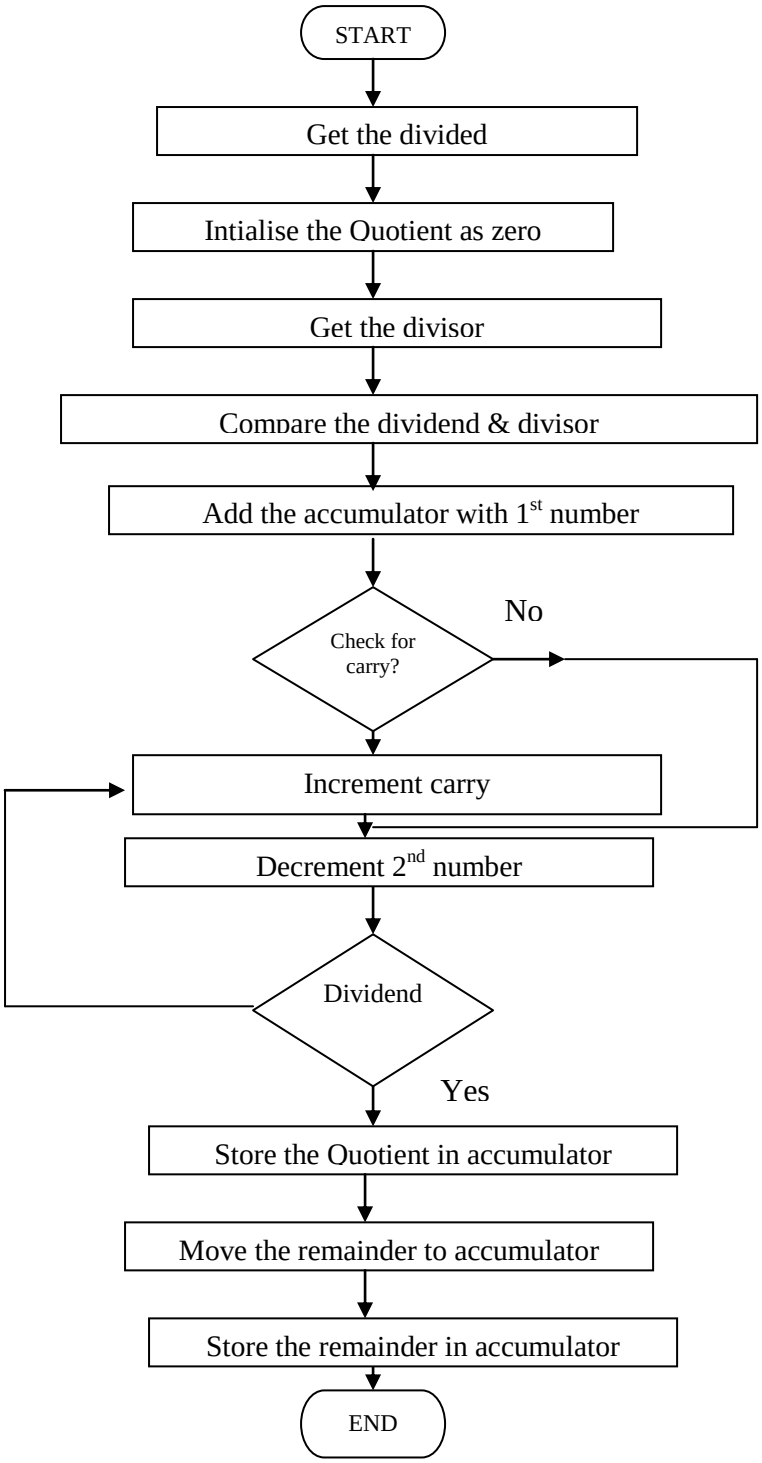
To write an assembly language program for dividing two 8 bit numbers using microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Intialise the Quotient as zero
Step 3	:	Load the 1st 8 bit data
Step 4	:	Copy the contents of accumulator into register 'B'
Step 5	:	Load the 2nd 8 bit data
Step 6	:	Compare both the values
Step 7	:	Jump if divisor is greater than dividend
Step 8	:	Subtract the dividend value by divisor value
Step 9	:	Increment Quotient
Step 10	:	Jump to step 7, till the dividend becomes zero
Step 11	:	Store the result (Quotient) value in accumulator
Step 12	:	Move the remainder value to accumulator
Step 13	:	Store the result in accumulator
Step 14	:	Stop the program execution


START
Get the divided
Intialise the Quotient as zero
Get the divisor
Compare the dividend & divisor
Add the accumulator with 1st number
Check for carry?
No
Increment carry
Decrement 2nd number
Dividend
Yes
Store the Quotient in accumulator
Move the remainder to accumulator
Store the remainder in accumulator
END

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C, 00	0E, 00	Intialise Quotient as zero
4102		LDA, 4500	3A 00, 45	Get the 1st data
4105		MOV B,A	47	Copy the 1st data into register 'B'
4106		LDA, 4501	3A 01, 45	Get the 2nd data
4109		CMP B	B8	Compare the 2 values
410A		JC (LDP)	DA 12,41	Jump if dividend lesser than divisor
410D	Loop 2	SUB B	90	Subtract the 1st value by 2nd value
410E		INR C	0C	Increment Quotient (410D)
410F		JMP (LDP, 41)	C3, 0D, 41	Jump to Loop 1 till the value of dividend becomes zero
4112	Loop 1	STA 4502	32 02,45	Store the value in accumulator
4115		MOV A,C	79	Move the value of remainder to accumulator
4116		STA 4503	32 03,45	Store the remainder value in accumulator
4119		HLT	76	Stop the program execution

Input

Input Address	Value
4500	09
4501	02

Output

Output Address	Value
4502	04 (quotient)
4503	01 (reminder)

1001
0010 – I

0111
0010 – II

0101
0010 – III

0011
0010 – IV

0001 – carry

Quotient - 04
Carry - 01

Result:

The assembly language program for division of two 8 bit numbers was executed using 8085 micro processing kit.

ASCENDING ORDER

Aim:

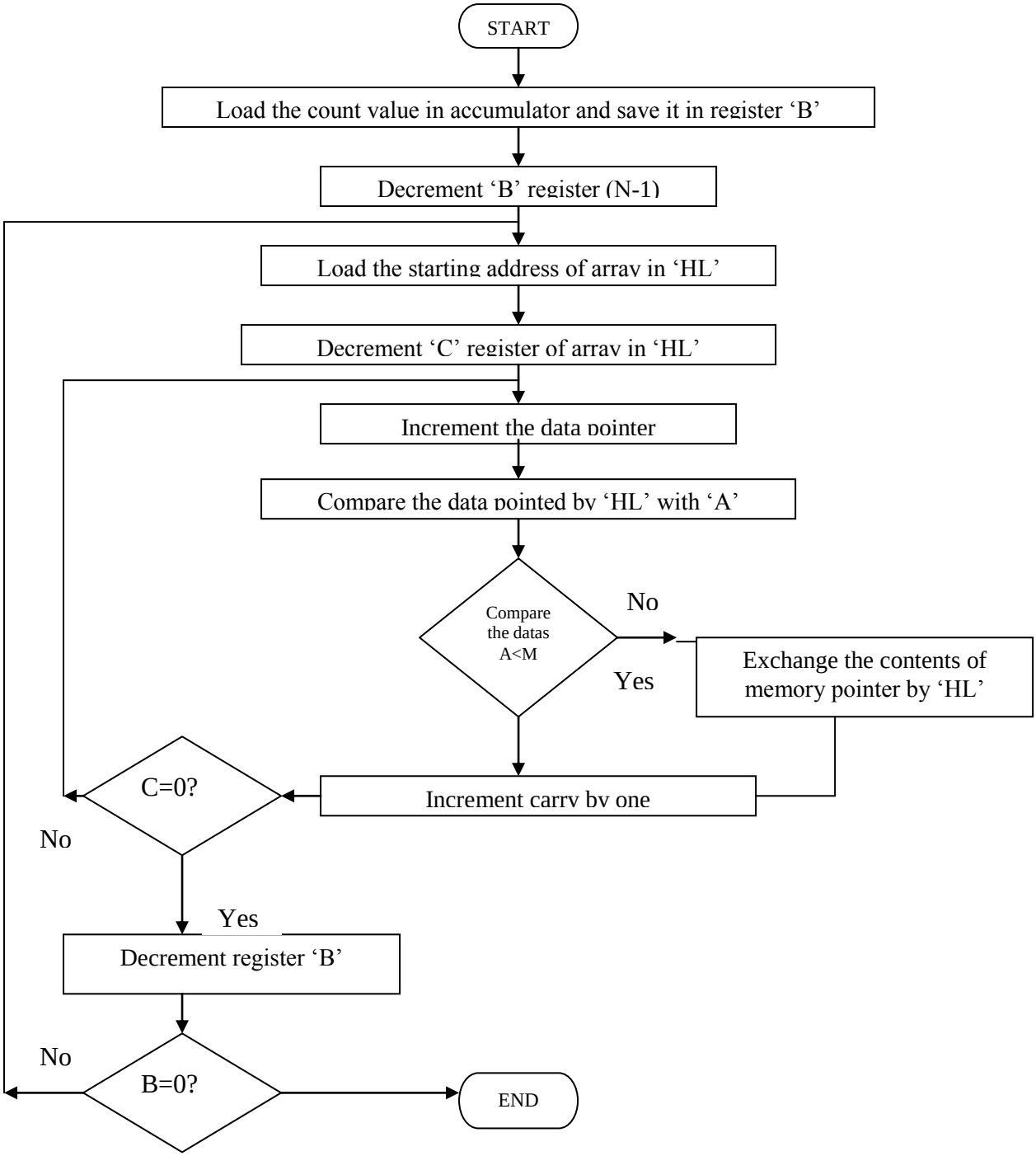
To write a program to sort given ‘n’ numbers in ascending order

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Accumulator is loaded with number of values to sorted and it is saved
Step 3	:	Decrement 8 register (N-1) Repetitions)
Step 4	:	Set ‘HL’ register pair as data array
Step 5	:	Set ‘C’ register as counter for (N-1) repetitions
Step 6	:	Load a data of the array in accumulator
Step 7	:	Compare the data pointed in ‘HL’ pair
Step 8	:	If the value of accumulator is smaller than memory, then jump to step 10.
Step 9	:	Otherwise exchange the contents of ‘HL’ pair and accumulator
Step 10	:	Decrement ‘C’ register, if the of ‘C’ is not zero go to step 6
Step 11	:	Decrement ‘B’ register, if value of ‘B’ is not zero, go step 3
Step 12	:	Stop the program execution


START
Load the count value in accumulator and save it in register 'B'
Decrement 'B' register (N-1)
Load the starting address of array in 'HL'
Decrement 'C' register of array in 'HL'
Increment the data pointer
Compare the data pointed by 'HL' with 'A'
Compare the datas A<M
No
Yes
Exchange the contents of memory pointer by 'HL'
Increment carry by one
C=0?
No
Yes
Decrement register 'B'
No
B=0?
END

Address	Label	Mnemonics	Hex Code	Comments
4100		LDA 4500	3A, 00,45	Load the number of values
4103		MOV B,A	47	Move it 'B' register
4104		DCR B	05	For (N-1) comparisons
4105	Loop 3	LXI H, 4500	21, 00,45	Set the pointer for array
4108		MOV C,M	4E	Count for (N-1) comparisons
4109		DCR C	0D	For (N-1) comparisons
410A		INX H	23	Increment pointer
410B	Loop 2	MOV A,M	7E	Get one data in array 'A'
410C		INX H	23	Increment pointer
410D		CMP M	BE	Compare next with accumulator
410E		JC	DA, 16, 41	If content less memory go ahead
4111		MOV D,M	56	If it is greater than interchange it
4112		MOV M,A	77	Memory content
4113		DCX H	2B	Exchange the content of memory pointed by 'HL' by previous location
4114		MOV M,D	72	One in by 'HL' and previous location
4115		INX H	23	Increment pointer
4116	Loop 1	DCR C	0D	Decrement 'C' register
4117		JNZ Loop 1	C2, 0B, 41	Repeat until 'C' is zero
411A		DCR B	05	Decrement in 'B' values
411B		JNZ Loop 2	C2, 05, 41	Repeat till 'B' is zero
411E		HLT	76	Stop the program execution

Input

Input Address	Value
4500	04
4501	AB
4502	BC
4503	01
4504	0A

Output Address & Value

Output Address	Value
4500	04
4501	01
4502	0A
4503	AB
4504	BC

Result:

The assembly language program for sorting numbers in ascending order was executed by microprocessor kit.

