Department of Electrical & Electronics Engineering
Program/course: B.Tech …….
V semester
July 2020 to December 2020

Lab Records
Of

Microprocessor and Embedded System Lab

Submitted By:

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List of Index:

S. No.	Objective of the Experiments	Date	Remarks	Page no.
1.	1A - Write a program using 8085 & verify for addition of Two 8-Bit numbers and Addition of Two 16-Bit Numbers 1B - Write a program using 8085 & verify for Subtraction of Two 8-Bit Numbers & Subtraction of Two 16-Bit Numbers. 1C - Write a program using 8085 & verify for Division of Two 8-Bit Numbers by Repeated Subtraction Method Division of Two 8-Bit Numbers by Repeated Subtraction Method.	19 August 2020		8-18
2.	Writing Program for 1's complement of eight-bit number, 2's complement of eight-bit number, 1's complement of sixteen-bit number, 2's complement of sixteen-bit number.	02 September 2020		19-26
3.	Writing Program for mask off least significant 4 bits of an eight-bit number & mask off Most significant 4 bits of an eight-bit number.	09 September 2020		27-28
4.	Write a program to shift an 8-bit number left by 1 bit. Write a program to shift an 8-bit number left by 2 bits Write a program to shift a 16-bit number left by 1 bit Write a program to shift a 16-bit number left by 2 bits.	16 September 2020		29-39

5.	To find square from lookup table. To find larger of two numbers. To find smaller of two numbers. To find larger number in a data array. To find smaller number in a data array. To find the sum of series of 8-bit numbers.	30 September 2020		40-62

	To find the sum of series of 8-bit numbers but sum is a 16-bit number. To arrange the data in ascending order. To arrange the data in descending order.		
6.	Interfacing of 8051 Microcontroller with various display devices.	11 November 2020	63-68
7.	Display number 2 ,9 and char A using SETB and CLR instruction.	18 November 2020	69-71
8.	Interfacing of 8051 Microcontroller with DC motor.	25 November 2020	72-77

Short Questions and Answers

Q1: What is Microprocessor?

A microprocessor is a computer processor that incorporates the functions of a central processing unit on a single (or more) integrated circuit (IC) of MOSFET construction. The microprocessor is a multipurpose, clock driven, register based, digital integrated circuit that accepts binary data as input, processes it according to instructions stored in its memory and provides results (also in binary form) as output.

Q2: What is the technology used in Microprocessor?

A microprocessor is an electronic component that is used by a computer to do its work. It is a central processing unit on a single integrated circuit chip containing millions of very small components including transistors, resistors, and diodes that work together.

Q3: What is the function of Flag, Register, Program counter and Stack pointer?

A flag is a value that acts as a signal for a function or process. The value of the flag is used to determine the next step of a program. The Stack Pointer register will hold the address of the top location of the stack. And the program counter is a register always it will hold the address of the memory location from where the next instruction for execution will have to be fetched.

Q4: What are the meant by Low level and High-level language?

A low-level language is a type of programming language that contains basic instructions recognized by a computer. ... Two common types of low-level programming languages are assembly language and machine language. Software programs and scripts are written in high-level languages, like C#, Swift, and PHP.

Q5: What is machine level programming?

Machine language, or machine code, is a low-level language comprised of binary digits (ones and zeros). High-level languages, such as Swift and C++ must be compiled into machine language before the code is run on a computer.

Q6: What jobs ALU of 8085 can perform?

The ALU takes two 8-bit inputs, which I'll call A and X, and performs one of five basic operations: ADD, OR, XOR, AND, and SHIFT-RIGHT. As well, if the input X is inverted, the ALU can perform subtraction and complement operations.

Q7: How many hardware interrupts 8085 supports.?

There are 5 Hardware Interrupts in 8085 microprocessors.

Q8: How many I/P ports can 8085 access?

256 ports can be accessed.

Q9: Describe the accumulator register of 8085?

It is one of the most important 8 bit register of 8085

It is responsible for coordinating input and output to and from the microprocessor through microprocessors primary purpose of this register is to store temporary data and for the placement of final values of arithmetic and logical operations. This accumulator register is mainly used for arithmetic, logical, store and rotate operations.

Q10: What is the function of RESET IN and RESET OUT function

RESET IN − This signal is used to reset the microprocessor by setting the program counter to zero. RESET OUT − This signal is used to reset all the connected devices when the microprocessor is reset.

Q11.What is an Instructions?

The 8085A instructions can be classified into the following five functional categories. I) Data transfer (copy) operations, ii) Arithmetic operations, iii) Logical operations iv) Branching operations and v) Machine-control operations.

Q12. What is meant by Instruction Set?

The function of a microprocessor system is implemented by a sequence of data transfers between memory, processor and I/O devices and data transformations that occur in the registers within the microprocessor, manipulating a register under program control, addressing it and using it for data transfer and transformation requires a set of binary codes which comprise the INSTRUCTION SET OF A MICRO-PROCESSOR

Q13. In how many categories the instruction of 8085 be classified?

The instructions of 8085 can be classified into 5 categories.

Q14. What is meant by ‘addressing mode’ different mode? Mention the different addressing

mode?

Since data and instructions may reside anywhere in internal registers, external register or memory, locating them requires a particular addressing. The instructions in these five functional groups can be categorized according to their method of addressing the hardware registers and memory. This method is called the ADDRESSING MODE and six modes are available with 8085A which are explained in detail here, I) Implied addressing ii) Register addressing iii) Immediate addressing iv) Direct addressing v) Register indirect addressing vi) Combined addressing.

Q15. Mention the Interrupts pin of 8085?

There are 8 software interrupts in 8085, i.e. RST0, RST1, RST2, RST3, RST4, RST5, RST6, and RST7. Hardware interrupt − There are 5 interrupt pins in 8085 used as hardware interrupts, i.e. TRAP, RST7. 5, RST6. 5, RST5.

Q16. Explain the maskable and Non-maskable Interrupt?

Maskable interrupt is a hardware Interrupt that can be disabled or ignored by the instructions of CPU.

A non-maskable interrupt is a hardware interrupt that cannot be disabled or ignored by the instructions of CPU.

Q17. What is meant by priority of interrupts?

The interrupt priority level is a part of the current system interrupt state, which indicates the interrupt requests that will currently be accepted.

Q18. What are the different types of data transfer operations possible?

The various types of data transfer operations possible are:

Data transfer is possible between two registers.
It is also possible between a memory location and a register.

Also, it can occur between an input/output device and an accumulator.
In reality data is never transferred it can only be copied from one location to another.

9. Mention the different type of operations with asthmatic, logical, branch & machine control

These types of instructions control machine functions such as Halt, Interrupt, or do nothing. This type of instructions alters the different type of operations executed in the processor.

Following are the type of Machine control instructions:

1. NOP (No operation)

2. HLT (Halt)

3. DI (Disable interrupts)

4. EI (Enable interrupts)

5. SIM (Set interrupt mask)

6. RIM (Reset interrupt mask)

Q20. What are the different instruction word sizes in 8085?

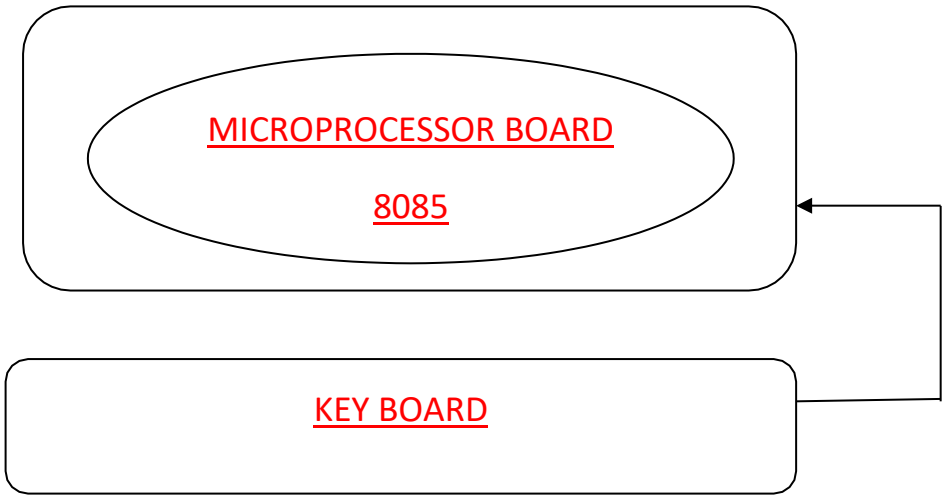
In 8085, the length is measured in terms of “byte” rather than “word” because 8085 microprocessor has 8-bit data bus.
Three types of instruction are: 1-byte instruction, 2-byte instruction, and 3-byte instruction.

Experiment 1 Complete

Experiment 1 a

Aim: Addition of two eight-bit numbers in memory and result also in memory

Apparatus Required: Microprocessor Kit 8085, Key Board, Op-Code Sheet



Theory: The first data is brought to Accumulator A and the second one in any one of the other registers, say B. The addition is done using ADD. The result is then stored at 4252. The ADD instruction affects flags depending on result.

Flow Chart Steps: -

1. **Start**
2. **Initialize memory register by loading content in HL**
3. **Load first number into Accumulator**
4. **Increment HL pair for next number**
5. **Add accumulator with M reg**

6. **Increment hall pair for M reg initialization**
7. **Load accumulator result into M Reg Location**
8. **End**

Procedure:

1. Click on **8085 simulator version 2** : Microprocessor Simulator and Java download to install it.
2. Write the program code on editor file window.
3. Store some input data at specified Memory Array.
4. Click on the option Assemble for simulation.
5. Write the starting address of the program to simulate option.
6. Simulation of entire code could be run at a time or step by step.
7. Execution results can be checked through the Register, Memory and Device environment window.
8. Note down updated register and memory content value for verification of result.
9. For instruction mnemonic details, click the Help option.

Program:

A. Addition of Two 8-Bit Numbers.

```
B. # ORG 7000H
C.
D.   LXI H,7501              // Get address of 1st no. in HL pair
E.   MOV A, M               // Move no. into accumulator F. INX
H              // HL points the address 7502 H
G.  ADD M                 // Add the 2nd no.
H.  INX   H               // HL points 7503 H
I.  MOV M, A              // Store result in 7503 H
J.  RST 1                       // Terminate
K.
L.  # ORG 7501H                    // Store input at the address
```

```
M. # DB 12H, 13H                    // Get two 8-bit no. in successive
   location n
```

B. Addition of Two 16-Bit Numbers (With Carry).

```
# ORG 7000H
LHLD  7601        //Get 1st no. in HL pair from memory 7601 H
XCHG              //Exchange cont. of DE       HL
LHLD  7603        //Get 2st no. in HL pair from location 7603
H MVI C,00        //Clear reg. C.
DAD D          //Get HL+DE & store result in HL
JNC down      //If no carry move to loop/if carry then move to next step.
INR C          //Increment reg.C
MOV A, C       //Move carry from reg. C to reg.
A STA 7502        //Store carry at 7502 H
down: SHLD 7500            //Store result in
7500 H.
RST 1             //Terminate

#ORG 7601H                 // Store input at the address
#DB 13,31,12,10          // Get two 16-bit no. in successive location
```

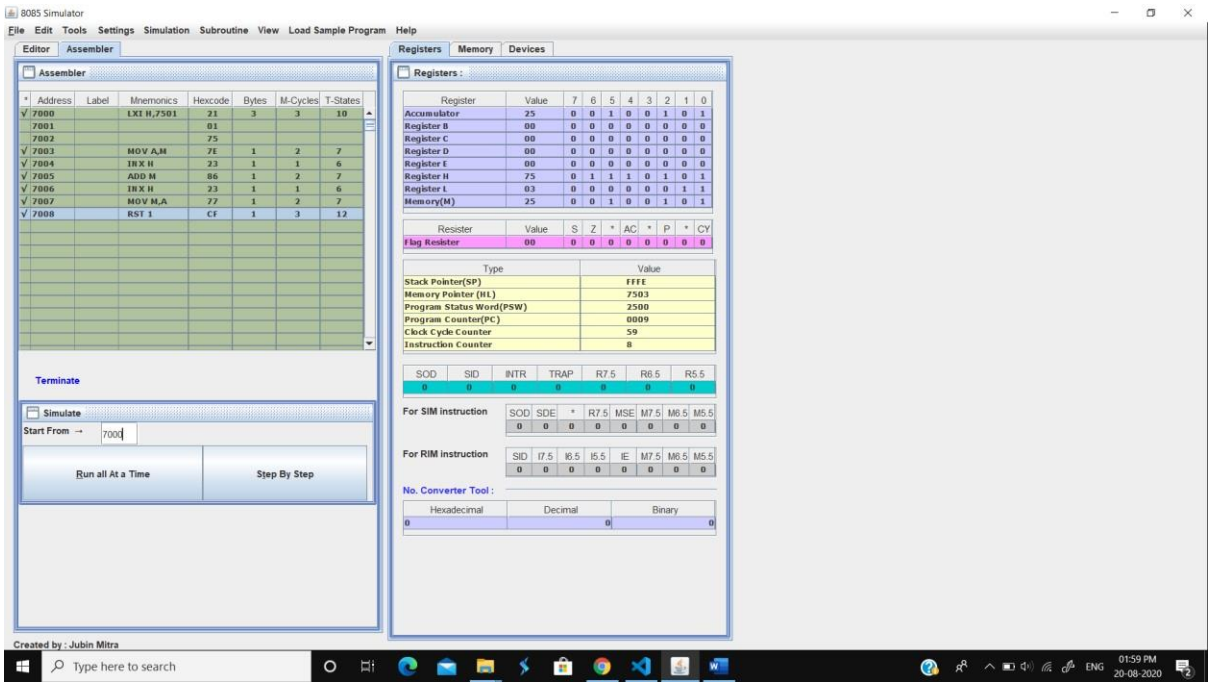
Results:

The two data to be added are at 4250 and 4251.The result is stored at 4252.