DESCENDING ORDER

Aim:

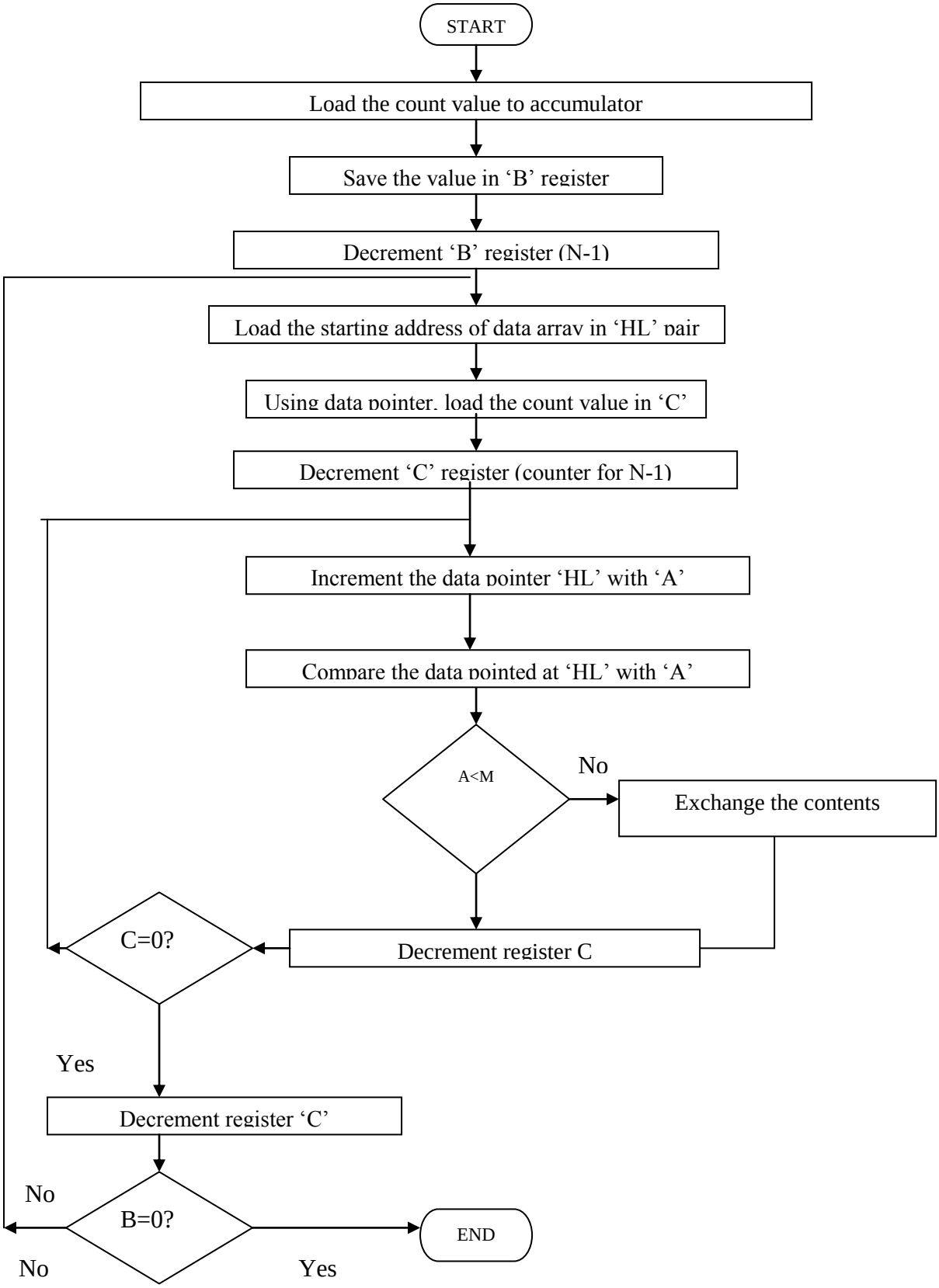
To write a program to sort given ‘n’ numbers in descending order

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Load the number of values into accumulator and save the number of values in register ‘B’
Step 3	:	Decrement register ‘B’ for (N-1) Repetitions
Step 4	:	Set ‘HL’ register pair as data array address pointer and load the data of array in accumulator
Step 5	:	Set ‘C’ register as counter for (N-1) repetitions
Step 6	:	Increment ‘HL’ pair (data address pointer)
Step 7	:	Compare the data pointed by ‘HL’ with accumulator
Step 8	:	If the value of accumulator is larger than memory, then jump to step 10, otherwise next step.
Step 9	:	Exchange the contents of memory pointed by ‘HL’ and accumulator
Step 10	:	Decrement ‘C’ register, if the of ‘C’ is not zero go to step 6, otherwise next step.
Step 11	:	Decrement ‘B’ register, if ‘B’ is not zero, go step 3, otherwise next step.
Step 12	:	Stop the program execution


START
Load the count value to accumulator
Save the value in 'B' register
Decrement 'B' register (N-1)
Load the starting address of data array in 'HL' pair
Using data pointer, load the count value in 'C'
Decrement 'C' register (counter for N-1)
Increment the data pointer 'HL' with 'A'
Compare the data pointed at 'HL' with 'A'
A<M
No
Exchange the contents
C=0?
Decrement register C
Yes
Decrement register 'C'
No
B=0?
END
No
Yes

Address	Label	Mnemonics	Hex Code	Comments
4100		LDA 4500	3A, 00,45	Load the number of values in accumulator
4103		MOV B,A	47	Move it to 'B' register
4104		DCR B	05	For (N-1) comparisons
4105	Loop 3	LXI H, 4500	21, 00,45	Set the pointer for array
4108		MOV C,M	4E	Count for (N-1) comparisons
4109		DCR C	0D	For (N-1) comparisons
410A		INX H	23	Increment pointer
410B	Loop 2	MOV A,M	7E	Get one data from array
410C		INX H	23	Increment pointer
410D		CMP M	BE	Compare next with number
410E		ICE, Loop 1	D2, 16,41	If content 'A' is greater than content of 'HL' pair
4111		MOV D,M	56	If it is greater than interchange the datas
4112		MOV M,A	77	Accumulator to memory value
4113		DCX H	2B	Decrement memory pointer
4114		MOV M,D	72	Move the old to 'HL' and previous location
4115		INX H	23	Increment pointer
4116	Loop 1	DCR C	0D	Decrement 'C' register
4117		JNZ Loop 2	C2, 0B, 41	Repeat till 'C' is zero
411A		DCR B	05	Decrement in 'B' values
411B		JNZ Loop 3	C2, 05, 41	Jump to loop till the value of 'B' be
411E		HLT	76	Stop the program execution

Input

Input Address	Value
4500	04
4501	AB
4502	BC
4503	01
4504	0A

Output Address & Value

Output Address	Value
4500	04
4501	BC
4502	AB
4503	0A
4504	01

Result:

The assembly language program for sorting '4' numbers in descending order was executed successfully using microprocessor kit.

SUM OF DATAS

Aim:

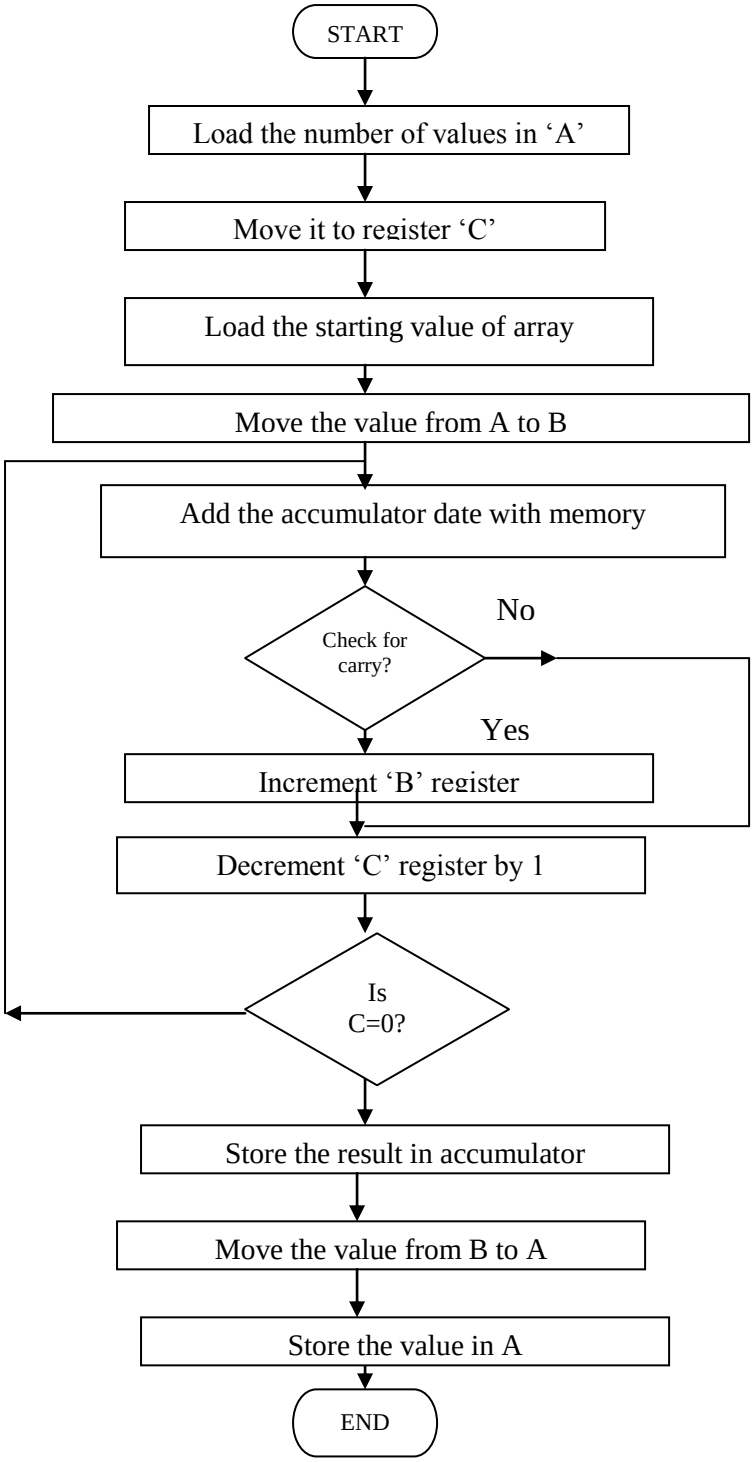
To write an assembly language program to calculate the sum of datas using 8085 microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Load the number of values in series in accumulator and move it to register C and load the starting address of array
Step 3	:	Intialize the value of A as '00'
Step 4	:	Move the value of 'A' to 'B' register
Step 5	:	Add the content of accumulator with the data pointed by 'HL' pair
Step 6	:	If there exists a carry, increment 'B' by 1, if not continue
Step 7	:	Increment the pointer to next data
Step 8	:	Decrement the value of 'C' by 1, which is used as counter
Step 9	:	If 'C' is equal to zero, go to step 10 if not go to step 5.
Step 10	:	Store the value of 'A' to memory, it shows the result
Step 11	:	Move the content of B to A
Step 12	:	Store the value of A to memory
Step 13	:	Stop the program


START
Load the number of values in ‘A’
Move it to register ‘C’
Load the starting value of array
Move the value from A to B
Add the accumulator date with memory
Check for carry?
No
Yes
Increment ‘B’ register
Decrement ‘C’ register by 1
Is C=0?
Store the result in accumulator
Move the value from B to A
Store the value in A
END

Address	Label	Mnemonics	Hex Code	Comments
4100		LDA 4200	3A 00,42	Load the accumulator with number of values
4103		MOV B,A	4F	Move it from A to C
4104		LXI H, 4201	21,01,42	Load the starting address of data array
4107		SUB A	97	Intialise 'A' as 00
4108		MOV B,A	47	Intialise 'B' as 00
4109	Loop	ADD M	86	Add the previous sum with next data
410A		JNC Skip	D2, 0E, 41	Jump on if no carry
410D		INR B	04	Increment carry by one
410E	Skip	INX H	23	Increment pointer for next data
410F		DCR C	0D	Decrement 'C' by one
4110		JNZ Loop	C2, 09, 41	Jump if not zero
4113		STA 4400	32,00,44	Store the sum in accumulator
4116		MOV A,B	78	Move the value of carry to A from B
4117		STA 4401	32,01,44	Store the carry in memory
411A		HLT	76	End of program

Input

Input Address	Value
4200	04
4201	07
4202	09
4203	03
4204	04

Output

Output Address	Value
4400	17
4401	00

07 + 09 + 03 + 04 = 23

= 17 (in Hexa decimal)
(0F + 8 = 233)

```
0F      =       0000    1111
08      =       0000    1000
                ----------------
                0001    0111
                1       7
```

Result:

The assembly language program for sum of datas was executed successfully using 8085 microprocessor kit.

FACTORIAL OF 8 BIT NUMBER

Aim:

To write an program to calculate the factorial of a number (between 0 to 8)

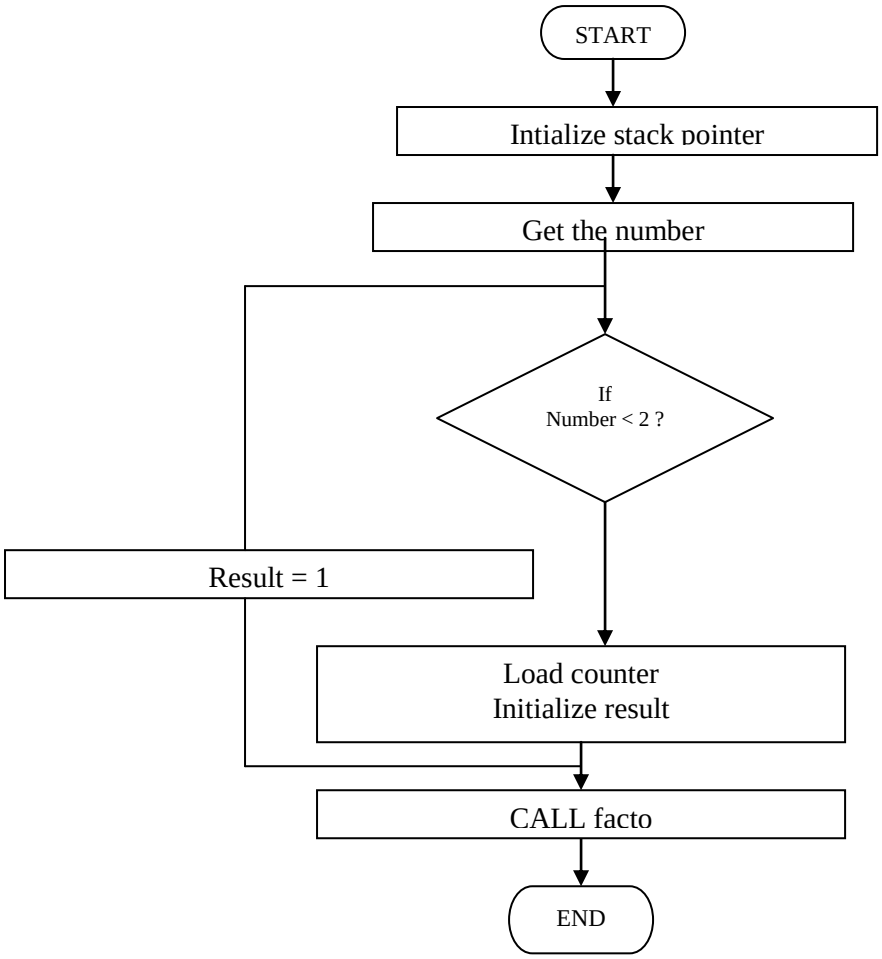
Apparatus required:

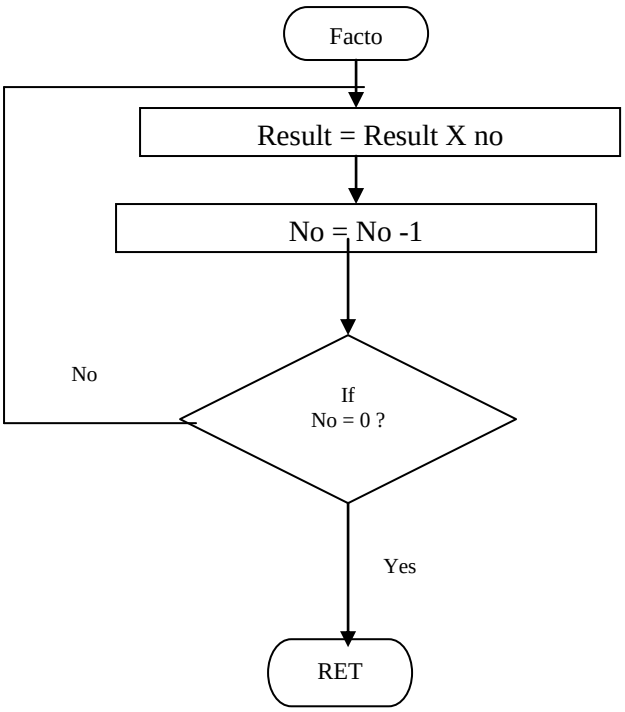
8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Intialize the stack pointer
Step 2	:	Get the number in accumulator
Step 3	:	Check for if the number is greater than 1. If no store the result otherwise go to next step.
Step 4	:	Load the counter and initialize result
Step 5	:	Now factorial program in sub-routine is called.
Step 6	:	In factorial, initialize H_L RP with 0. Move the count value to B Add H_L content with R_p. Decrement count (for multiplication)
Step 7	:	Exchange content of Rp (DE) with HL.
Step 8	:	Decrement counter (for factorial) till zero flag is set.
Step 9	:	Store the result
Step 10	:	Hault

Memory address	Content
4250	05
4251	(120_{10})


START
Intialize stack pointer
Get the number
If
Number < 2 ?
Result = 1
Load counter
Initialize result
CALL facto
END


Facto
Result = Result X no
No = No -1
No
If
No = 0 ?
Yes
RET

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4200 4201 4202	3A 50 42		LDA	4250	Get the number in accumulator
4203 4204	FE 02		CPI	02H	Compare data with 2 and check it is greater than 1
4205 4206 4207	DA 17 42		JC	Loop 1	If cy =1 jump to loop 1 If cy = 0 proceed
4208	5F		MOV	E,A	Move content of A to E
4209 420A	16 00		MVI	D,00	Load this term as a result
420B	3D		DCR	A	Decrement accumulator by 1
420C	4F		MOV	C,A	Move 'A' content to 'C' (counter 1 less than A)
420D 420E 420F	CD 00 46		CALL	Facto	Call sub routine programe Facto
4210	EB		XCHG		Exchange (DE) – (HL)
4211 4212 4213	22 51 42		SHLD	4251	Store content of HL in specified memory location
4214 4215 4216	C3 1D 42		JMP	Loop 3	Jump to Loop 3
4217 4218 4219	21 00 01	Loop 1	LXI	$H,0001_H$	HL is loaded with data 01
421A 421B 421C	22 51 42		SHLD	4251	Store the result in memory
421D	76	Loop 3	HLT		Terminate the program
Sub Routine					
4600 4601 4602	21 00 00	Facto	LXI	H,0000	Initialize HL pair
4603	41		MOV	B,C	Content of 'C' is moved to B
4604	19	Loop 2	DAD	D	Content of DE is added with HL
4605	05		DCR	B	'B' is decremented
4606 4607 4608	C2 04 46		JNZ	Loop 2	Multiply by successive addition till zero flag is set

4609	EB		XCHG		[DE] – [HL]
460A	0D		DCR	C	Decrement counter value
460B 460C 460D	C4 00 46		CNZ	Facto	Call on no zero to facto (i.e repeat process till zero flag for c = 1)
460E	C9		RET		Return to main program

Memory address	Content
4250	04
4251	18

1 x 2 x 3 x 4 = 24

Hexadecimal

16 | 24
1-8

Result:

Thus, factorial program was done successfully

FIBANOCCI SERIES

Aim:

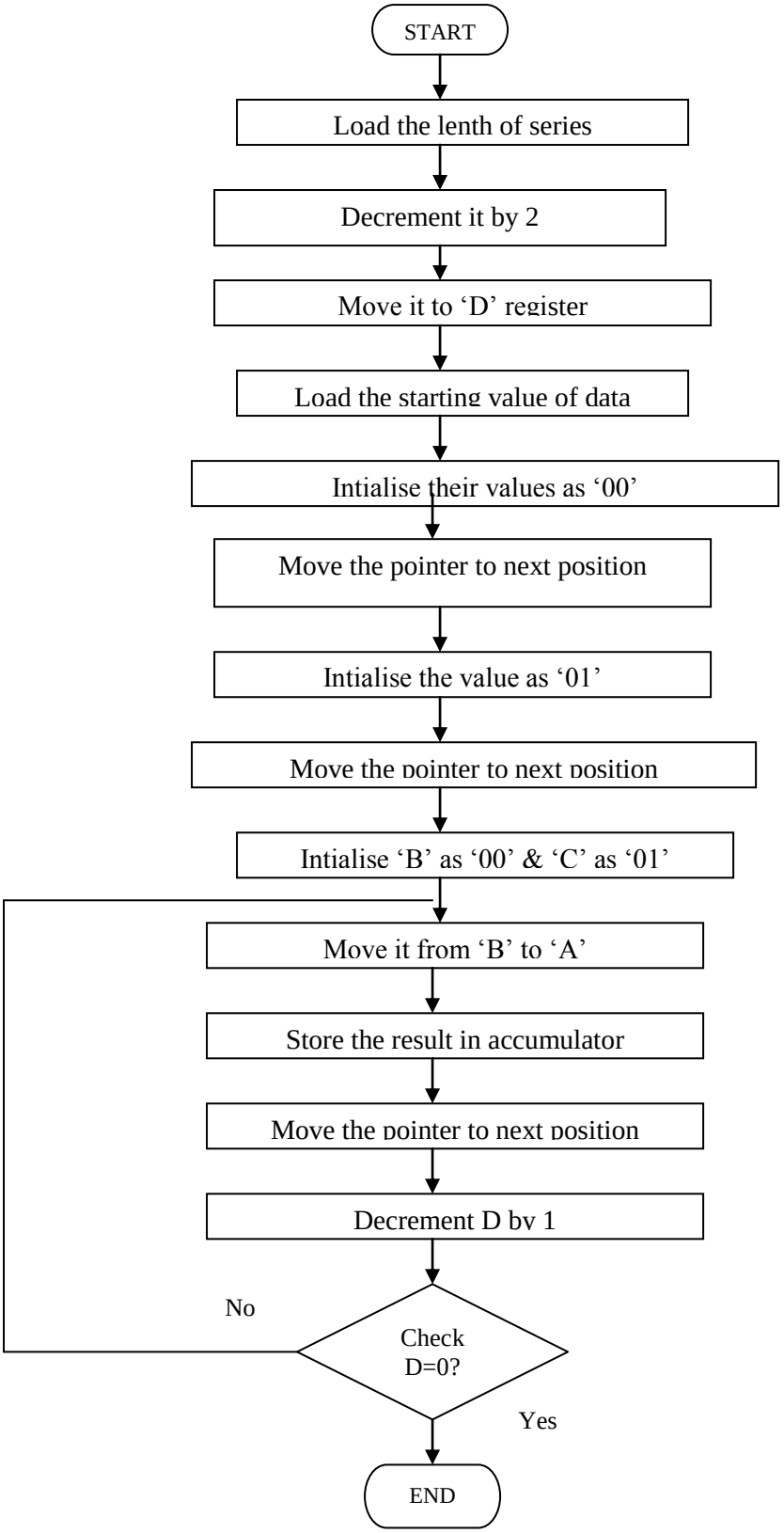
To write an assembly language program to displace Fibanocci Series.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Load the length of series in the accumulator and decrement it by 2
Step 3	:	Move the value to register 'D'
Step 4	:	Load the starting value of data value address
Step 5	:	Intialise the 1st number as 00
Step 6	:	Move the pointer to 2nd data and intialise them as '01'
Step 7	:	Move the pointer to next position for next data
Step 8	:	Intialise B as '00' and C as '01' for calculations
Step 9	:	Copy the contents of 'B' to accumulator
Step 10	:	Add the content of 'C' register to accumulator
Step 11	:	Move the content 'C' to 'B' and 'A' to C
Step 12	:	Now store the result to memory pointed by 'HL' pair
Step 13	:	Move the pointer to next pointer
Step 14	:	Decrement 0 by 1 for counter
Step 15	:	If 'D' is not zero, go to step 9
Step 16	:	if 'D' is zero, end the program


START
Load the lenth of series
Decrement it by 2
Move it to ‘D’ register
Load the starting value of data
Intialise their values as ‘00’
Move the pointer to next position
Intialise the value as ‘01’
Move the pointer to next position
Intialise ‘B’ as ‘00’ & ‘C’ as ‘01’
Move it from ‘B’ to ‘A’
Store the result in accumulator
Move the pointer to next position
Decrement D by 1
No
Check
D=0?
Yes
END

Address	Label	Mnemonics	Hex Code	Comments
4200		LDA 4300	3A, 00, 43	Store the length of series in 'A'
4203		SUI 02	D6, 02	Decrement 'A' by 02
4205		MOV D,A	57	Move 'A' to 'D' (counter)
4206		LXI H, 4301	21,01,43	Load the starting address of array
4209		MVI M,00	36,00	Intialise 4301 as '00'
420B		INX H	23	Increment pointer
420C		MVI M, 01	36,01	Initialize 2nd as '01'
420E		INX H	23	Increment pointer
420F		MVI B,00	06,00	Intialise 'B' as '00'
4211		MVI, C, 01	0E, 01	Intialise 'C' as '01'
4213	Loop	MOV A,B	78	Move B to A
4214		ADD C	81	Add 'A' and 'C'
4215		MOV B,C	41	Move C to B
4216		MOV C,A	4F	Move A to C
4217		MOV M,A	77	Move the result to memory
4218		INX H	23	Increment pointer
4219		DCR D	15	Decrement counter
421A		JNZ loop	C2, 13,42	If D = 0, jump to loop
421D		HLT	76	Stop the program

Input

Input Address	Value
4300	05

Output

Output Address	Value
4301	00
4302	01
4303	01
4304	02
4305	03

00 + 01 = 01
01+ 01 = 02
02 + 01 = 03

Result:

The assembly language for Fibonaci series was executed successfully using 8085 microprocessor kit.

16 – BIT MULTIPLICATION

Aim:

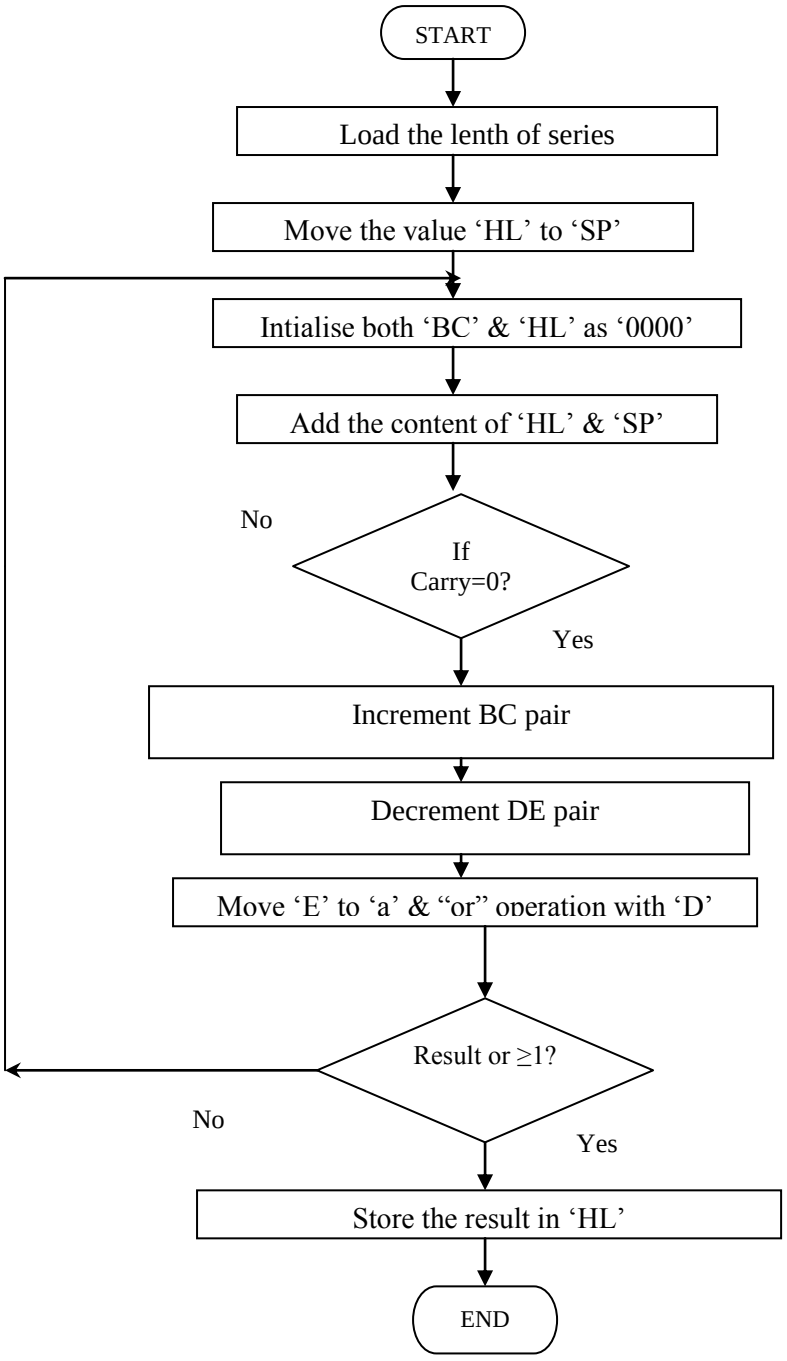
To write an assembly language program for 16 bit multiplication by using 8085 microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Load the 1st data in 'HL' register pair
Step 3	:	Move content of 'HL' pair to stack pointer
Step 4	:	Load the 2nd data in 'HL' and move it to 'DE'
Step 5	:	Make 'HL' pair as '00' and '00'
Step 6	:	Add 'HL' pair and 'SP'
Step 7	:	Check for carry condition, if carry is present increment it by one else move to next step.
Step 8	:	Decrement DE register
Step 9	:	Then move E to 'A' and perform 'OR' operation with 'a' and 'D'
Step 10	:	The value of operation is zero, then store the value else go to step 3
Step 11	:	Stop the program