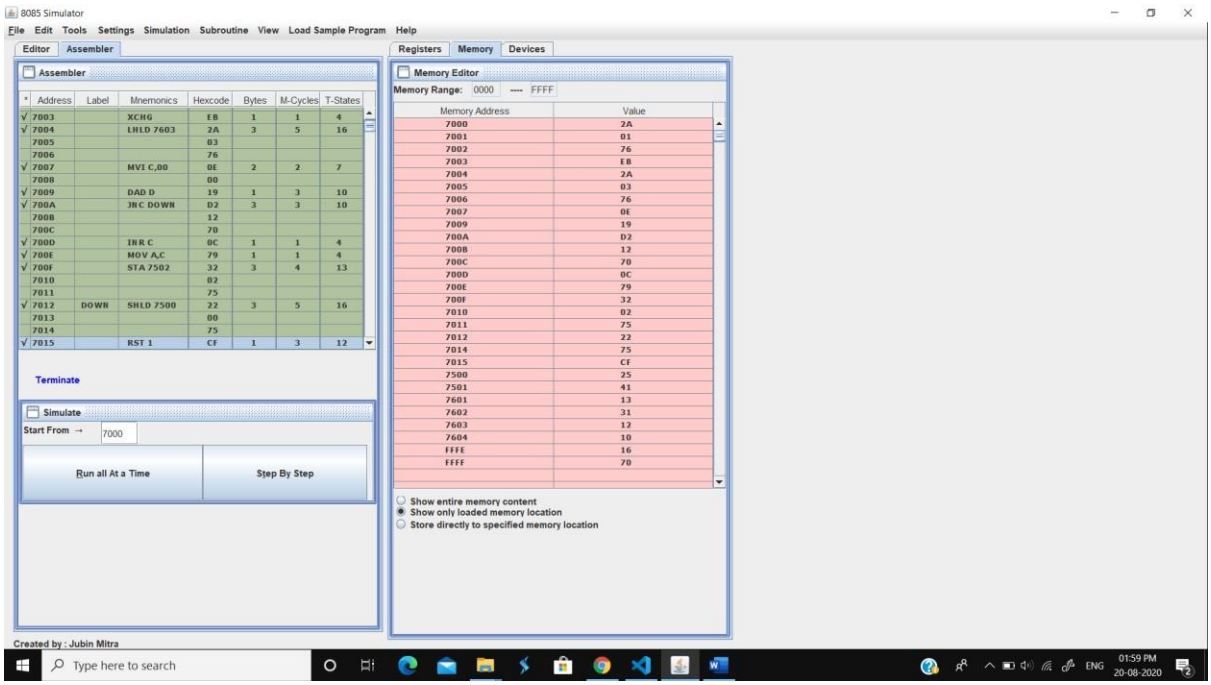
Data: (4250) = 23, (4251) = 35

Result: (4252) = 58

A. Addition of Two 8-Bit Numbers.



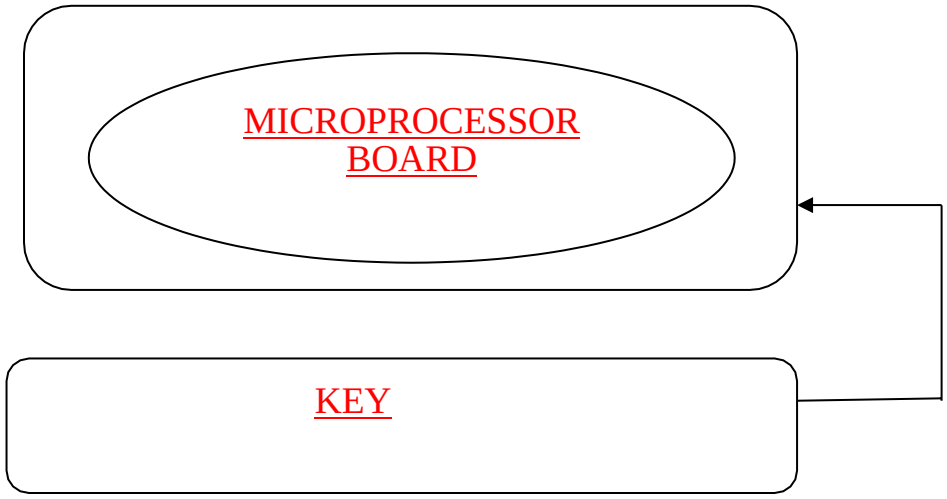
B. Addition of Two 16-Bit Numbers (With Carry).



Experiment 1b

Aim: Subtraction of two eight-bit numbers in memory and result also in memory

Apparatus Required: Microprocessor Kit 8085, Key Board, Op-Code Sheet



Theory: The first data is brought to Accumulator A and the second one in any one of the other registers, say B. The addition is done using SBB. The SBB instruction affects flags depending on result.

Flow Chart Steps: -

1. **Start**
2. **Initialize memory register by loading content in HL**
3. **Load first number into Accumulator**
4. **Increment HL pair for next number**
5. **Subtract M Reg. content to accumulator.**
6. **Increment HL pair for initialization M Reg.**
7. **Load accumulator result into M Reg Location**
8. **End**

Procedure:

1. Click on 8085 simulator version 2: **Microprocessor Simulator** and **Java** download to install it.
2. Write the program code on editor file window.
3. Store some input data at specified Memory Array.
4. Click on the option Assemble for simulation.
5. Write the starting address of the program to simulate option.
6. Simulation of entire code could be run at a time or step by step.
7. Execution results can be checked through the Register, Memory and Device environment window.
8. Note down updated register and memory content value for verification of result.
9. For instruction mnemonic details, click the Help option.

Program:

A. Subtraction of Two 8-Bit numbers

```
# ORG 7000H
LXI H, 7501       // Get address of its no. in HL pair
MOV A, M        // Move no. into accumulator
INX H       // HL points 7502 H.
SBB M       // Subtract 2nd no. from Its no.
```

```
INX H       //HL points 7503 H.
MOV M, A        // Move contents of acc. to memory
RST 1                   // Terminate

#ORG 7501H          // Store no. at address
#DB 20,10       // Get the two 8-bit no. at successive location
```

B. Subtraction of Two 16-Bit Numbers

```
# ORG 7000H

LHLD  7501        // Get 1st 16-bit no. in HL pair
XCHG            // Exchange HL pair with DE.
LHLD  7503        // Get 2nd 16-bit no. in HL pair
MOV A, E        // Get lower byte of Ist no.
SUB L         // Subtract lower byte of 2nd no.
MOV L, A        // Store the result in reg. L
MOV A, D        // Get higher byte of Ist no.
SBB H         // Subtract higher byte of 2nd no. with borrow
MOV H, A       // Move from acc. To H
SHLD  7505        // Store 16-bit result at 7505 H &7506 H
RST 1                   // Terminate

# ORG 7501H             // Store inputs at the address
# DB 30,40,10,20          // Get two 16-bit no. from successive locations
```

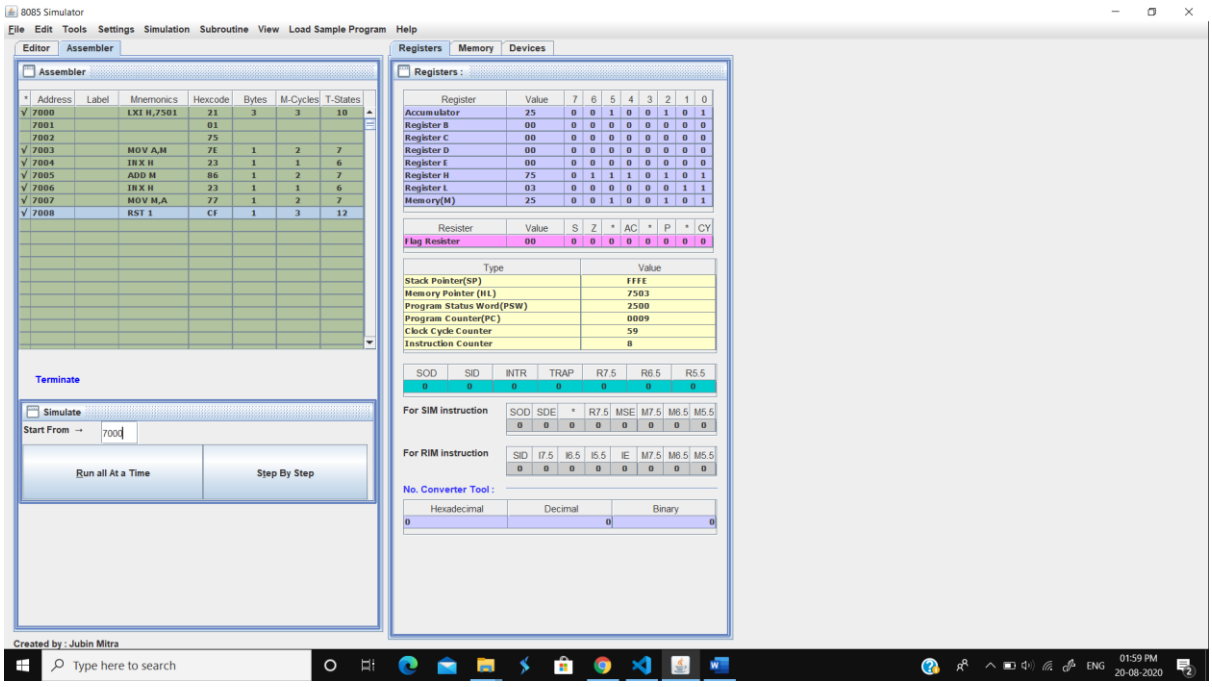
Results:

The two data to be added are at 4250 and 4251.The result is stored at 4252.

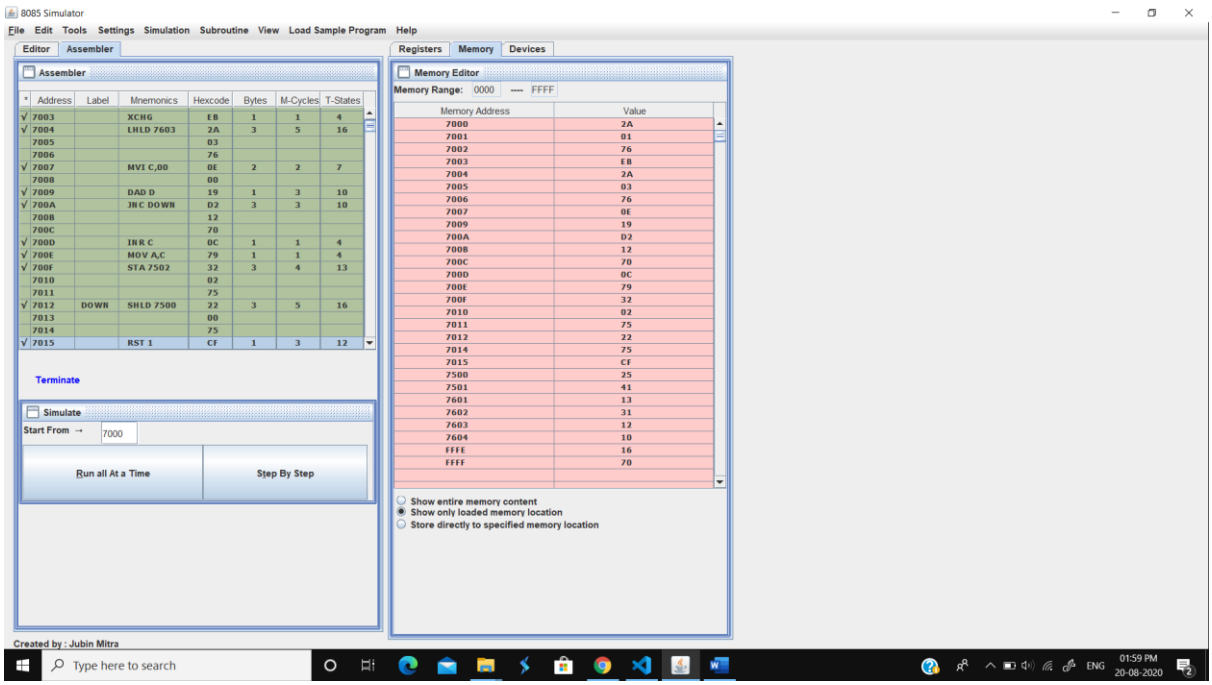
Data: (4250) = 23, (4251) = 35

Result: (4252) = 58

A. Subtraction of Two 8-Bit numbers



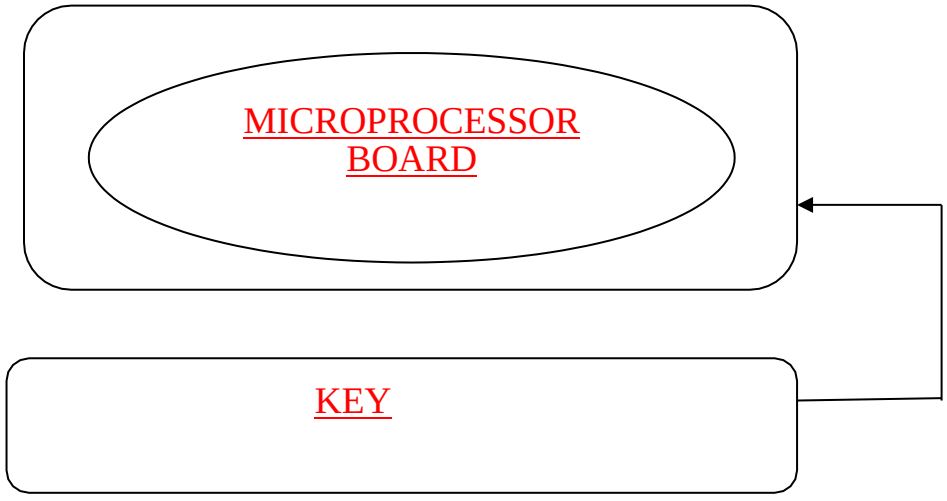
B. Subtraction of Two 16-Bit Numbers



Experiment 1 c

Aim: A. Multiplication of Two 8-Bit Numbers by Bit Rotation Method.
B. Division of Two 8-Bit Numbers by Repeated Subtraction Method