START
Load the lenth of series
Move the value ‘HL’ to ‘SP’
Intialise both ‘BC’ & ‘HL’ as ‘0000’
Add the content of ‘HL’ & ‘SP’
No
If
Carry=0?
Yes
Increment BC pair
Decrement DE pair
Move ‘E’ to ‘a’ & “or” operation with ‘D’
Result or ≥1?
No
Yes
Store the result in ‘HL’
END

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4100	2A,00,42		LHLD	4200	Get the 1st data in HL
4103	F9		SP HL		Save it in stack pointer4106
4106	2A,02,42		LHLD	4202	Get the 2nd data in HL
4107	EB		XCHG		Exchange 'HL' and 'DC'
4108	21,00,00		LXI H	0000	Make HL – 0000
410B	01,00,00		LXI B	0000	Make BC – 0000
410E	39	Next	DAD	SP	Add 'SP' and 'HL'
410F	D2, 13, 41		JNC	Loop	Jump to loop if no carry
4112	03		INX	B	Increment 'BC' by one
4113	1B	Loop	DCX	D	Decrement 'DE' by one
4114	7B		MOV	A,E	Make E – A
4115	B2		ORA	D	'OR' gate between A & D
4116	C2,0E,41		JNZ	Next	Jump on if number zero
4119	22,04,42		SHLD	4204	Store the LSB in memory
411C	69		MOV	L,C	Make C to L
411D	60		MOV	H,B	Make B to H
411E	22,06,42		SHLD	4206	Store the MSB in memory
4121	76		HLT		Stop the program

Input

Input Address	Value
4200	04
4201	07
4202	02
4203	01

Output

Output Address	Value
4204	08
4205	12
4206	01
4207	00

Result:

Thus the assembly language program for 16 bit multiplication was executed successfully.

16 – BIT DIVISION

Aim:

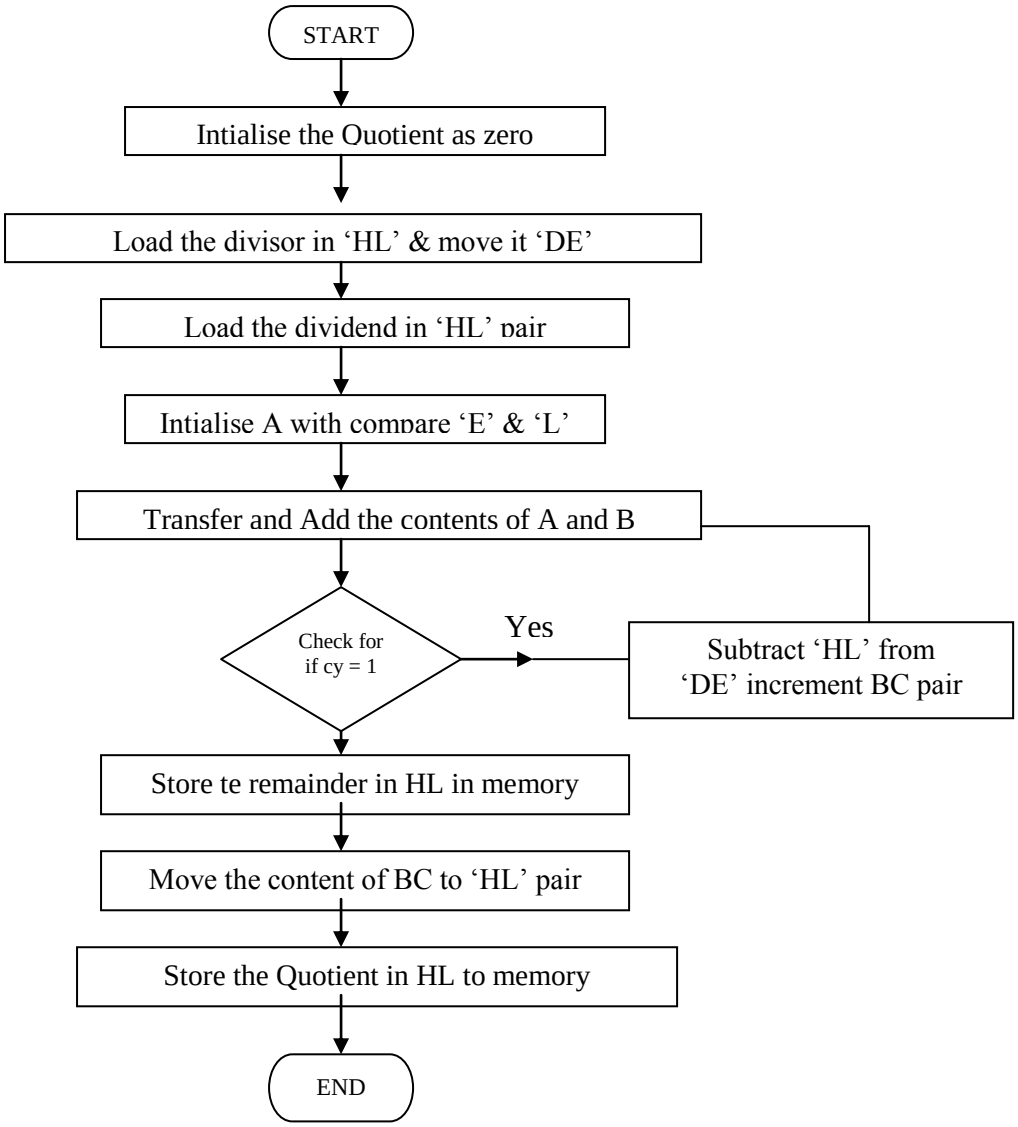
To write an assembly language program for 16 bit division in 8085 microprocessor.

Apparatus required:

8085 microprocessor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Intialise ‘BC’ as ‘0000’ for Quotient
Step 3	:	Load the divisor in ‘HL’ pair and save it in ‘DE’ register pair
Step 4	:	Load the dividend in ‘HL’ pair
Step 5	:	Move the value of ‘a’ to register ‘E’
Step 6	:	Subtract the content of accumulator with ‘E’ register
Step 7	:	Move the content ‘A’ to ‘C’ & ‘H’ to ‘A’
Step 8	:	Subtract with borrow, the content of ‘A’ with ‘D’
Step 9	:	Move the value of ‘a’ to ‘H’
Step 10	:	If cy = 1, go to step 12, otherwise next step
Step 11	:	Increment ‘B’ register & jump to step ‘4’
Step 12	:	Add both contents of ‘DC’ and ‘HL’
Step 13	:	Store the remainder in memory
Step 14	:	Move the content of ‘C’ to ‘L’ & ‘B’ to ‘H’
Step 15	:	Store the Quotient in memory
Step 16	:	Stop the program


START
Intialise the Quotient as zero
Load the divisor in 'HL' & move it 'DE'
Load the dividend in 'HL' pair
Intialise A with compare 'E' & 'L'
Transfer and Add the contents of A and B
Check for if cy = 1
Yes
Subtract 'HL' from 'DE' increment BC pair
Store te remainder in HL in memory
Move the content of BC to 'HL' pair
Store the Quotient in HL to memory
END

Address	Label	Mnemonics	Hex Code	Comments
4500		LXI B,0000	0,00,00	Intialise Quotient as '0000'
4503		LHLD 4802	2A,02,48	Load the divisor in 'HL'
4506		XCHG	EB	Exchange 'HL' and 'DE'
4507		LHLD 4800	2A,00,48	Load the dividend
450A	Loop 2	MOV A,L	7D	Move the 'L' value to 'A'
450B		SUB E	93	(A-E) – A
450C		MOV L,A	6F	A- L (A value is move t L)
450D		MOV A,H	7C	H – A (a is stored with H)
450E		SBB D	9A	Subtract 'D' from 'A'
450F		MOV H,A	67	Then A is moved to 'H'
4510		JC loop 1	DA,17,45	If cy is present go to loop 1
4513		INX B	03	Increment BC pair by 1
4514		JMP loop 2	C3, 0A, 45	Jump to loop 2
4517	Loop 1	DAD 'D'	19	'DE' and 'HL' pair all added
4518		SHLD 4806	22,06,48	HL is stored in memory
451B		MOV L,C	69	Move 'C' register data to 'L'
451C		MOV H,B	60	Move 'B' register data to 'H'
451D		SHLD 4804	22,04,48	Store the result in 'HL' pair
4520		HLT	76	Stop the program

Input

Input Address	Value
4800	04
4801	00
4802	02
4803	00

Output

Output Address	Value
4804	02
4805	00
4806	FE
4807	FF

Result:

Thus the assembly language program for 16 bit division was executed successfully.

BINARY TO BCD CONVERSION

Aim:

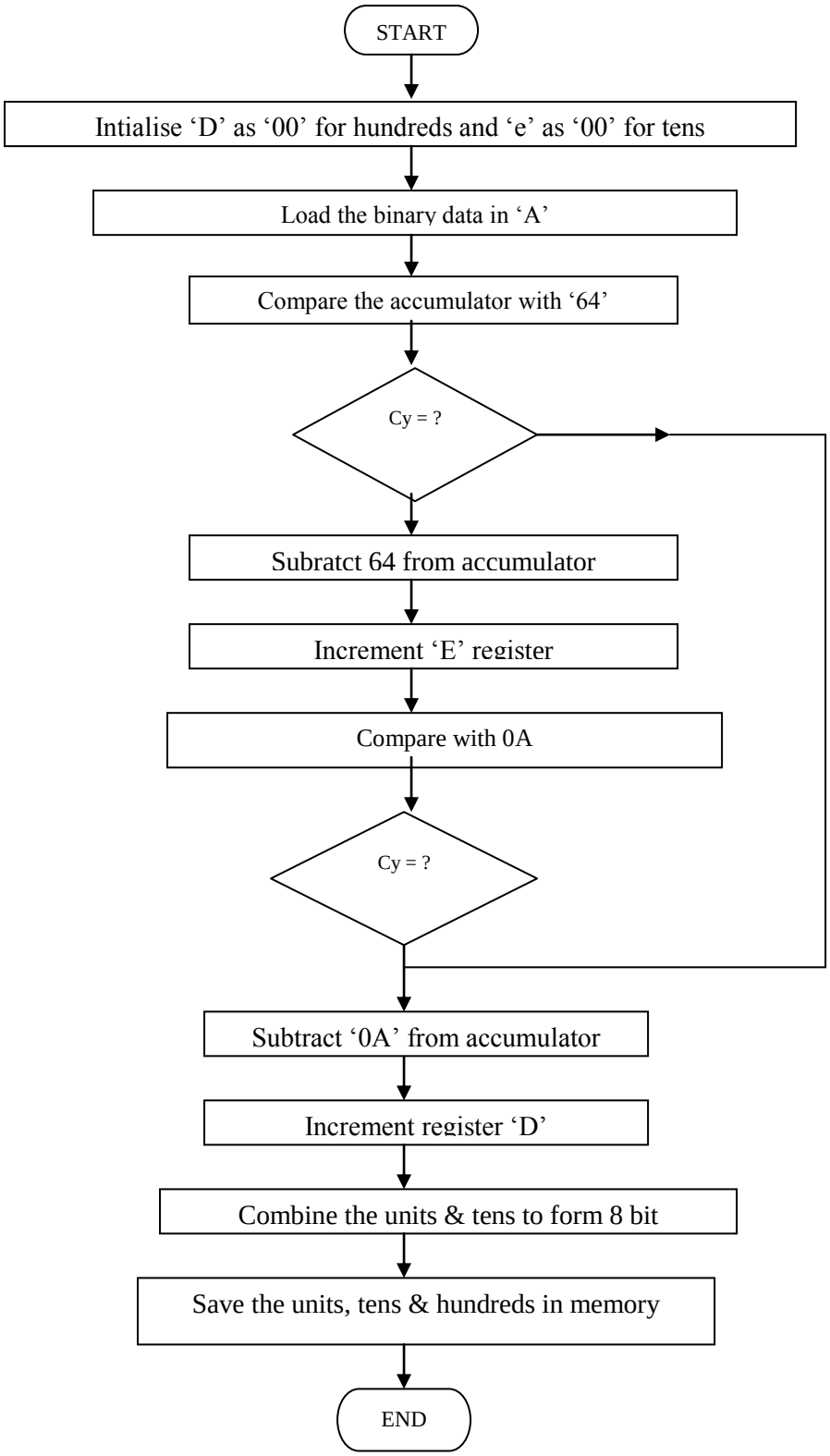
To write an assembly language program to convert an 8 bit binary data to BCD using 8085 microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Clear 'D' and 'E' register to account for hundred's and ten's load the binary data in accumulator
Step 3	:	Compare 'A' with 64 if cy = 01, go step C otherwise next step
Step 4	:	Subtract 64 from (64+1) 'A' register
Step 5	:	Increment 'E' register
Step 6	:	Compare the register 'A' with '0A', if cy=1, go to step 11, otherwise next step
Step 7	:	Subtract ($0A_H$) from 'A' register
Step 8	:	Increment D register
Step 9	:	Go to step 7
Step 10	:	Combine the units and tens to from 8 bit result
Step 11	:	Save the units, tens and hundred's in memory
Step 12	:	Stop the program execution