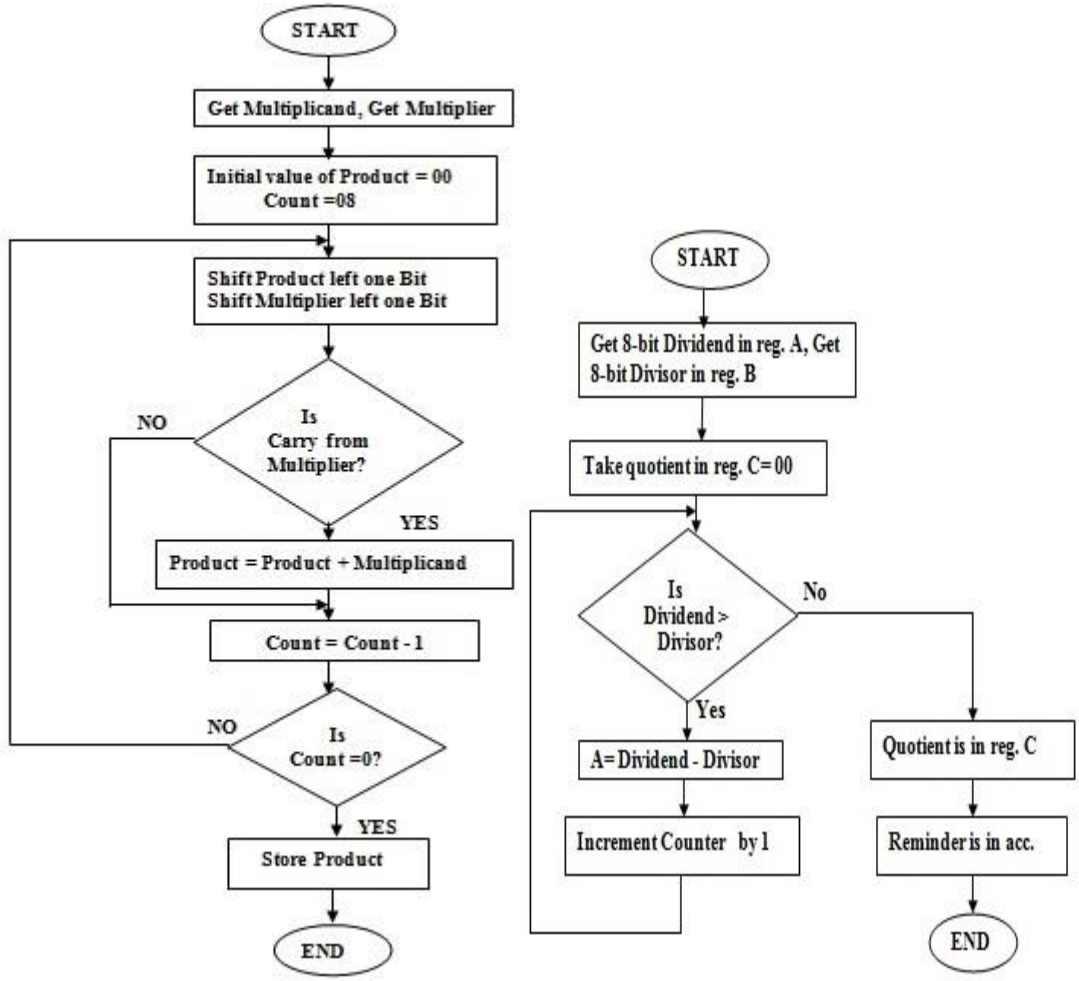
Apparatus Required: Microprocessor Kit 8085, Key Board, Op-Code Sheet



Theory:

1. LXI H (LOAD REGISTER PAIR IMMEDIATELY) loads 16-bit data in register pair designated by operand.
2. XCHG (EXCHANGE) exchange HL with DE pair.
3. LDA (LOAD ACCUMULATOR) copies the address content to accumulator.
4. LHLD Addr. (LOAD HL PAIR DIRECT) loads 16-bit data from specified address to designate in register pair.
5. MOV A, M copies the data byte into accumulator from the memory specified by the address in H-L pair.
6. MVI (MOVE IMMEDIATE DATA) moves immediate value to specified register.
7. DAD instruction Add specified register pair content to HL pair content and store results into HL pair.
8. SUB (SUBTACTION) subtracts register content to accumulator and stores result into accumulator.
9. CMP (COMPARE WITH ACCUMULATOR) compares the register/memory content to accumulator
   If (A) < (Reg/Mem) ; carry flag is set and zero flag is reset.
   If (A) = (Reg/Mem) ; carry flag is reset and zero flag is set.
   If (A) > (Reg/Mem) ; both carry flag and zero flag are reset.
10. JNC Addr. Instruction jump the execution to the specified Address if carry flag is reset.
11. RAL (ROTATE ACCUMULATOR LEFT THROUGH CARRY)
12. DCR instruction decrement the specified register content by 1.
13. STA address (STORE ACCUMULATOR DIRECT) copies the contents of the accumulator to the memory location specified in the instruction
14. SHLD Addr. (STORE HL DIRECT) instruction store HL pair content to specified address.
15. JNC Addr. (JUMP IF NO CARRY) jump to specified address if carry flag reset.

Flow Chart:



Procedure:

1. Click on 8085 simulator version 2: **Microprocessor Simulator** and **Java** download to install it 2. Write the program code on editor file window.
3. Store some input data at specified Memory Array.
4. Click on the option Assemble for simulation.
5. Write the starting address of the program to simulate option.
6. Simulation of entire code could be run at a time or step by step.
7. Execution results can be checked through the Register, Memory and Device environment window.
8. Note down updated register and memory content value for verification of result.
9. For instruction mnemonic details, click the Help option.

Program:

A. Multiplication of Two 8-Bit Numbers by Bit Rotation Method.

B. # ORG 7000H

C. LHLD 7501 // Get Multiplicand in H-L pair.

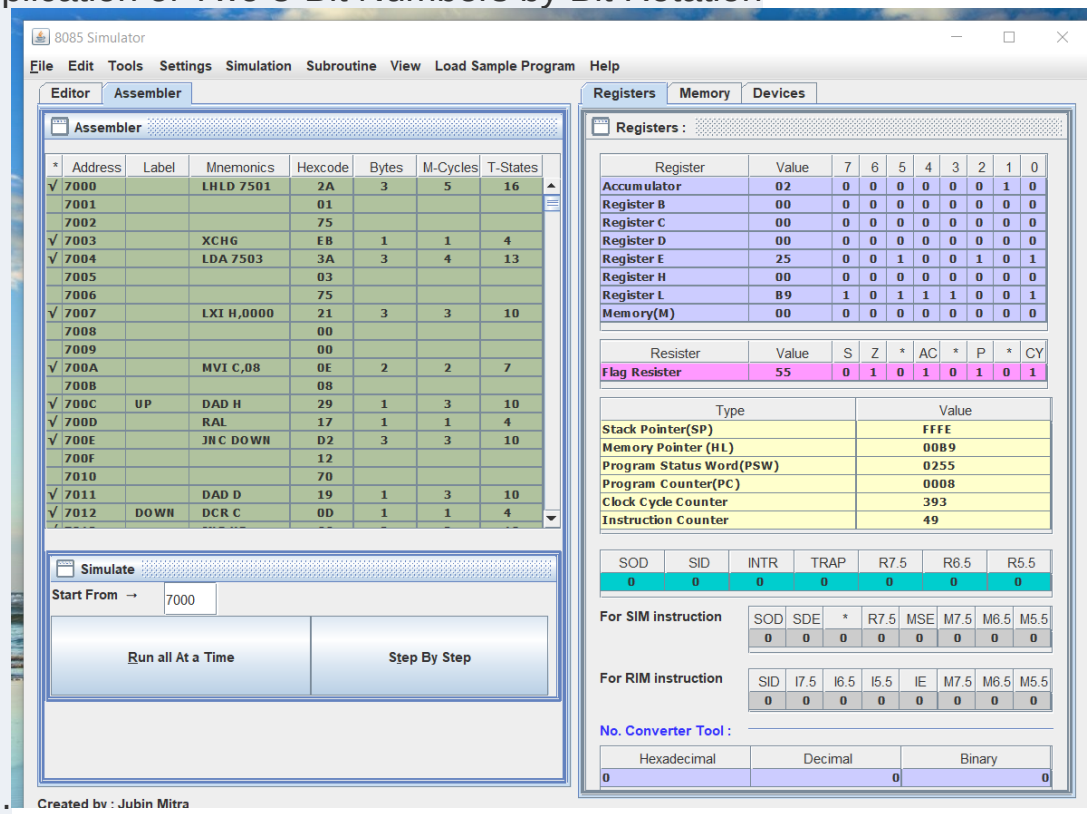
```
D.  XCHG          // Exchange HL pair with DE pair
E.  LDA 7503      // Get 2nd no. in acc.
F.  LXI H,0000    // Initial product in HL=00
G.  MVI C,08      // Count=08 in reg .C
H.  up: DAD H     // Shift partial product left by 1 bit
I.  RAL           // Rotate multi. by 1 bit. Is multiplier = 1?
J.  JNC down      // No, go to ahead
K.  DAD D         // Product=Product + Multiplicand
L.  down:DCR C    // Decrement Count
M.  JNZ up        // Jump until C=0
N.  SHLD  7504    // Store result
O.  RST 1         // Terminate
P.
Q.  #ORG 7501H    // Store inputs at the address
R.  # DB 25,00,05 // Get the numbers from successive locations
```

B. Division of Two 8-Bit Numbers by Repeated Subtraction Method.

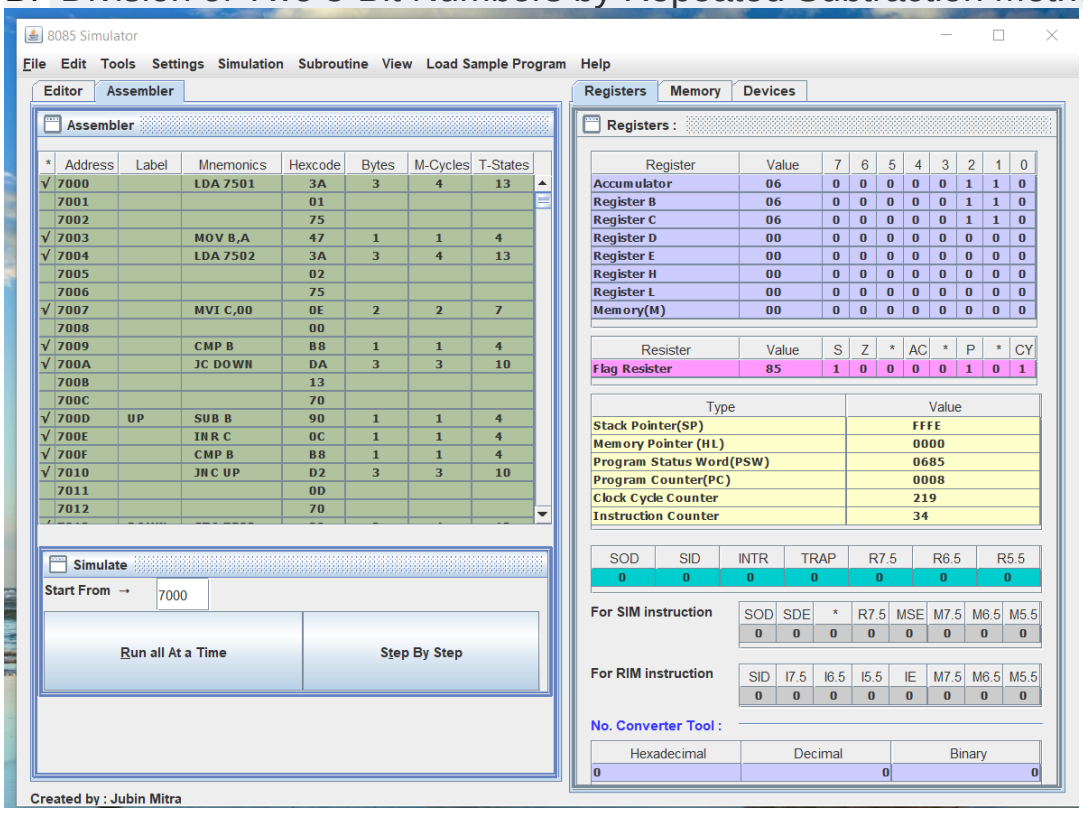
```
# ORG 7000H

LDA     7501    // [7501] =>A (Divisor)
MOV   B,A     // Take divisor in reg,B
LDA   7502    // Take dividend in reg,A
MVI   C,00    // Quotient=00
CMP   B       // Compare A to B
JC  down      // Jump if carry
up:SUB   B    // Dividend-divisor=>A
INR   C       // C=C+1
```

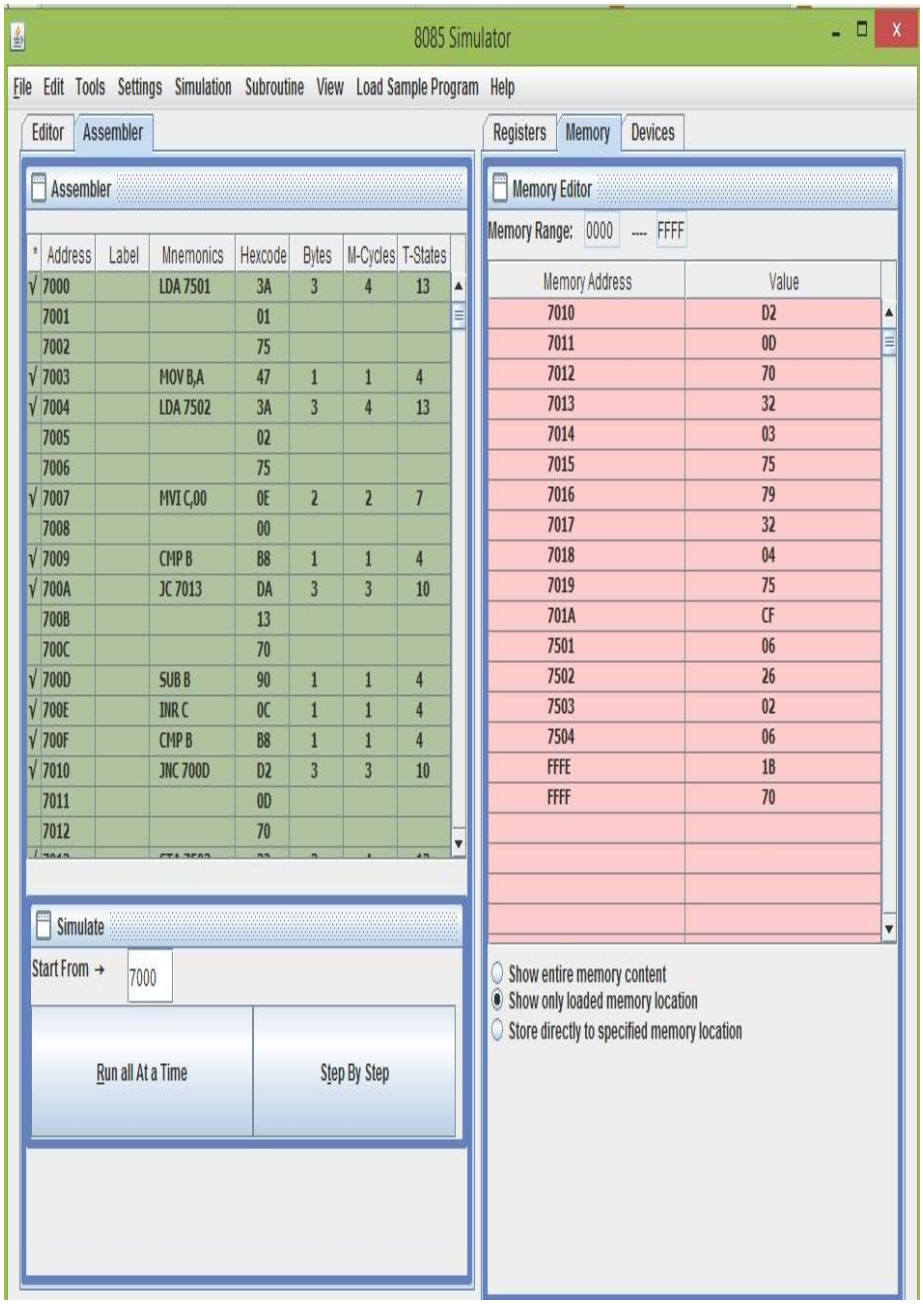
```
CMP   B     // Is dividend < divisor
JNC   up    // If not, go back
down:STA   7503      // Store Remainder
MOV   A, C     // C=>A
STA   7504      // Store Quotient
RST 1       // Terminate

# ORG 7501H       // Store the inputs at the address
# DB 06,26          // Get the numbers from successive loc.
```

A. Multiplication of Two 8-Bit Numbers by Bit Rotation Method.



B. Division of Two 8-Bit Numbers by Repeated Subtraction Method.




8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Registers Memory Devices
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 7000 LDA 7501 3A 3 4 13
7001 01
7002 75
√ 7003 MOV B,A 47 1 1 4
√ 7004 LDA 7502 3A 3 4 13
7005 02
7006 75
√ 7007 MVI C,00 0E 2 2 7
7008 00
√ 7009 CMP B B8 1 1 4
√ 700A JC 7013 DA 3 3 10
700B 13
700C 70
√ 700D SUB B 90 1 1 4
√ 700E INR C 0C 1 1 4
√ 700F CMP B B8 1 1 4
√ 7010 JNC 700D D2 3 3 10
7011 0D
7012 70
Simulate
Start From → 7000
Run all At a Time
Step By Step
Memory Editor
Memory Range: 0000 ---- FFFF
Memory Address Value
7010 D2
7011 0D
7012 70
7013 32
7014 03
7015 75
7016 79
7017 32
7018 04
7019 75
701A CF
7501 06
7502 26
7503 02
7504 06
FFFE 1B
FFFF 70
Show entire memory content
Show only loaded memory location
Store directly to specified memory location

Experiment 2

Name: Kartikey Semwal
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Roll Number: R142218074
Branch: B. Tech CSE GG (batch -2)

Aim

Program for
a. 1's complement of eight-bit number.
b. 2's complement of eight-bit number
c. 1's complement of sixteen-bit number
d. 2's complement of sixteen-bit number

Apparatus

Microprocessor Kit 8085, Key Board, Op-Code Sheet.

Theory

Program for 1's complement of 8-bit number

In this experiment to obtain one's compliment of a number its 0 bits are replaced by 1 and 1 by 0.

The number is placed in the memory location 4250.

The result is stored the memory location 4251

Program for 2's complement of 8-bit number

In this experiment to obtain Two's compliment of a number is obtain by adding 1 to the 1's compliment of the number.

The number is placed in the memory location 4250.

The result is to be stored in the memory location 4251.

Program for 1's complement of 16-bit number

In this experiment, the 8 LSBs of the number are in the memory location 4250. The address 4250 is placed in H-L pair. The 8 LSBs of the number are transferred from 4250 to the accumulator. The instruction CMA takes one's complement of 8 LSBs. The 8 LSBs of the result are stored in the memory location 4252. The address 8 MSBs of the number is 4251, and it is placed in H-L pair. The 8 MSBs of the number are transferred from 4251 to the accumulator. The instruction CMA takes one's compliment of 8 MSBs. The 8 MSBs of the result are stored in memory location 4253.

Program for 2's complement of 16-bit number

In this experiment, the 8 LSBs of the number are in memory location 4251. They are taken first and 1's compliment is obtained. To obtain 2's complement 1 is added to 1's complement. 8 LSBs of 2's complement is stored in 4253. The carry resulting from the addition of 1 to 1's complement is stored in register. After this 8 MSBs of the number are taken and 1's complement is obtained. They carry is added to it. The 8 MSBs of the result are stored in 4254. In case of no carry the program jumps from JNC GO to INX H and the content of register B is not incremented. It remains zero. The addition of zero to 1's complement of 8 MSBs does not affect result.

Precautions

1. All steps should be followed carefully.
2. Make sure all power sources are disconnected
3. Make sure you are properly grounded.
4. Don't touch the live wire.

Procedure

EXPERIMENTAL PROCEDURE: STEP WISE – 1's complement of 8-bit number

i) Key in the Op-codes from the address specified.
ii) Enter data at 4250 specified in the example.
iii) Execute the program and check for the result at 4251.
iv) Change data at 4250 and execute each time and check for result.

EXPERIMENTAL PROCEDURE: STEP WISE – 2's complement of 8-bit number

i) Key in the Op-codes from the address specified.
ii) Enter data at 4250 specified in the example.
iii) Execute the program and check for the result at 4251.
iv) Change data at 4250 and execute each time and check for result.

EXPERIMENTAL PROCEDURE: STEP WISE – 1's complement of 16-bit number

i) Key in the Op-codes from the address specified.

ii) Enter data at 4251 and 4252 specified in the example.

iii) Execute the program and check for the result at 4253 and 4254.

iv)Change data at 4251 and 4252 and execute each time and check for result.

EXPERIMENTAL PROCEDURE: STEP WISE – 2's complement of 16-bit number

i) Key in the Op-codes from the address specified.

ii) Enter data at 4251 and 4252 specified in the example.

iii) Execute the program and check for the result at 4253 and 4254.

iv) Change data at 4251 and 4252 and execute each time and check for result.

Program Code and object code

1’s complement of 8-bit number:

Memory Address	Opcodes	Mnemonics	Comments
4200	3A, 50, 42	LDA 4250	Get data in accumulator
4203	2F	CMA	Take its complement.
4204	32, 42, 51	STA	Store result in 4251
4207	76	HLT	Stop

2’s complement of 8-bit number:

Memory Address	Opcodes	Mnemonics	Comments
4200	3A, 50, 42	LDA 4250	Get data in accumulator
4203	2F	CMA	Take its 1’s

			complement.
4204	3C	INR A	Take 2's complement.
4207	32, 51 ,42	STA 4252	Store result in 4251.
4208	76	HLT	Stop

1's complement of 16-bit number:

Memory Add.	Op-codes	Mnemonics	Comments
4200	21, 51,42	LXI H, 4251	Address OF LSBs of the number.
4203	7E	MOV A, M	8 LSBs of the number in accumulator.
4204	2F	CMA	Complement of 8 LSBs of the number.
4205	32, 53, 42	STA 4253	Store 8 LSBs of result.
4208	23	INX H	Address of 8 MSBs of the number.
4209	7E	MOV A, M	8 MSBs of the number in accumulator.
420A	2F	CMA	Complement of 8 MSBs of the number.
420B	32, 54, 42	STA 4254	Store 8 MSBs of the result.
420E	76	HLT	Stop

2's complement of 16-bit number:

Memory Add.	Op-codes	Mnemonics	Comments
4200	21, 51,42	LXI H,4251	Address OF LSBs of the number.
4203	06, 00	MVI B,00	Use registers B to store carry.
4205	7E	MOV A, M	8 LSB in accumulator.
4206	2F	CMA	1's Complement of 8 LSBs of the number.
4207	C6, 01	ADI 01	2's complement of 8 LSBs of the number
4209	32, 03, 25	STA 4253	Store 8 LSBs of result.
420C	D2, 10, 42	JNC ; ***GO***	Label
420F	04	INR B	Store carry.
4210	23	***GO;*** INX H	Address of 8 MSBs of the number.
4211	7E	MOV A,M	8 MSBs in accumulator.

4212	2F	CMA	1’s Complement of 8 LSBs of the number.
4213	80	ADD B	Add carry
4214	32, 54, 42	STA 4254	Store 8 MSBs of the result.
4217	76	HLT	Stop

Results

1’s complement of 8-bit number

DATA: 4250 – 96

RESULT: 4251 -- 69

DATA: 4250 – E4

RESULT: 4251 – 1B.

2’s complement of 8-bit number

DATA: 4250 – 96

RESULT: 4251 – 6A

DATA: 4250 – E4

RESULT: 4251 – 1C

1’s complement of 16-bit number

DATA: 4251 – 85, LSB of the number

4252 – 54, MSBs of the number.

RESULT: 4253 – 7A, LSBs of the result.

4254 – AB, MSBs of the result.

DATA: 4251 – 7E, LSB of the number

4252 – 89, MSBs of the number.

RESULT: 4253 – 81, LSBs of the result.

4254 – 76, MSBs of the result.

2’s complement of 16-bit number

DATA: 4251 – 8C, LSB of the number

4252 – 5B, MSBs of the number.

RESULT: 4253 – 74, LSBs of the result.

4254 – A4, MSBs of the result.

2’s complement of the number is A474.

DATA: 4251 – 00, LSB of the number

4252 – 5B, MSBs of the number.

RESULT: 4253 – 00, LSBs of the result.

4254 – A5, MSBs of the result.

Sources of Error

1. Select op-codes carefully whenever you doing programming.
2. Make space whenever you doing program on kit.
3. You should properly enter the program and exit through proper command.

Experiment no.3:

Aim:

1. Mask off Least significant 4 bits of an eight-bit number
2. Mask off Most significant 4 bits of an eight-bit number

Apparatus Required:

Microprocessor Kit 8085, Key Board, Op-Code Sheet.

Theory:

Mask off Least significant 4 bits of an eight-bit number:

Get data in accumulator using LDA operation

Mask off the most significant 4 bits using ANI F0

Store result in 4252 using STA 4252

Stop using HLT

Mask off Most significant 4 bits of an eight-bit number:

Get data in accumulator using LDA.

Mask off the most significant 4 bits using ANI 0F

Store result in 4252 using STA 4252

Stop using HLT.

Precautions:

1. All steps should be followed carefully.
2. Make sure all power sources are disconnected
3. Make sure you are properly grounded.
4. Don’t touch the live wire.

Procedure:

Mask off Least significant 4 bits of an eight-bit number:

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4251.
4. Change data at 4250 and execute each time and check for result.