START
Intialise ‘D’ as ‘00’ for hundreds and ‘e’ as ‘00’ for tens
Load the binary data in ‘A’
Compare the accumulator with ‘64’
Cy = ?
Subratct 64 from accumulator
Increment ‘E’ register
Compare with 0A
Cy = ?
Subtract ‘0A’ from accumulator
Increment register ‘D’
Combine the units & tens to form 8 bit
Save the units, tens & hundreds in memory
END

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4100	0E,00		MVI	E,00	Clear 'E' register (Hund)
4102	53		MOV	D,E	Clear 'D' register (tens)
4103	3A,00,42		LDA	4200	Get the data in 'A'
4106	C3,06,41	HUND	CPI	64	Compare the data with 64
4108	DA,11,41		JC	TEN	If content is less jump to ten
410B	D6, 64		SUI	64	Subtract data by 64
410D	IC		INR	E	Increment carry each time
410E	C3,06,41		JMP	HUND	Jump to hundred & repeat
4111	C3, 0A	TEN	CPI	0A	Compare the data with 0A
4113	DA,1C,41		JC	UNIT	If data is less jump to unit
4116	D6, 0A		SUI	0A	Subtract the data by 0A
4118	14		INR	D	Increment 'D' each time
4119	C3,11,41		JMP	TEN	Jump to ten & repeat
411C	4F	UNIT	MOV	4A	Move the value 'A' to 'C'
411D	7A		MOV	A,D	Move the value 'D' to 'A'
411E	07		RLC		Rotate the value of 'A'
411F	07		RLC		Of 'A' so that
4120	07		RLC		Lower and upper niddle
4121	07		RLC		Gets exchanged
4122	81		ADD	C	Add 'A' and 'C'
4123	32,50,42		STA	42,50	Save ten' & units in 'M'
4126	7B		MOV	A,E	Move to E to A
4127	32,51,42		STA	4251	Save hundreds unit in 'A'
412A	76		HLT		Stop the program execution

Input

Input Address	Value
4200	54

Output

Output Address	Value
4250	84
4251	00

Result:

Thus the binary to BCD conversion was executed successfully

BCD TO BINARY

Aim:

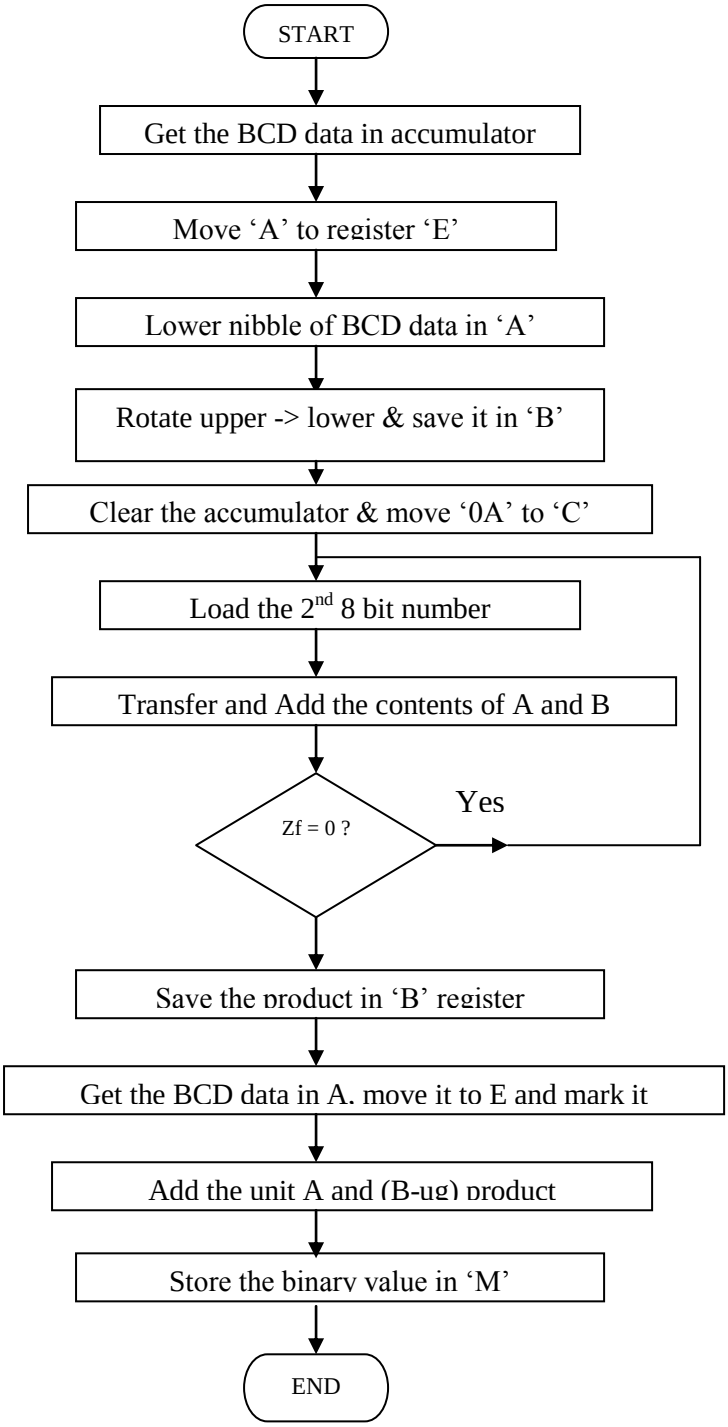
To write an assembly language program to convert BCD data to Binary data using 8085 microprocessor kit.

Apparatus required:

8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Start the microprocessor
Step 2	:	Get the BCD data in accumulator and save it in register 'E'
Step 3	:	Mark the lower nibble of BCD data in accumulator
Step 4	:	Rotate upper nibble to lower nibble and save it in register 'B'
Step 5	:	Clear the accumulator
Step 6	:	Move $0A_H$ to 'C' register
Step 7	:	Add 'A' and 'B' register
Step 8	:	Decrement 'C' register. If zf = 0, go to step 7
Step 9	:	Save the product in 'B'
Step 10	:	Get the BCD data in accumulator from 'E' register and mark the upper nibble
Step 11	:	Add the units (A-ug) to product (B-ug)
Step 12	:	Store the binary value in memory
Step 13	:	End the program


START
Get the BCD data in accumulator
Move ‘A’ to register ‘E’
Lower nibble of BCD data in ‘A’
Rotate upper -> lower & save it in ‘B’
Clear the accumulator & move ‘0A’ to ‘C’
Load the 2nd 8 bit number
Transfer and Add the contents of A and B
Zf = 0 ?
Yes
Save the product in ‘B’ register
Get the BCD data in A, move it to E and mark it
Add the unit A and (B-ug) product
Store the binary value in ‘M’
END

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4100	3A,00,42		LDA	4200	Get the data in ‘A’
4103	5E		MOV	E,A	Save in ‘E’ register
4104	E6, F0		ANI	F0	Mark the lower nibble
4106	07		RLC		Rotate the upper
4107	07		RLC		To lower nibble
4108	07		RLC		And save in
4109	07		RLC		Register B
410A	47		MOV	B,A	Move it from ‘A’ to ‘B’
410B	AF		XRA	A	Clear the accumulator
410C	0E,0A		MVI	C,0A	Intialise ‘C’ as ‘0A’
410E	08		REP		
410F	0D		DCR	C	Decrement ‘C’ register
4110	C2,0E,41		JNZ		Jump till value ‘C’ is 0
4113	47		MOV	B,A	Move the value A to B
4114	7B		MOV	A,E	Get the BCD in ‘A’
4115	E6, 0F		ANI	0F	Mark the upper nibble
4117	80		ADD	B	Add ‘A’ and ‘B’
4118	32,01,42		STA	4201	Save the binary data
411B	76		HLT		Stop the program execution

Input

Input Address	Value
4200	68

Output

Output Address	Value
4201	44

16	68
	4-4

Result:

Thus the BCD to binary conversion was executed successfully

SPEED CONTROL OF STEPPER MOTOR

Aim:

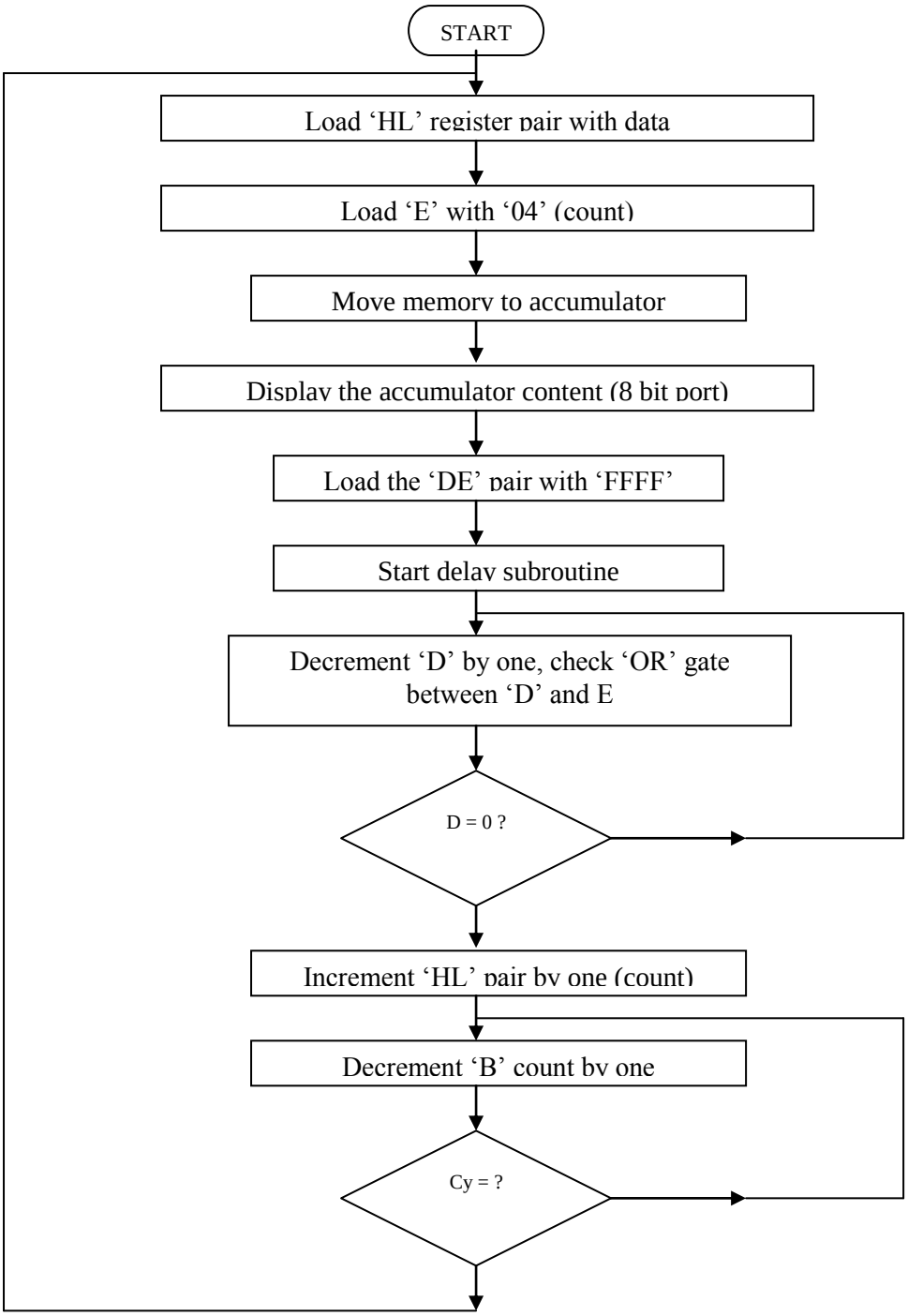
To write an assembly program to make the stepper motor run in forward and reverse direction.

Apparatus required:

Stepper motor
8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Load the ‘HL’ pair wit value from table
Step 2	:	Move it to ‘B’ register for setting the counter
Step 3	:	Move the memory value to accumulator and display it by control word
Step 4	:	Load ‘DE’ register pair with FFFF for starting delay subroutine
Step 5	:	Run the delay loop control D-register becomes zero.
Step 6	:	Increment ‘H’ address for next value from table
Step 7	:	Jump on no zero
Step 8	:	When B = 0, go to start and restart the program


START
Load ‘HL’ register pair with data
Load ‘E’ with ‘04’ (count)
Move memory to accumulator
Display the accumulator content (8 bit port)
Load the ‘DE’ pair with ‘FFFF’
Start delay subroutine
Decrement ‘D’ by one, check ‘OR’ gate between ‘D’ and E
D = 0 ?
Increment ‘HL’ pair by one (count)
Decrement ‘B’ count by one
Cy = ?

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4100	Start	LXI	H,Look up	21,1A,41	Load the 'HL' with data
4103		MVI	B,04	06,04	B = 04
4105	Repeat	MOV	A,M	7E	Memory value to 'A'
4106		OUT	C0	D3, C0	Display it
4108		LXI	D,03,03	11	Load 'DE' with FFFF
410B	Delay	NOP		00	Start delay loop
410C		DCX	D	1B	Decrement DE by 1
410D		MOV	A,E	7B	Move 'E' to 'A'
410E		ORA	D	B2	Check De = 0 or not
410F		JNZ	DELAY	C2, 0B,41	Jump on zero
4112		INX	H	23	Increment HL by 1
4113		DCR	B	05	Decrement B by 1
4114		JNZ	Repeat	C2,05,41	Jump on no zero
4117		JMP	START	C3,00,41	Jump to start

Input

Input Address	Value
411A	0A
411B	06
411C	05
411D	09

Reverse Direction

Output Address	Value
411A	09
411B	05
411C	06
411D	0A

Result:

Thus, an assembly language program to control of stepper motor was written using 8085 microprocessor kit.