Mask off Most significant 4 bits of an eight-bit number:

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4251.
4. Change data at 4250 and execute each time and check for result.

Practical:

Mask off Least significant 4 bits of an eight-bit number:

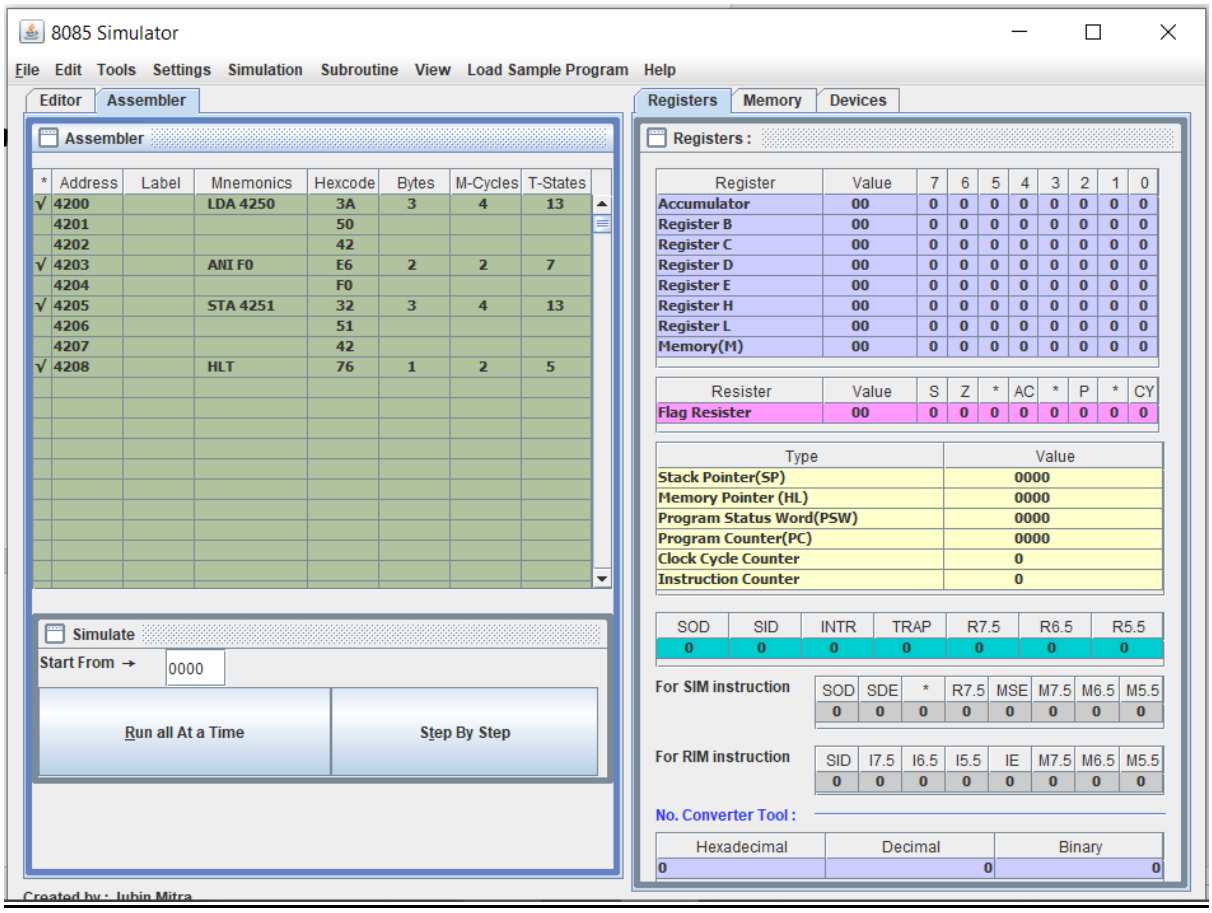
Step wise Procedure:

1. Get data in accumulator
2. Mask off the most significant 4 bits
3. Store result in 4252
4. Stop

Code:

```
1. #ORG 4200
2. LDA 4250
3. ANI F0
4. STA 4251
5. HLT
```

Output:



Mask off Most significant 4 bits of an eight-bit number:

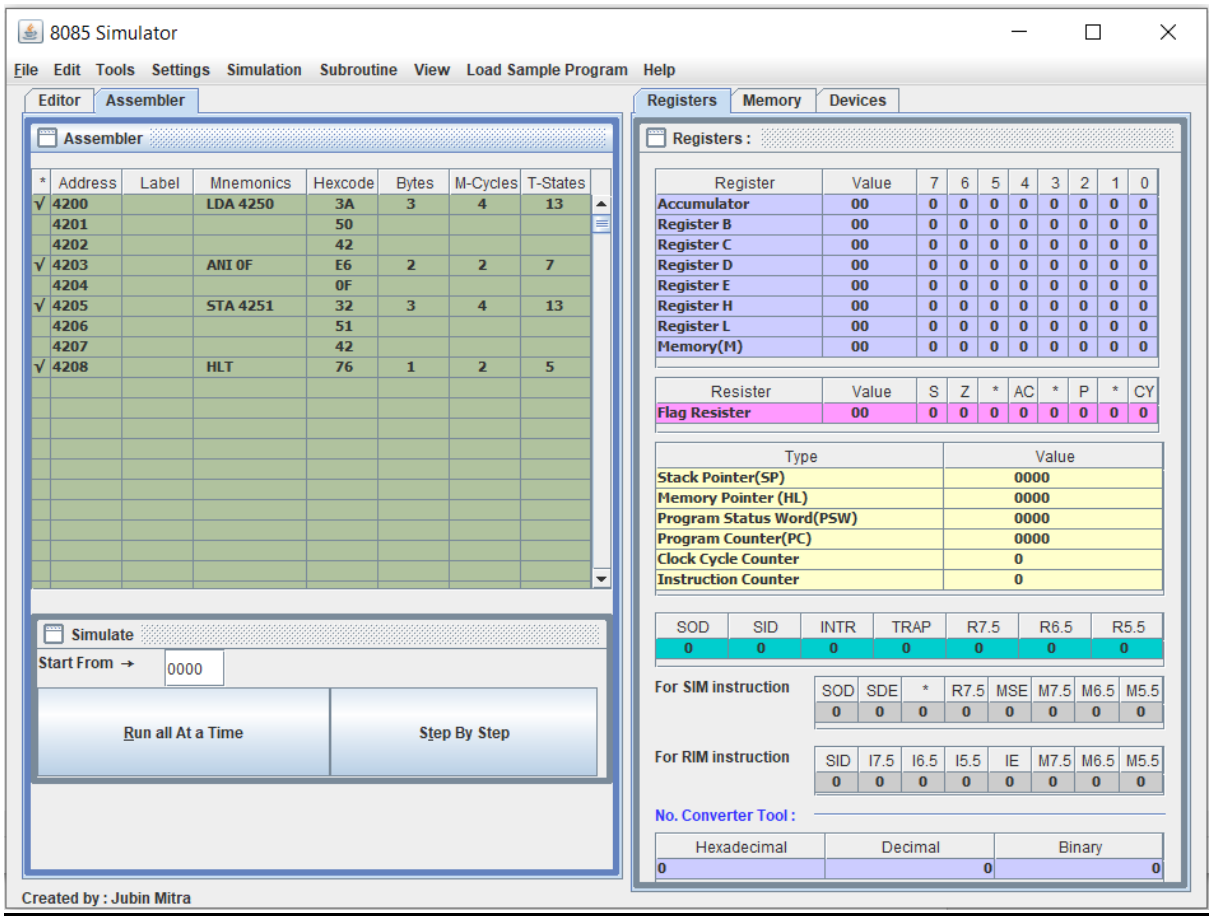
Step wise Procedure:

1. Get data in accumulator
2. Mask off the most significant 4 bits
3. Store result in 4252
4. Stop

Code:

1. #ORG 4200
2. LDA 4250
3. ANI 0F
4. STA 4251
5. HLT

Output:



Alternate Code:

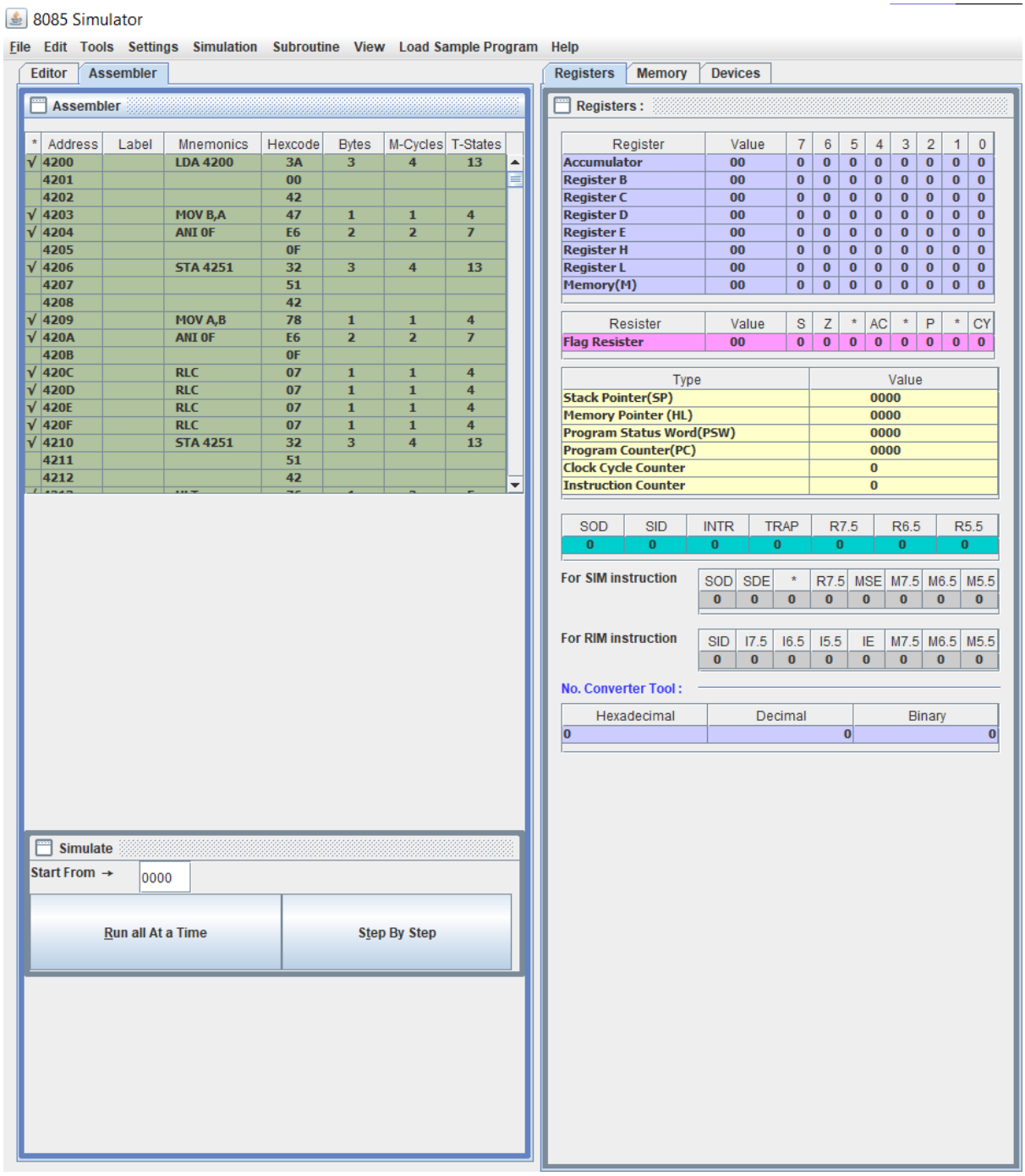
1. #ORG 4200
2. LDA 4200
3. MOV B, A
4. ANI 0F
5. STA 4251
6. MOV A, B
7. ANI 0F
8. RLC
9. RLC
10. RLC
11. RLC
12. STA 4251
13. HLT

Stepwise Procedure:

1. A <- M [4200]
2. B <- A
3. //Perform masking of least significant bit half nibble.

4. A <- A (AND) 0F
5. M [4251] <- A
6. A <- B
7. ///Perform masking of upper Significant Bits upper Nibble
8. A <- A (AND) 0F
9. Rotation with Steps.
10.
11. rotate content of A left by 1 bit without carry
12. rotate content of A left by 1 bit without carry
13. rotate content of A left by 1 bit without carry
14. rotate content of A left by 1 bit without carry
15. M [4251] <- A
16. END

Output:


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 4200 LDA 4200 3A 3 4 13
4201 00
4202 42
√ 4203 MOV B,A 47 1 1 4
√ 4204 ANI 0F E6 2 2 7
4205 0F
√ 4206 STA 4251 32 3 4 13
4207 51
4208 42
√ 4209 MOV A,B 78 1 1 4
√ 420A ANI 0F E6 2 2 7
420B 0F
√ 420C RLC 07 1 1 4
√ 420D RLC 07 1 1 4
√ 420E RLC 07 1 1 4
√ 420F RLC 07 1 1 4
√ 4210 STA 4251 32 3 4 13
4211 51
4212 42
Simulate
Start From → 0000
Run all At a Time
Step By Step
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 00 0 0 0 0 0 0 0 0
Register B 00 0 0 0 0 0 0 0 0
Register C 00 0 0 0 0 0 0 0 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 00 0 0 0 0 0 0 0 0
Register L 00 0 0 0 0 0 0 0 0
Memory(M) 00 0 0 0 0 0 0 0 0
Resister Value S Z * AC * P * CY
Flag Resister 00 0 0 0 0 0 0 0 0
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 0000
Program Status Word(PSW) 0000
Program Counter(PC) 0000
Clock Cycle Counter 0
Instruction Counter 0
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0

Experiment 4

Aim:

Shifting left an 8-bit number by 1 bit Shifting left an 8-bit number by 2 bits Shifting left a 16-bit number by 1 bit Shifting left a 16-bit number by 2 bits

Apparatus Required: Microprocessor Kit 8085, Key Board, Op-Code Sheet.

Theory:

Shifting left an 8-bit number by 1 bit

In this experiment to obtain, the instruction LDA 4251 transfers the number from memory location 4251 to the accumulator. ADD A adds the contents of the accumulator to itself. The results are twice the number and thus the number is shifted left by one bit. This program does not take carry account after ADD instruction. If the number to be handled is likely to produce carry the program may be modified to store it.

Shifting left an 8-bit number by 2 bits

In this experiment to obtain, the instruction LDA 4251 transfers the number from memory location 4251 to the accumulator. We have to use two ADD A it adds the contents of the accumulator to itself twice. The results are twice the number and thus the number is shifted left by two-bit. This program does not take carry account after ADD instruction. If the number to be handled is likely to produce carry the program may be modified to store it.

Shifting left a 16-bit number by 1 bit

In this experiment to obtain, the instruction LHLD 4251 transfers the number from memory location 4251 and 4252 to the accumulator. DAD H adds the contents of the accumulator to itself twice. The results are twice the number and thus the number is shifted left by one bit. This program does not take carry account after DAD instruction. If the number to be handled is likely to produce carry the program may be modified to store it.

Shifting left a 16-bit number by 2 bits

In this experiment to obtain, the instruction LHLD 4251 transfers the number from memory location 4251 and 4252 to the accumulator. We have to use two DAD H it adds the contents of the accumulator to itself twice. The results are twice the number and thus the

number is shifted left by two-bit. This program does not take carry account after DAD instruction. If the number to be handled is likely to produce carry the program may be modified to store it.

Procedure:

Shifting left an 8-bit number by 1 bit

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4251.
4. Change data at 4250 and execute each time and check for the result.

Shifting left an 8-bit number by 2 bits

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4251.
4. Change data at 4250 and execute each time and check for the result.

Shifting left a 16-bit number by 1 bit

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4252.
4. Change data at 4250 and execute each time and check for the result.

Shifting left a 16-bit number by 2 bits

1. Key in the Opcodes from the address specified.
2. Enter data at 4250 specified in the example.
3. Execute the program and check for the result at 4252.
4. Change data at 4250 and execute each time and check for the result.

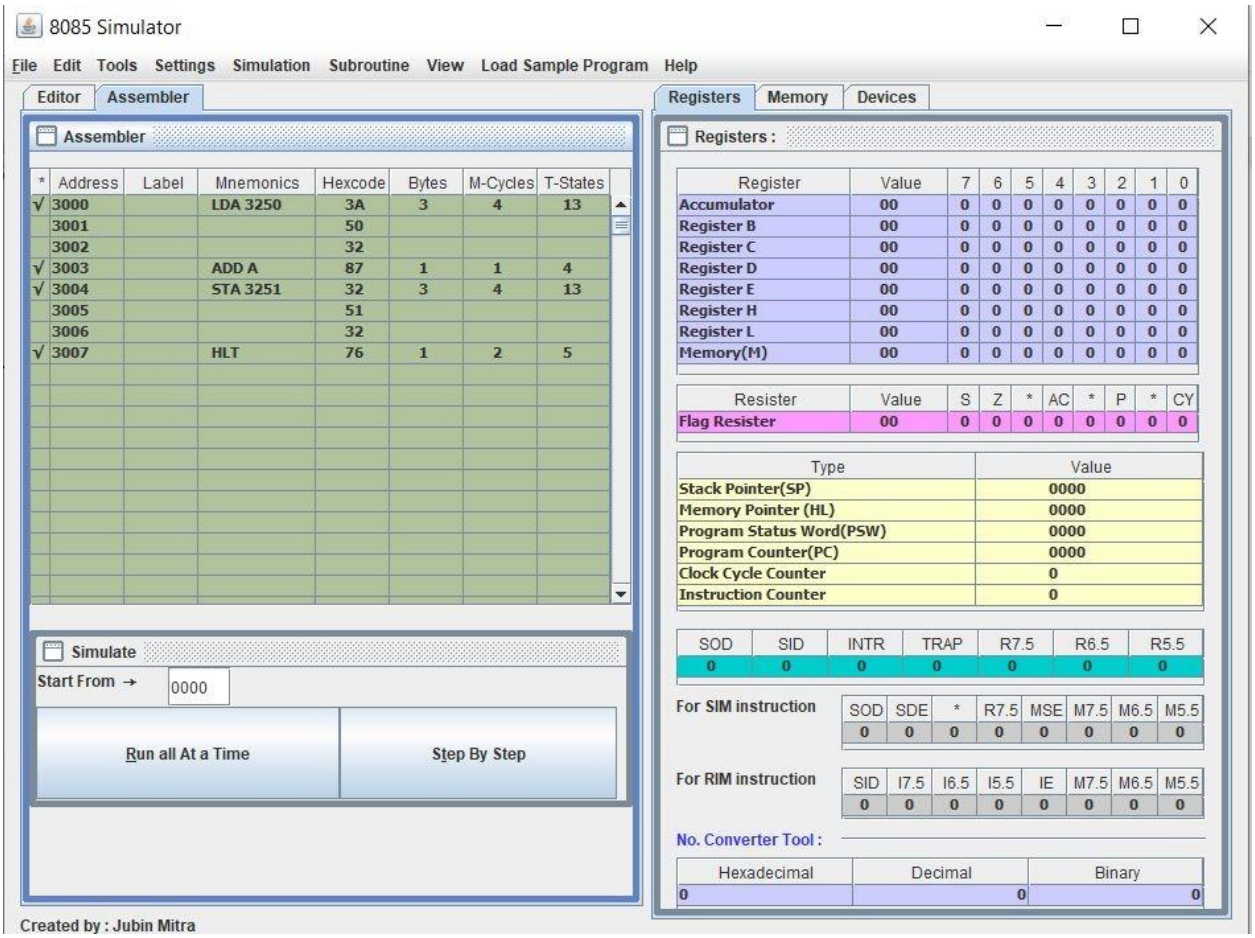
Program:

Shifting left an 8-bit number by 1 bit

```
 # ORG
 3000H
 LDA
 3250
 ADD A
ST
A
32
```

51
HL
T
#
ORG
3250
DB
25H

Output 1:



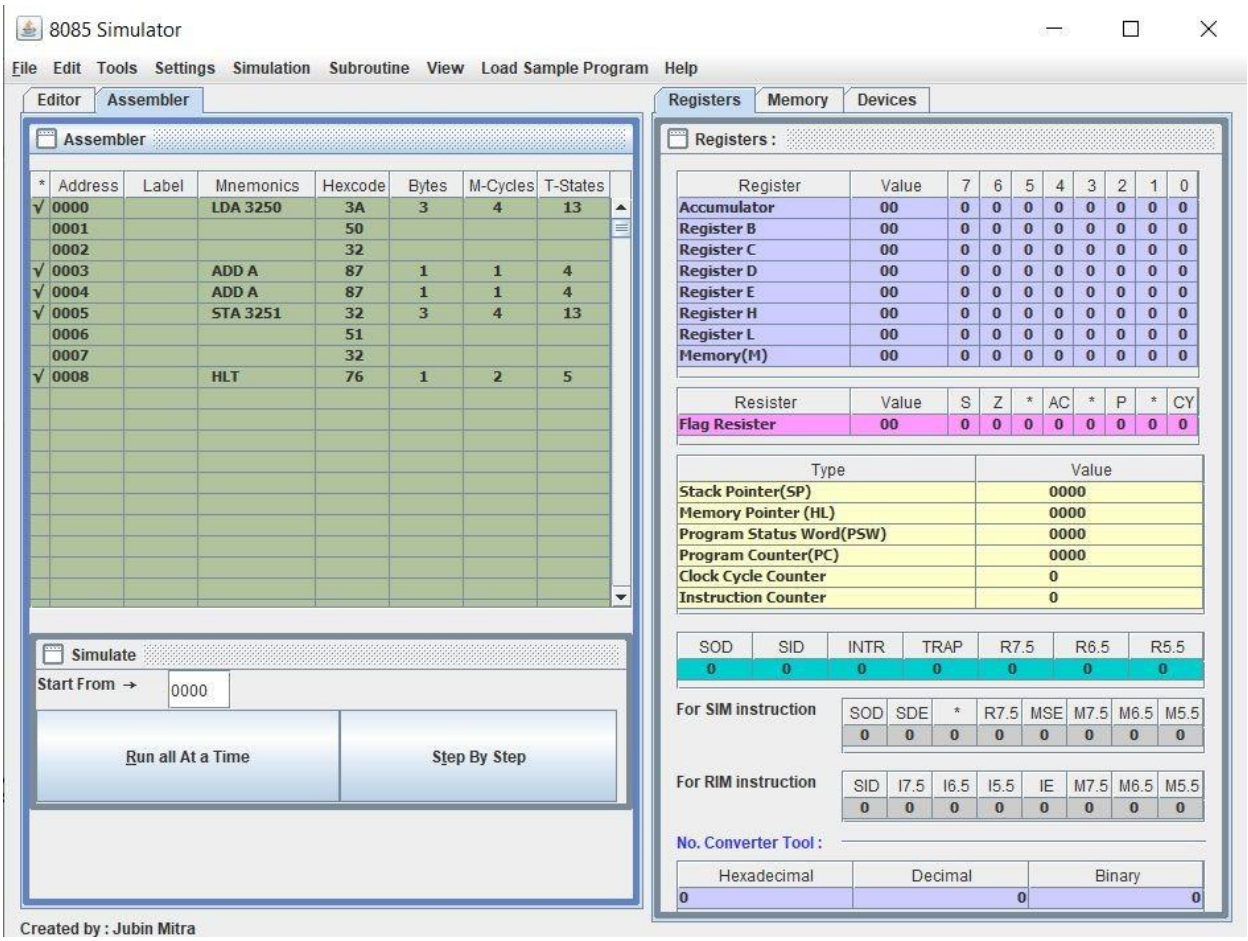
Shifting left an 8-bit number by 2 bits

LD
A
325
0
AD
D A
AD
D A

ST
A
325
1
HL
T

#
ORG
3250
DB
25H

Output 2:

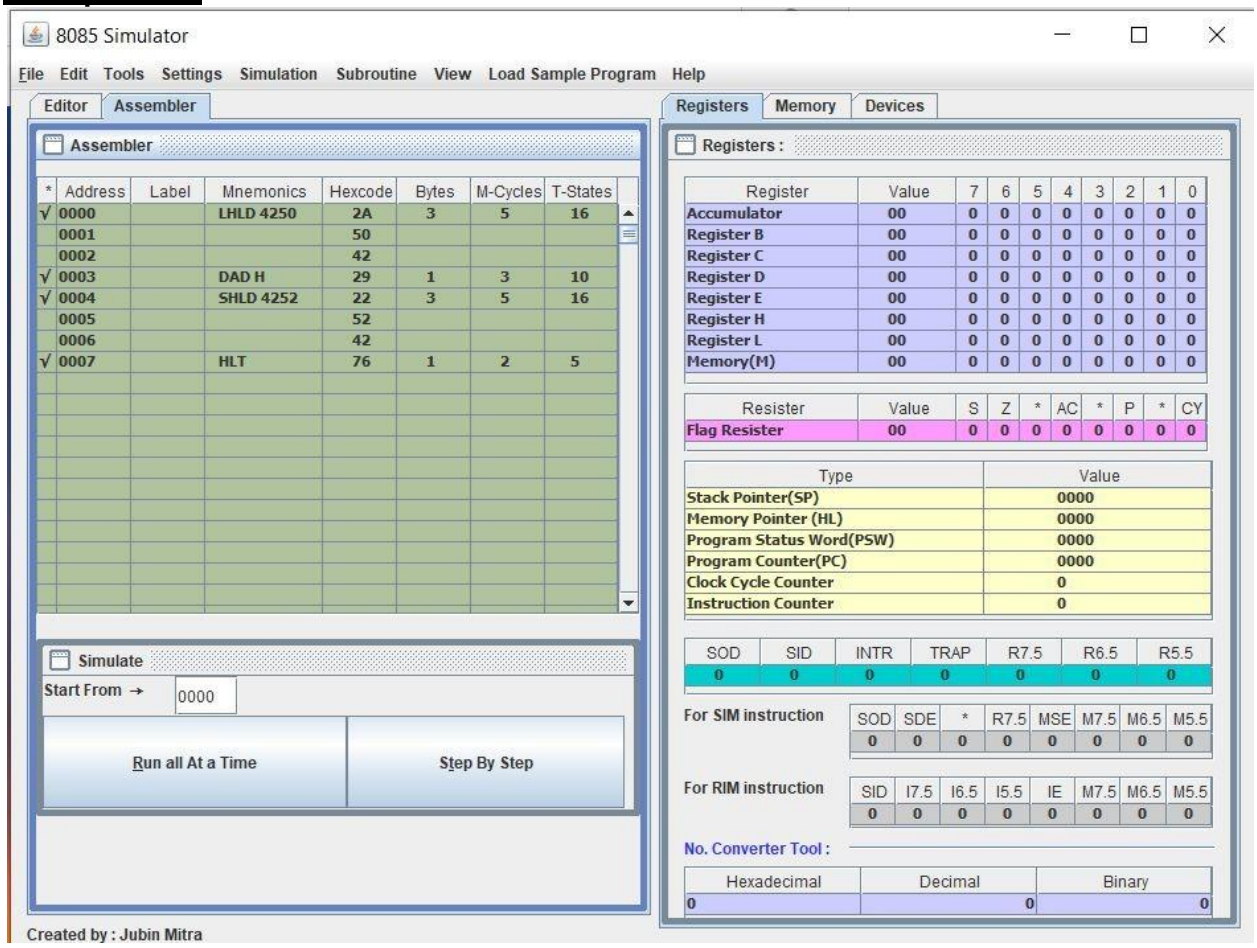


Shifting left a 16-bit number by 1 bit

LHL
D
4250
DAD
H
SHL
D

4252
HLT
ORG 4250
DB 05H,20H

Output 3:

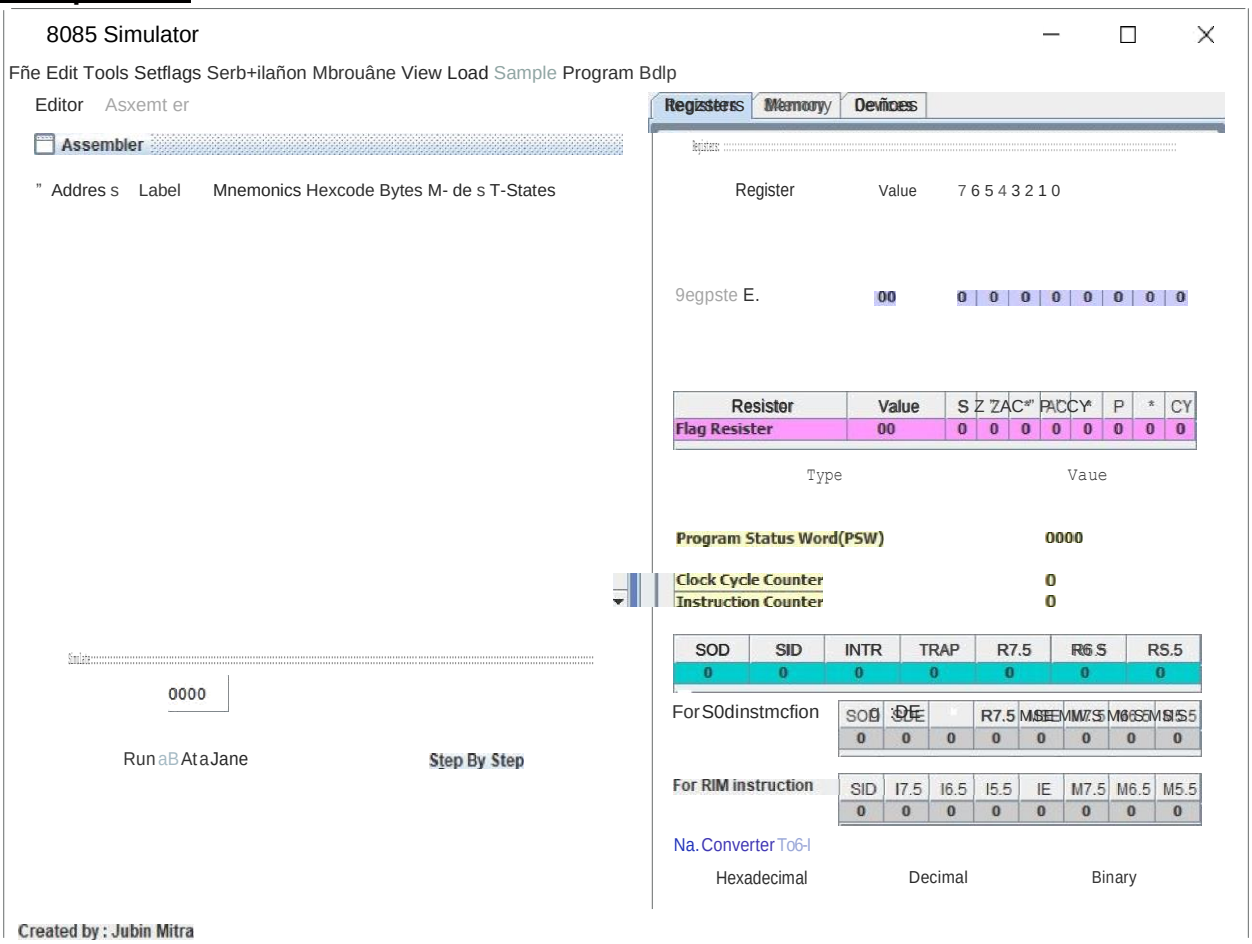


Shifting left a 16-bit number by 2 bits

LHL
D
425
0
DA
D H
DA
D H
SHL
D
425
2
HLT

ORG 4250
DB 05,20

Output 4:



EXPERIMENT: 5

Aim:

1. To find square from lookup table.
2. To find larger of two numbers.
3. To find smaller of two numbers.
4. To find larger number in a data array.
5. To find smaller number in a data array.
6. To find the sum of series of 8-bit numbers.
7. To find the sum of series of 8-bit numbers but sum is a 16-bit number.

Apparatus Required: Microprocessor Kit 8085, Key Board, Op-Code Sheet.

Theory:

We are putting away the square outcome into the memory. At the point when the number is more noteworthy than F, we are putting away FFH into memory to demonstrate an ERROR. We are taking the number from area 8000H, and the query table is put away at the 9000H area. We can locate the square of the numbers at various spaces.

The arrangement is to instate max as first component, at that point cross the given exhibit from second component till end. For each navigated

Component, contrast it and max, on the off chance that it is more noteworthy than max, at that point update max.

In this program the information is put away at area 8001H onwards. The 8000H is containing the size of the square. Subsequent to executing this program, it will restore the most modest number and store it at area 9000H.

Rationale is basic, we are taking the primary number at register B to begin the activity. In every emphasis we are getting the number from memory and putting away it into register A. At that point in the event that B > An, at that point we basically update the estimation of B with An, in

any case go for the following cycle. Consequently, we can locate the most modest number in a square of bytes.

Utilizing area 8000H to hold the length of the square. The principle block is put away from address 8010H. We are putting away the outcome at area 9000H and 9001H. The 9000H holding the lower byte, and 9001H is holding the upper byte.

Over and over we are taking the number from the memory, at that point including it with collector and increment the register E content when convey banner is set. At first E is cleared.

Precautions:

1. All steps should be followed carefully.
2. Make sure all power sources are disconnected
3. Make sure you are properly grounded.
4. Don't touch the live wire.

Procedure:

To find square from lookup table:

1. Assign 20 to register H, 50 to register L and 00 to accumulator A.
2. Load the content of memory location which is specified by M in register B.
3. Add content of M in accumulator A and decrement value of B by 01.
4. Check if B holds 00, if true then store the value of A at memory location 3050 otherwise go to step 3.

To find larger of two numbers:

1. Load value in the accumulator.
2. Then, copy the value to any of the register.
3. Load next value in the accumulator.
4. Compare both values.
5. Check carry flag, if reset then jump to the required address to store the value.

6. Copy the result in the accumulator.7. Store the result at the required address.

To find smaller of two numbers:

1. Load the content from memory location.
2. Move content of Accumulator into Register B.
3. Load the content from Memory location.
4. Compare the content of Register B.
5. If carry flag is equal to 1 go to step 7.
6. Move content of Register B into Accumulator.
7. Store the content into Memory.

8. End of program.

To find larger number in a data array:

1. We are taking first element of array in A.
2. Comparing A with other elements of array, if A is smaller than store that element in A otherwise compare with next element.
3. The value of A is the answer.

To find smaller number in a data array:

1. Load the address of the first element of the array in HL pair.
2. Move the count to B - reg.
3. Increment the pointer.
4. Get the first data in A - reg.
5. Decrement the count.
6. Increment the pointer.
7. Compare the content of memory addressed by HL pair with that of A - reg.
8. If carry = 1, go to step 10 or if Carry = 0 go to step 9.
9. Move the content of memory addressed by HL to A - reg.
10. Decrement the count.
11. Check for Zero of the count. If ZF = 0, go to step 6, or if ZF = 1 go to next step.
12. Store the smallest data in memory.
13. Terminate the program.

To find the sum of series of 8-bit numbers:

1. This program finds the sum of numbers in an array.
2. In order to find the sum of numbers, first, the counter must be initialized with the size of an array and accumulator must be initialized to zero.
3. Then, the first number is moved to register B and added with the accumulator.
4. After addition, the counter is decremented and checked whether it has reached zero. If it has, the loop terminates otherwise, the next number is moved to register B and added.
5. Let us assume that the memory location 3000H stores the counter. The next memory locations store the array.
6. Initially, H-L pair is loaded with the address of the counter and is moved to register C.
7. Accumulator is initialized with 00H.
8. Then, H-L pair is incremented to point to the first number in the array and it is moved to register B.
9. Register B is added to the accumulator and the result is stored in the accumulator.
10. Then, the counter is decremented and checked whether it has become zero.

11. If it hasn’t become zero, it means there are numbers left in the array. In this case, the control jumps back to increment the H-L pair and moves the next number to register B.
12. This process continues until counter becomes zero, i.e. all the numbers in the array are added.
13. At last, H-L pair is incremented and the result is moved from accumulator to memory.

To find the sum of series of 8-bit numbers but sum is a 16-bit number:

1. This program finds the sum of numbers in an array.
2. In order to find the sum of numbers, first, the counter must be initialized with the size of an array and accumulator must be initialized to zero.
3. Then, the first number is moved to register B and added with the accumulator.
4. After addition, the counter is decremented and checked whether it has reached zero. If it has, the loop terminates otherwise, the next number is moved to register B and added.
5. Let us assume that the memory location 3000H stores the counter. The next memory locations store the array.
6. Initially, H-L pair is loaded with the address of the counter and is moved to register C.
7. Accumulator is initialized with 00H.
8. Then, H-L pair is incremented to point to the first number in the array and it is moved to register B.
9. Register B is added to the accumulator and the result is stored in the accumulator.
10. Then, the counter is decremented and checked whether it has become zero.
11. If it hasn’t become zero, it means there are numbers left in the array. In this case, the control jumps back to increment the H-L pair and moves the next number to register B.
12. This process continues until counter becomes zero, i.e. all the numbers in the array are added.
13. At last, H-L pair is incremented and the result is moved from accumulator to memory.

Program Code and Object code:

Program to find square from lookup table:

```
#  ORG 2000H
#  LDA 2500
HLT
STA 2501
#  ORG 2500
#  DB 07
#  ORG 2600
#  DB 00, 01, 02, 09, 16, 25, 36, 49, 64, 81
```

OR

```
LDA 8050
ADI 60
MOV L, A
MVI H,80
MOV A, M
STA 8051
HLT
#  ORG 8060
#  DB 00H,01H,04H,09H,16H,25H,36H,49H,64H,81H
#  ORG 8050
#  DB 09
```

Program to find larger of two numbers:

```
# ORG 2000H
        LXI H,2501
        MOV A, M
```

```
        INX H
        CMP M
        JNC AHEAD
        MOV A, M

AHEAD:  STA 2503
HLT
# ORG 2501
# DB 98H,87H
```

Program to find smaller of two numbers:

```
# ORG 2000H
        LXI H,2501
        MOV A, M
        INX H
        CMP M
        JC AHEAD
        MOV A, M

AHEAD:  STA 2503
        HLT
```

ORG 2501

DB B9H,8AH

Program to find larger number in a data array:

```
# ORG 2000H
        LXI H,2500
        MOV C, M
        INX H
        MOV A, M
        DCR C

LOOP:   CMP M
        JNC AHEAD
        MOV A, M
AHEAD:

        JNZ LOOP
STA 2609
```

ORG 2500

DB 03,98,75,99

Program to find smaller number in a data array:

```
# ORG 2000H
        LXI H,2500
        MOV B, M
        INX H
        MOV A, M
        DCR B

LOOP    INX H
:
        CMP M
        JC AHEAD
```

```
MOV       A, M


AHEAD:              DCR B
                    JNZ LOOP
                    STA 2609
                    HLT
#   ORG 2500
#   DB 03,98,75,99
```

To find the sum of series of 8-bit numbers:

```
  # ORG 2000
                    LXI H,2500
                   MOV C, M
                    MVI A,00


  LOOP:             INX H
                    ADD M
                          C
DCR
```