FLASHING DISPLAY

Aim:

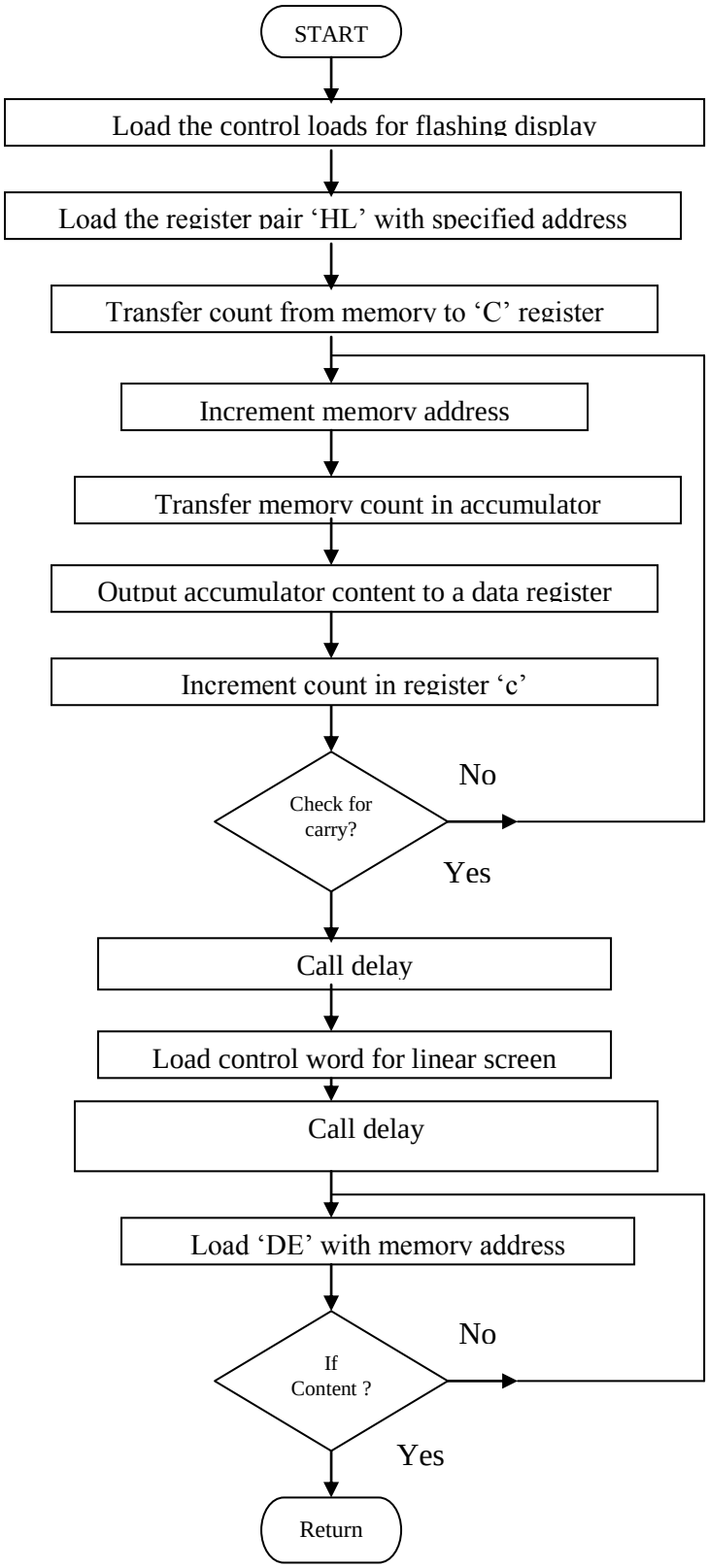
To write an assembly language program to obtain the following flashing display of a particular data.

Apparatus required:

8085 micro processing kit
(0-5V) power supply

Algorithm:

Step 1	:	Get the control words in accumulator and output words through 8 bit address
Step 2	:	Load ‘HL’ register pair with memory address
Step 3	:	Get the count value in ‘C’ register
Step 4	:	Increment the register pair by one and display the character and call for delay.
Step 5	:	Clear the display and call delay routine to step 7
Step 6	:	Go to step 7
Step 7	:	Load ‘DE’ register pair with memory address
Step 8	:	Decrement ‘DE’ pair with memory address
Step 9	:	If the content is not equal to zero, go to step 8
Step 10	:	Return to main program


START
Load the control loads for flashing display
Load the register pair 'HL' with specified address
Transfer count from memory to 'C' register
Increment memory address
Transfer memory count in accumulator
Output accumulator content to a data register
Increment count in register 'c'
Check for carry?
No
Yes
Call delay
Load control word for linear screen
Call delay
Load 'DE' with memory address
If Content ?
No
Yes
Return

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4300		MVI	A,00	3E,00	Intialise ‘A’ as ‘00’
4302		OUT	01	DE,01	Out the control word trough 8 bit
4304		MVI	A,90	3E,90	Intialise ‘a’ with cw for RAM
4306		OUT	01	D3,01	Out the cw
4308		MVI	A,CC	3E,CC	A = CC
430A		OUT	01	0D,01	Out the cw
430C	Loop 2	LXI	H,5000	21,00,50	Load ‘HL’ with
430F		MOV	C,M	4E	M to C
4310	Loop 1	INX	H	23	Increment ‘H’ by
4311		MOV	A,M	7E	Move M to A
4312		OUT	00	D3, 00	Out the character
4314		DCR	C	0D	Decrement ‘C’ by 1
4315		JNZ	Loop 1	C2,10,43	Check for zero
4318		CALL	Delay	C0,00,46	Call subroutine
431B		MVI	A,DC	3E,DC	A <- 0C
431D		OUT	01	D3, 01	A<-01
431F		CALL	Delay	CD,00,46	Call subroutine
4322		JMP	Loop 2	C3 0C,43	Check for zf
4600	Delay	LXI	D,FFFF	11,FF,FF	Intialise DE=FFFF
4603	Loop 3	DCX	D	1B	Decrement DE by 1
4604		MOV	A,E	7B	Move ‘E’ to ‘A’
4605		ORA	D	B2	Check ‘De’ = ‘00’
4606		JNZ	Loop 3	C2,03,46	Jump on no zero
4609		RET	C9	C9	Return to main program

Input

Input Address	Value
5000	05
5001	68
5002	68
5003	68
5004	FD
5005	88

Output

EEE – A

Result:

Thus, an assembly language program to obtain flashing display of a particular data was written using 8085 microprocessor kit.

ROLLING DISPLAY

Aim:

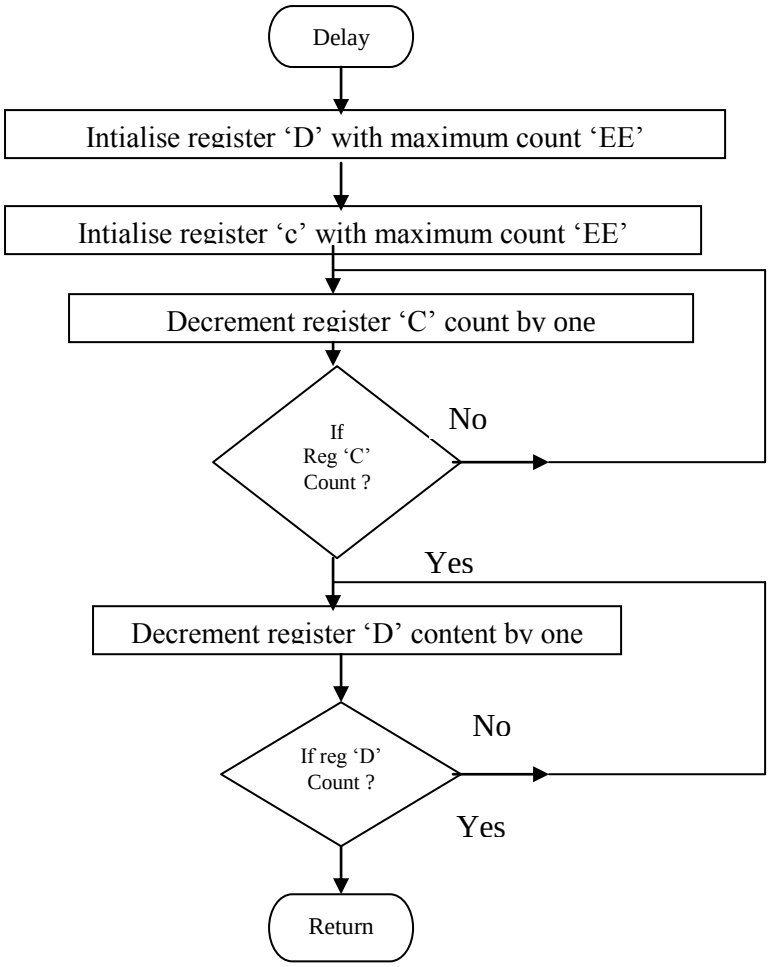
To write an assembly language program to obtain a rolling display of a particular data by using 8085 microprocessor

Apparatus required:

8085 micro processing kit
(0-5V) power supply

Algorithm:

Step 1	:	Get the control words in accumulator and output the control words through 8 bit port address
Step 2	:	Load ‘HL’ register pair with memory address and transfer memory content to ‘C’ register
Step 3	:	Increment ‘HL’ pair with one and transfer the particular bit pattern through 8 bit port address
Step 4	:	Call subroutine delay at step 6
Step 5	:	If the count value in ‘C’ is not equal to zero then go to step 3 else go to step 2
Step 6	:	Load ‘DE’ register pair by memory address
Step 7	:	Decrement ‘DE’ register pair by one
Step 8	:	If DE is not equal to zero, go to step 7 else main program


Delay
Intialise register ‘D’ with maximum count ‘EE’
Intialise register ‘c’ with maximum count ‘EE’
Decrement register ‘C’ count by one
If
Reg ‘C’
Count ?
No
Yes
Decrement register ‘D’ content by one
If reg ‘D’
Count ?
No
Yes
Return

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4500		MVI	A,00	3E,00	Initialise A 00
4502		OUT	01	DE, 01	Control word through 8 bit
4504		MVI	A,90	3E, 90	A = RAM cw
4506		OUT	01	DE,01	Output cw through 8 bit port
4508		MVI	A,CC	3E,CC	A = CC
450A		OUT	01	DE,01	Output cw through 8 bit port
450C	Loop 2	LXI	H,5000	21,00,50	Memory -> HL location
450F		MOV	C,M	4E	M -> C
4510	Loop 1	INX	H	23	Increment 'HL'
4511		MOV	A,M	7E	Move 'H' to 'A'
4512		OUT	00	DE, 00	Output the character
4514		CALL	Loop	CD,00,46	Call the subroutine
4517		DCR	C	0D	Decrement 'C' by one
4518		JNZ	Loop 1	C2,10,45	Jump on no zero
451B		JMP	Loop 2	C3,0C,45	Jump to L2
4600	Loop	LXI	D,FFFF	11,FFFF	Load DE-FFFF
4603	Loop 3	DCX	D	1B	Decrement 'DE' by 1
4604		MOV	A,D	7A	Move 'D' to 'A'
4605		ORA	E	B3	(A) = (A) check
4606		JNZ	Loop 3	C2,03,46	Jump on no zero
4609		RET		C9	Return to main program

Input

Input Address	Value
5000	06
5001	98
5002	68
5003	7A
5004	C8
5005	1A
5006	2C

Output

HELPUS

Result:

Thus, an assembly language program to obtain rolling display of a particular value written using 8085 microprocessor kit.

SQUARE WAVE GENERATOR

Aim:

To write a program and to generate square generator using DAC.

Apparatus required:

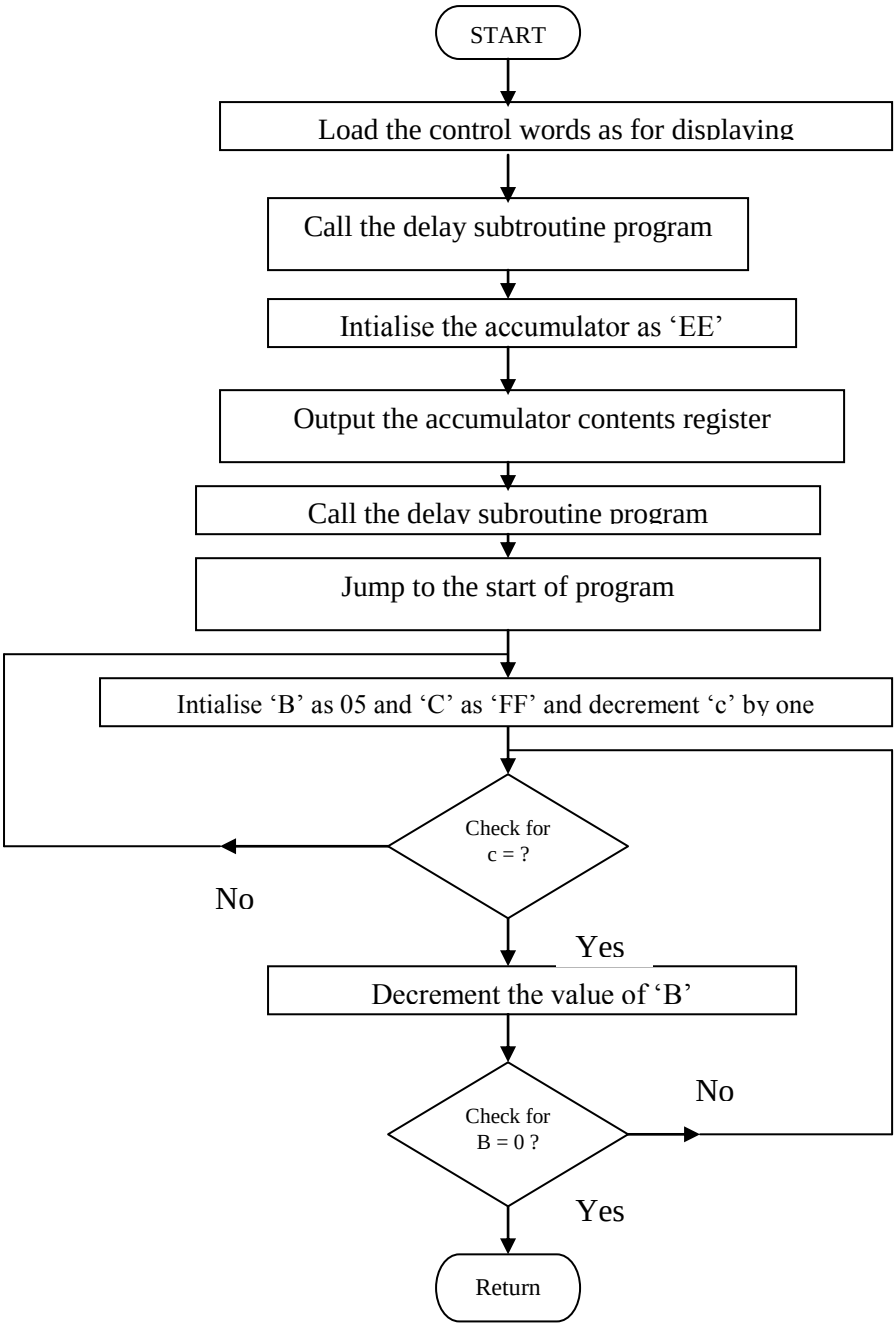
8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Intialise ‘A’ as ‘00’ and take data pointer to port C8
Step 2	:	Call delay
Step 3	:	Move FF to A and take port ‘C8’
Step 4	:	Call delay
Step 5	:	Go to step 1

Delay Subtroutine

Step 1	:	Counter 1 = 05
Step 2	:	Counter 2 = FF
Step 3	:	Decrement counter 2
Step 4	:	Check if c= 0, if no jump to step 3
Step 5	:	Decrement counter 1
Step 6	:	Check if B = 0, if no jump to step 2
Step 7	:	Return to main program


START
Load the control words as for displaying
Call the delay subtroutine program
Intialise the accumulator as ‘EE’
Output the accumulator contents register
Call the delay subroutine program
Jump to the start of program
Intialise ‘B’ as 05 and ‘C’ as ‘FF’ and decrement ‘c’ by one
Check for c = ?
No
Yes
Decrement the value of ‘B’
Check for B = 0 ?
No
Yes
Return

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4100	3E,00	Start	MVI	A,00	Intialise ‘A’ with ‘00’
4102	D3,C8		OUT	C8	Load the control words
4104	CD,11,41		CALL	Delay	Call delay sutroutine
4107	3E,FF		MVI	A,FF	Intialise ‘A’ with ‘FF
4109	D3,C8		OUT	C8	A -> C8
410B	CD,11,41		CALL	Delay	Call delay subroutine
410E	C3,00,41		JMP	Start	Jump to start
4111	06,05	Delay	MVI	B,05	B -> 05
4113	0E	Loop 1	MVI	C,FF	[C] => FF
4115	OD	Loop 2	DCR	C	Decrement ‘C’ register
4116	C2,15,41		JNZ	Loop 2	Jump on no zero
4119	05		DCR	B	Decrement ‘B’ register
411A	C2,13,41		JNZ	Loop 1	Jump on n zero
411D	C9		RET		Return to main program

Result:

Thus square wave was generated using 8085 microprocessor kit.

TRIANGULAR WAVE GENERATOR

Aim:

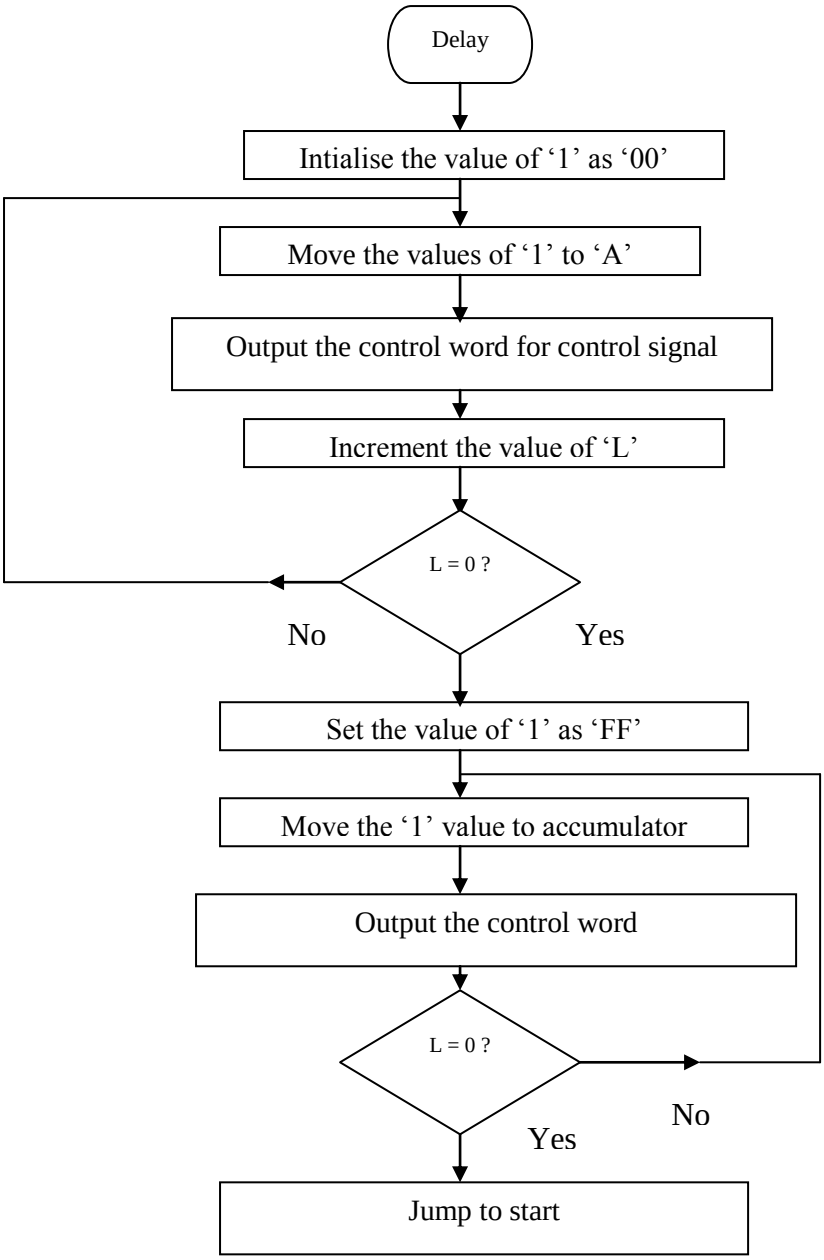
To write an assembly language program for generating triangular wave using DAC.

Apparatus required:

8085 micro processor kit
(0-5V) DC battery

Algorithm:

Step 1	:	Move content of ‘C’ to ‘A’ where ‘L’ is intialised to ‘00’
Step 2	:	Output content of C8
Step 3	:	Increment L till zf = 0
Step 4	:	Intialise ‘L’ register with FF
Step 5	:	Move content of ‘L’ to accumulator and output to port
Step 6	:	Decrement ‘L’ if not equal to zero jump else go to next step
Step 7	:	Jump on next step


Delay
Intialise the value of ‘1’ as ‘00’
Move the values of ‘1’ to ‘A’
Output the control word for control signal
Increment the value of ‘L’
L = 0 ?
No
Yes
Set the value of ‘1’ as ‘FF’
Move the ‘1’ value to accumulator
Output the control word
L = 0 ?
No
Yes
Jump to start

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4300	2E,00	Start	MVI	L,00	Intialise ‘L’ as ‘00’
4302	7D	Loop 1	MOV	A,L	[L] -> [A]
4303	D3,C8		OUT	C8	Load the control words
4305	2C		INR	L	Increment register ‘L’
4306	C2,02,43		JNZ	Loop 1	Jump on no zero to loop 1
4309	2E, FF		MVI	L,FF	L = FF
430B	70	Loop 2	MOV	A,L	L -> A
430C	D3,C8		OUT	C8	[C8] -> [A]
430E	2D		DCR	L	Decrement L by one
430F	C2,0B,43		JNZ	Loop 2	Jump on no zero to 430B
4312	C3,00.43		JMP	Start	Repeat process

Result:

Thus the triangular wave was generated using 8085 microprocessor kit.

SAWTOOTH WAVE GENERATOR

Aim:

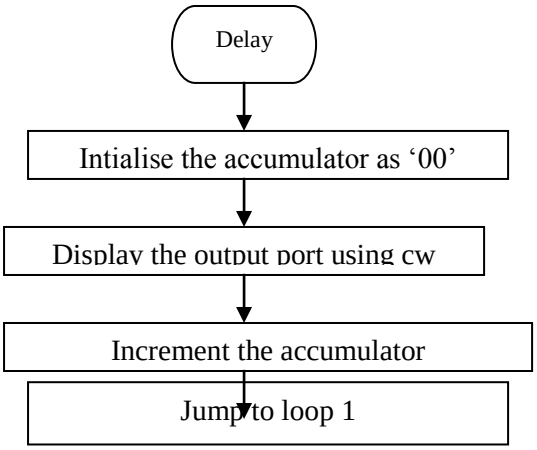
To write an assembly language program for generating Sawtooth waveform by using microprocessor 8085.

Apparatus required:

8085 microprocessor kit
(0-5V) power supply

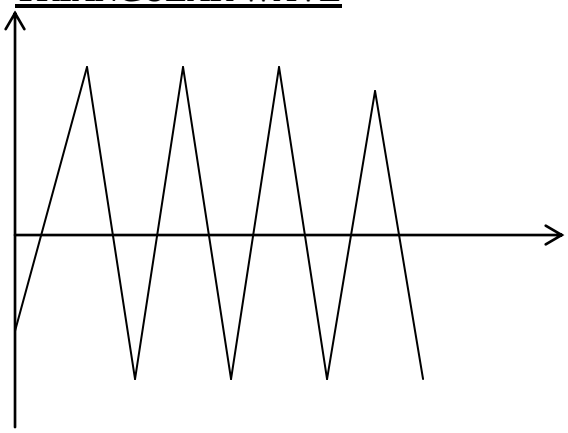
Algorithm:

Step 1 : Intialise accumulator with '00'
Step 2 : Output current address specified
Step 3 : Increment accumulator by one
Step 4 : Jump to step one

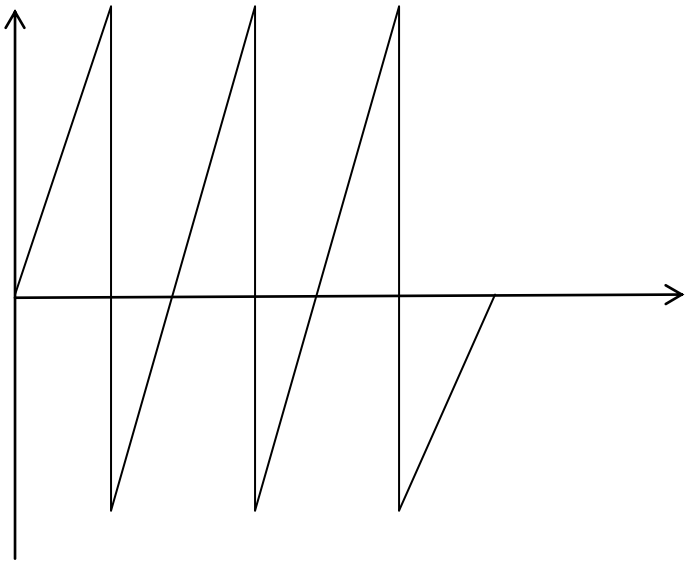


Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
4500	3E,00	Start	MVI	A,00	Intialise 'A' as '00'
4502	D3, C8	Loop 1	OUT	C8	A = [C8]
4504	3C		INR	A	Increment 'A' by one
4505	C3,02,45		JMP	Loop 1	Jump to loop one

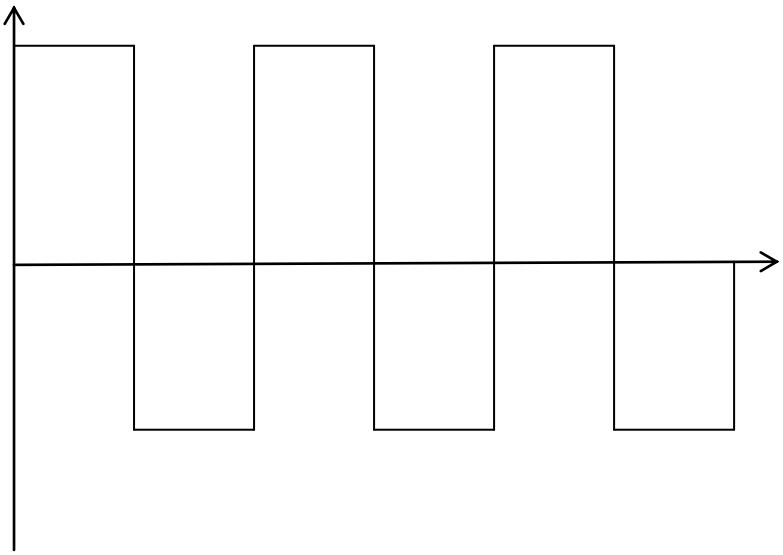
TRIANGULAR WAVE



SAW TOOTH WAVE



SQUARE WAVE



Result:

Thus the Sawtooth wave was generated using 8085 microprocessor kit.

ANALOG TO DIGITAL CONVERTER

Aim:

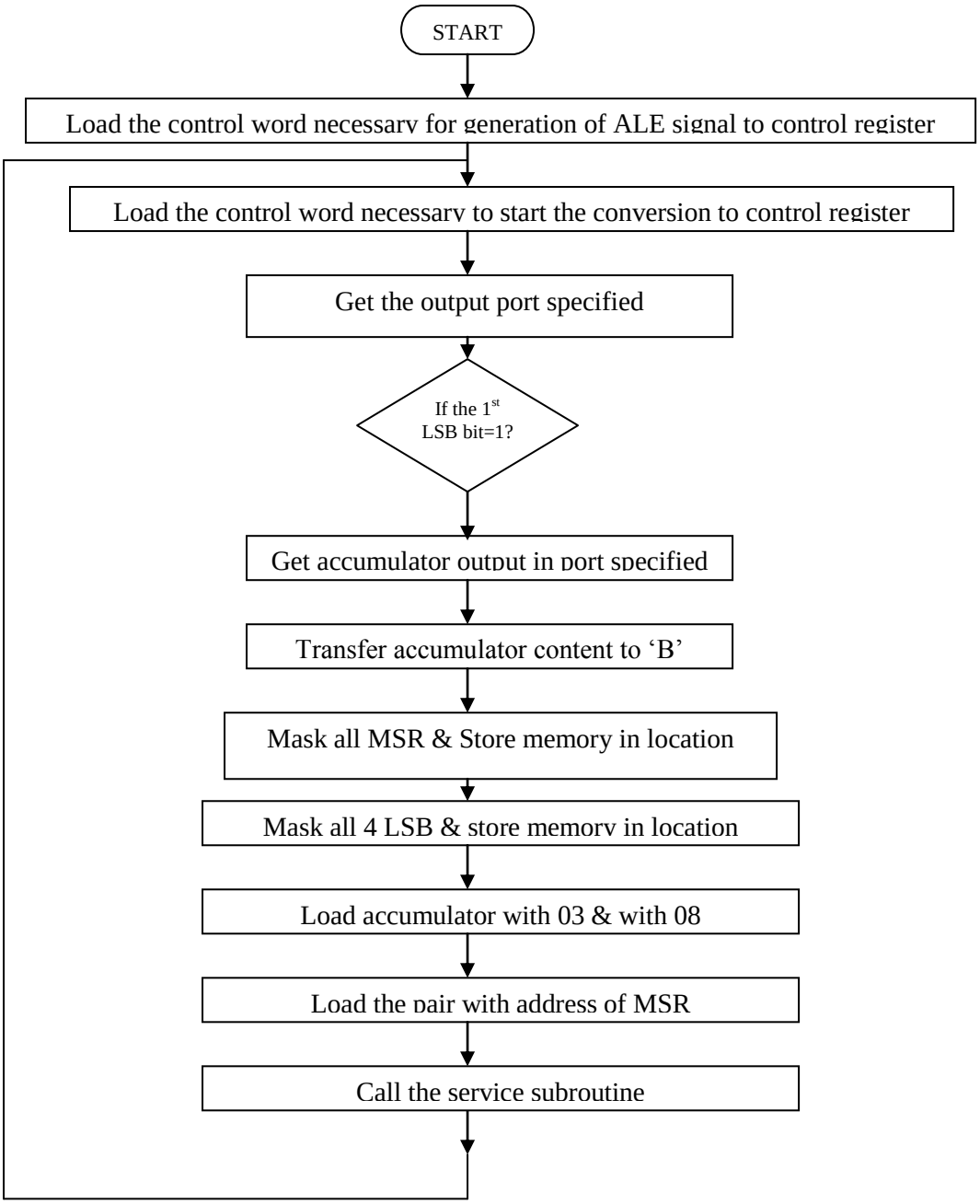
To write an assembly language program to convert analog to digital signal and to display it in 7 segment LED display

Apparatus required:

8085 microprocessor kit
(0-5V) power supply

Algorithm:

Step 1	:	Access the channel of ADC
Step 2	:	Intialise the accumulator with start of conversion signal & output it to the ADC
Step 3	:	Send '0' signal for ending the conversion for ADC
Step 4	:	Get the analog value converted to display from ADC
Step 5	:	The digital signal is separated into two nibbles and displayed in hexadecimal from by calling service subroutine.
Step 6	:	Go to step 1


START
Load the control word necessary for generation of ALE signal to control register
Load the control word necessary to start the conversion to control register
Get the output port specified
If the 1st LSB bit=1?
Get accumulator output in port specified
Transfer accumulator content to 'B'
Mask all MSR & Store memory in location
Mask all 4 LSB & store memory in location
Load accumulator with 03 & with 08
Load the pair with address of MSR
Call the service subroutine

Memory Location	Hex Code	Label	Mnemonics		Comments
			Op code	Operand	
5000	3E,10		MVI	A,10	Intialise ‘a’ with 10
5002	D3,C		OUT	C8	Output channel through
5004	3E,18		MVI	A,18	Intialise ‘A’ with 18
5006	D3, C8		OUT	C8	Output channel through 8 bit port
5008	00		NOP		No operation
5009	00		NOP		No operation
500A	3E,10		MVI	A,10	Intialise ‘A’ with 2nd signal
500C	D3,C8		OUT	C8	Output channel through 8 bit port
500E	3E,01	L2	MVI	A,01	Intialise ‘A’ with 2nd
5010	D3,D0		OUT	D0	Output through 8 bit
5012	00		NOP		
5013	00		NOP		
5014	00		NOP		
5015	3E,00		MVI	A,00	
5017	D3,D0		OUT	D0	
5019	DB,D8	L1	IN	D8	
501B	E6,01		ANI	01	
501D	CA,19,50		JZ	L1	
5020	DB,C0		IN	C0	Get input from
5022	47		MOV	B,A	B -> A
5023	E6,0F		ANI	0F	And of with ‘A’
5025	32,51,51		STA	5151	Store in 5151
5028	78		MOV	A,B	B -> A
5029	E6,F0		ANI	F0	And F0 with A
502B	0F		RRC		Rotate content ‘A’
502C	0F		RRC		
502E	0F		RRC		
502F	32,50,51		STA	550	Store MSB in 5150
5032	3E,03		MVI	A,03	03 -> A
5034	0E,08		MVI	C,08	08 -> C
5036	21,50,51		LXI H	5150	Load ‘HL’ pair with 5150
5039	CD,05,00		CALL	0005	Call device subroutine
503C	C3,0E,50		JMP	500E	Jump to 500E

Result:

Thus the analog to digital conversion was done microprocessor.

ARTHMETIC OPERATIONS USING 8051

Aim:

To do the arithmetic operations using 8051 microprocessor

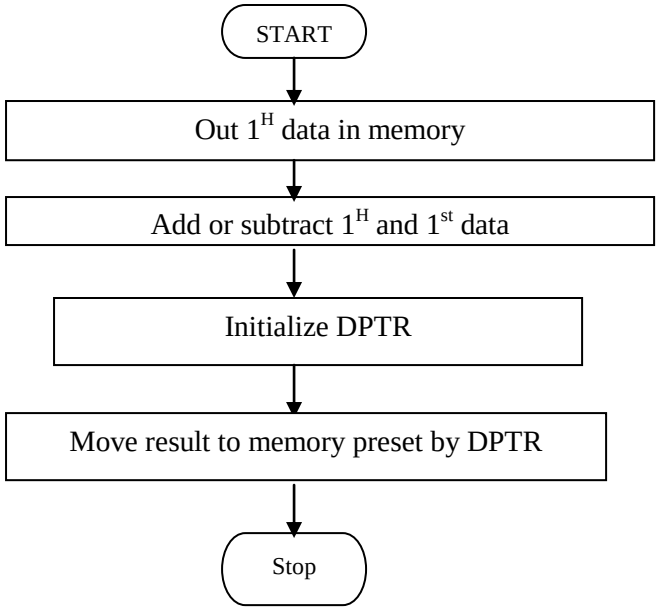
Apparatus required:

8085 microprocessor kit
DAC interface kit
Keyboard

Algorithm:

Addition / Subtraction

Step 1 : Move 1^H data to memory
Step 2 : Add or subtract 1^H data with 2^{nd} data
Step 3 : Initialize data pointer.
Step 4 : Move result to memory pointed by DPTR.



Program: 8-bit Addition:

Memory Location	Label	Opcode	Mnemonics	Comments
4100	Start	C3	CLR C	Clear the carry flat
4101		74DA	MOV A, # data 1	Moves data 1 to register A
4103		24DA	ADD A, # data 2	Add content of A and data 2 and store in A
4105		464500	MOV DPTR, # 4500	Moves data 4500 to DPTR
4108		F0	MOV A @ DPTR, A	Moves control of A to location pointed DTPR
4109		80 FE	SJMP 4109	Short jump to 4109

Execution:
Addition:

ML	Input
4103	0L
4109	03

ML	Output
4500	05

Program: 8-bit Subtraction:

Memory Location	Label	Opcode	Mnemonics	Comments
4100	Start	C3	CLR C	Clear the carry flat
4101		74DA	MOV A, # data 1	Moves data 1 to register A
4103		24DA	SUB B, # data 2	Subtract data 2 from content of A and store result in A
4105		464500	MOV DPTR, # 4500	Moves 4500 to DPTR
4108		F0	MOV X @ DPTR, A	Moves result by location by DTPR
4109		80 FE	SJMP 4109	Short jump to 4109

Execution:
Subtraction:

ML	Input
4101	05
4103	02

ML	Output
4500	03

Result:

Thus 8-bit addition, subtraction is performed using 8051.

ARTHMETIC OPERATIONS USING 8051

Aim:

To do the arithmetic operations using 8051 microprocessor

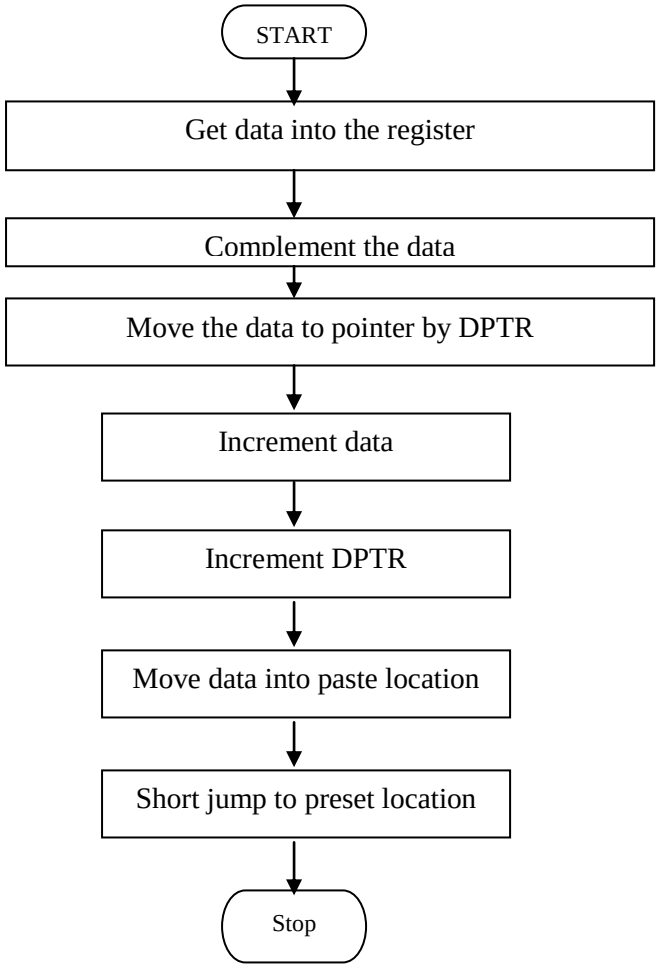
Apparatus required:

8085 microprocessor kit
DAC interface kit
Keyboard

Algorithm:

Multiplication / Division

Step 1 : Get 1^H data and 2^{nd} data to memory
Step 2 : Multiply or divide 1^H data with 2^{nd} data
Step 3 : Initialize data pointer.
Step 4 : Move result to memory pointed by DPTR (first port)
Step 5 : Increment DPTR
Step 6 : Move 2^{nd} part of result to register A
Step 7 : Move result to 2^{nd} memory location pointer by DPTR



Yes

Program: 8-bit Multiplication:

Memory Location	Label	Opcode	Mnemonics	Comments
4100	Start	7403	MOV A, # data 1	Move immediate data to accumulator
4101		75F003	MOV B, # data 2	Move 2nd data to B register
4105		A4	MUL A B	Get the product in A & B
4106		904500	MOV DPTR, # 4500	Load data in 4500 location
4109		F0	MOV X @DPTR, A	Move A t ext RAM
410B		E5F0	MOV A,B	Move 2nd data in A
410D		F0	MOV A @ DPTR	Same the ext RAM
410E		80FE	SJMP 410E	Remain idle in infinite loop

Execution:
Multiplication:

ML	Input
4101	0L
4103	04

Output Address	Value
4500	08

Program: 8-bit Division:

Memory Location	Label	Opcode	Mnemonics	Comments
4100	Start	7408	MOV A, # data 1	Move immediate data to accumulator
4102		75F002	MOV B, @ data 2 DIV AB	Move immediate to B reg.
4105		84	DIV AB	Divide content of A & B
4106		904500	MOV DPTR, # 4500	Load data pointer with 4500 location
4109		F0	MOV X @ DPTR, A	Move A to ext RAM
410A		A3	INC DPTR	Increment data pointer
410B		ESF0	MOV A,B	Move remainder to A
410D		F0	MOV @ DPTR, A	Move A to ext RAM
410E		80FE	SJMP 410E	Remain idle in infinite loop

Execution:
Division:

ML	Input
4101	08
4103	04

Output Address	Value
4500	02

Result:

Thus 8-bit multiplication & division is performed using 8051.