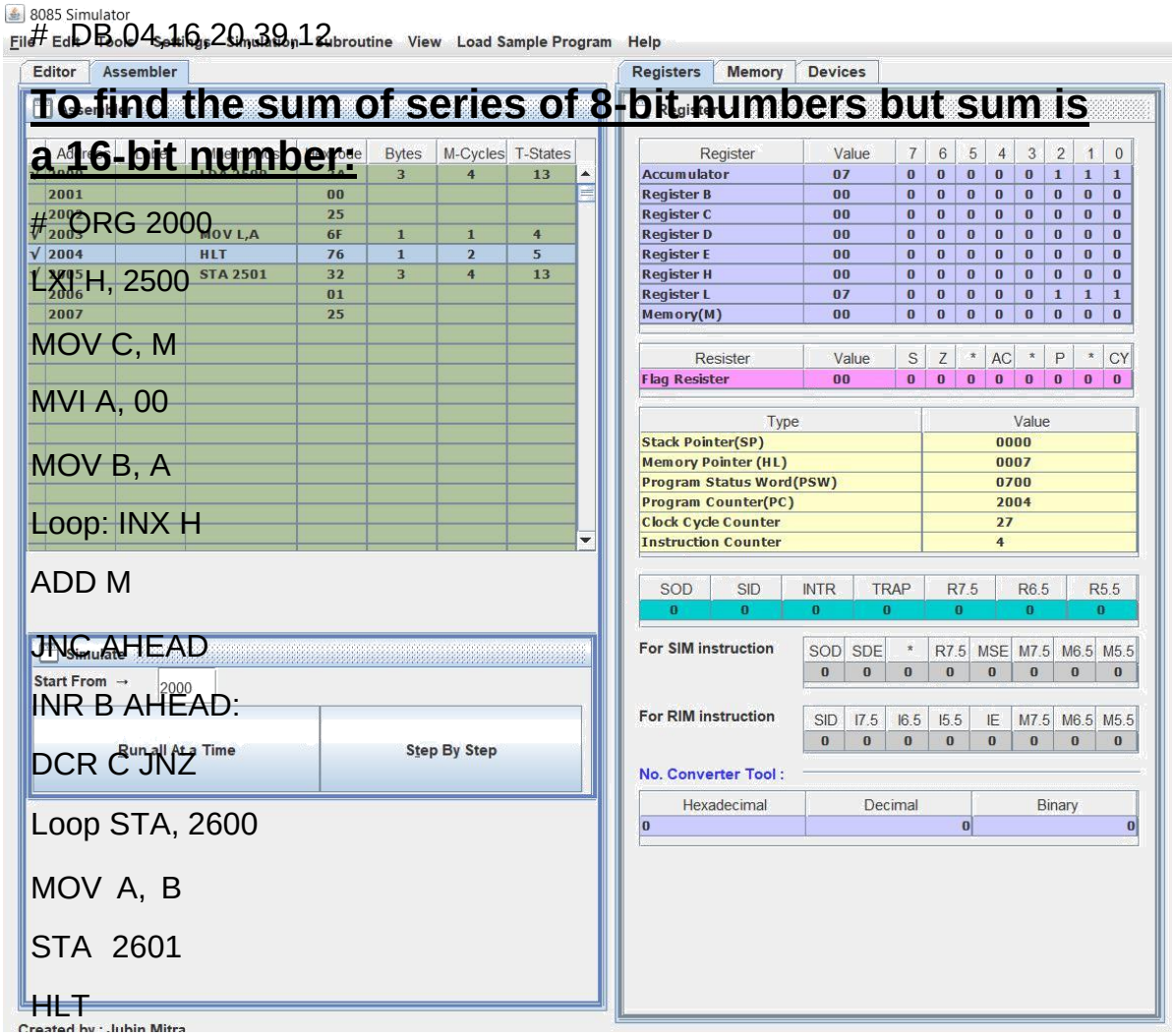
JNZ LOOP

STA 2600

HLT

ORG 2500

DB 04,16,20,39,12



To find the sum of series of 8-bit numbers but sum is a 16-bit number:

ORG 2000

LXI H, 2500

MOV C, M

MVI A, 00

MOV B, A

Loop: INX H

ADD M

JNC AHEAD

INR B AHEAD:

DCR C JNZ

Loop STA, 2600

MOV A, B

STA 2601

HLT

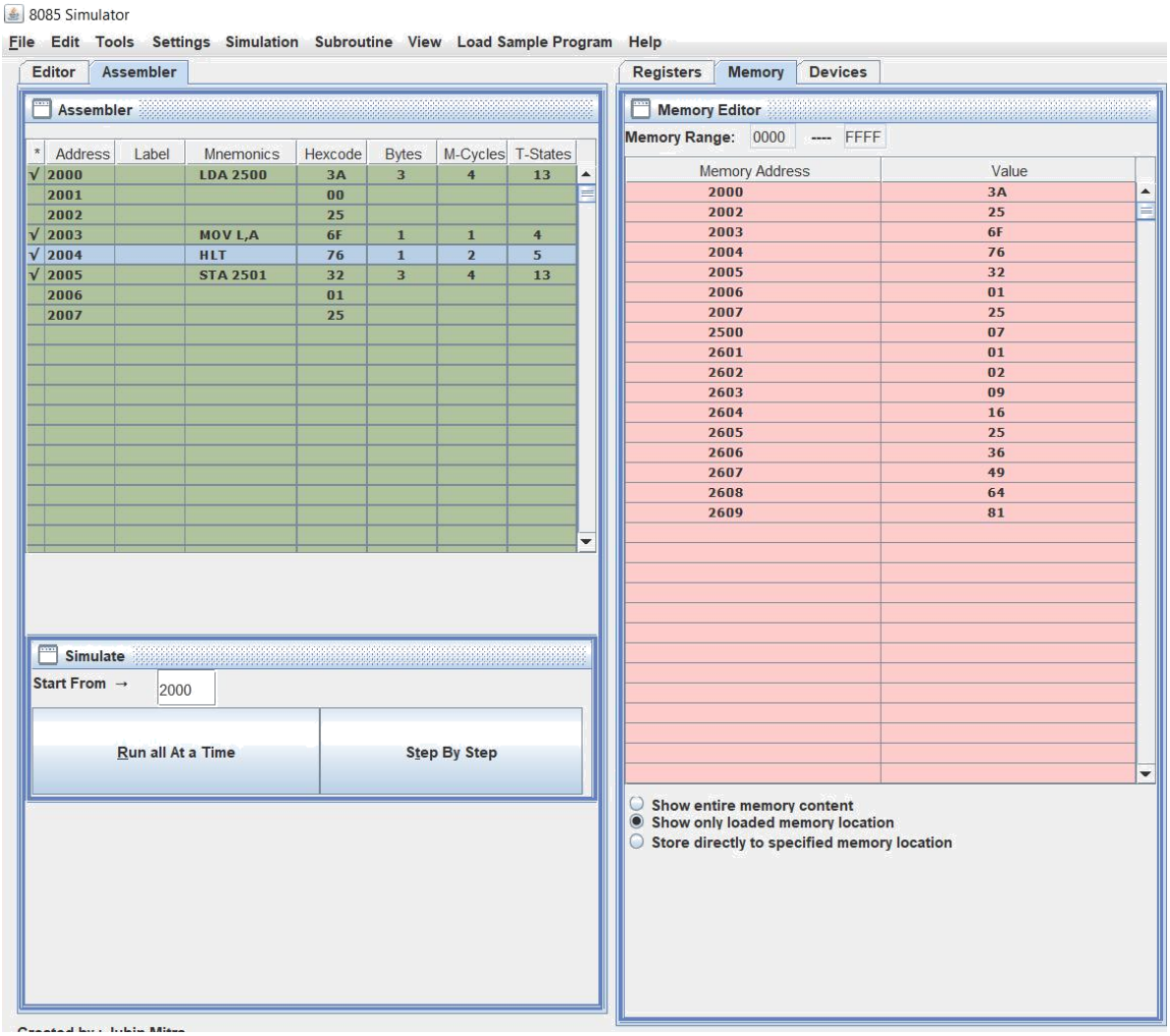
ORG 2500

DB 04,16,20,39,12

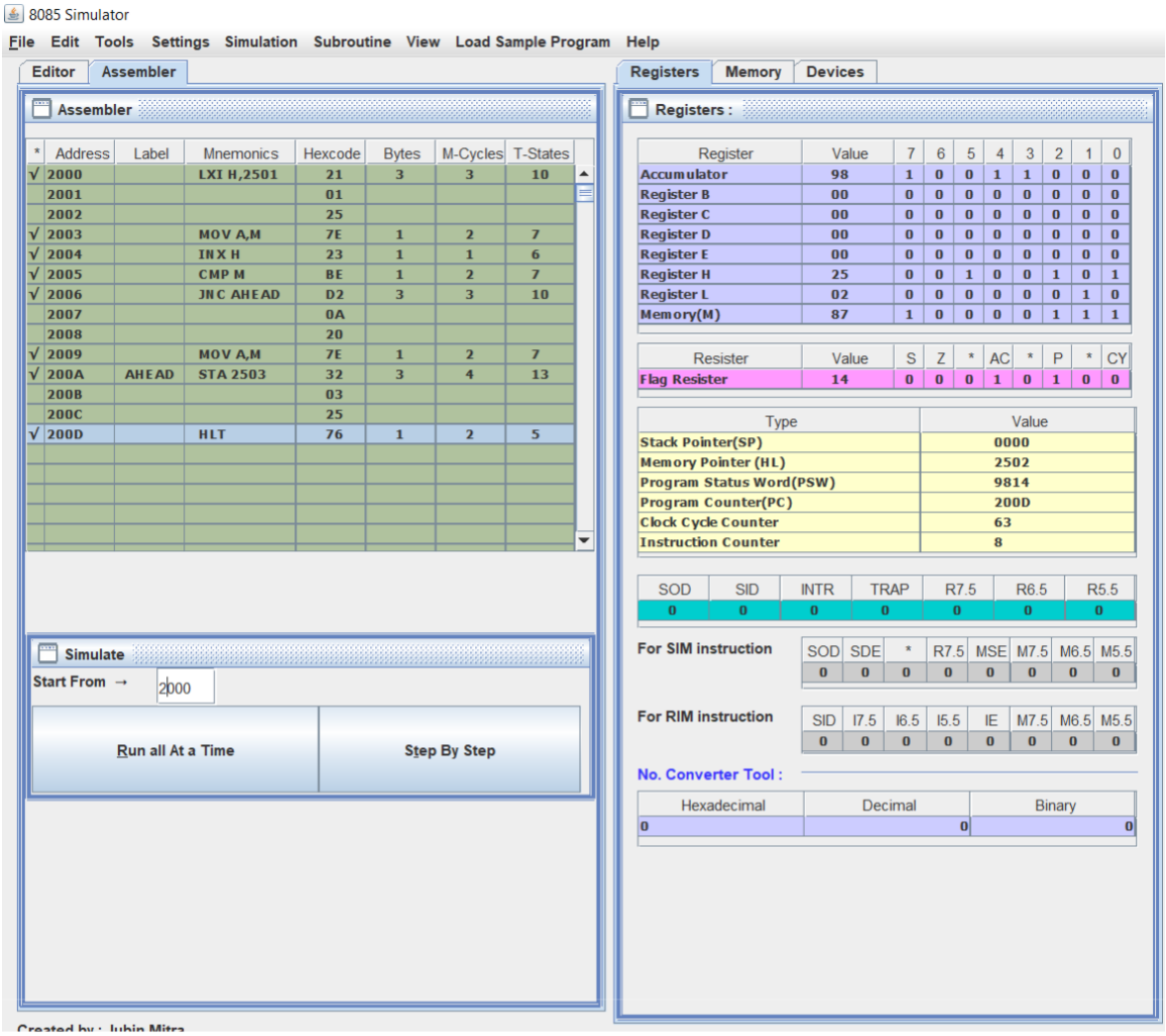
Results:

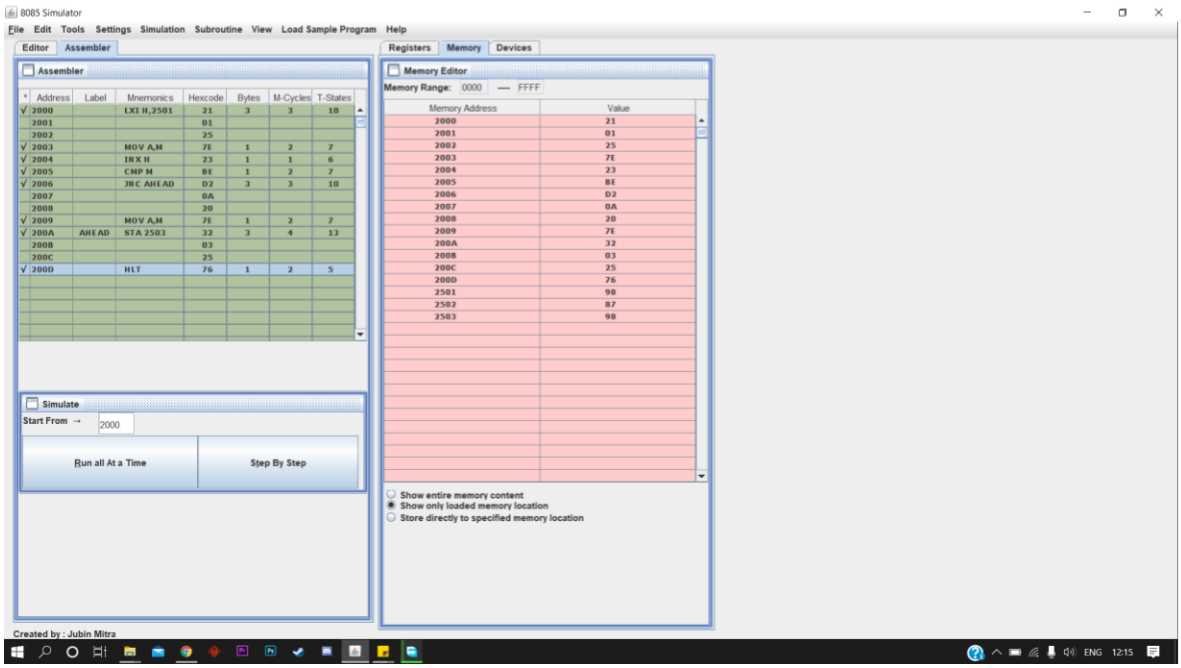
To find square from lookup table.

Output:

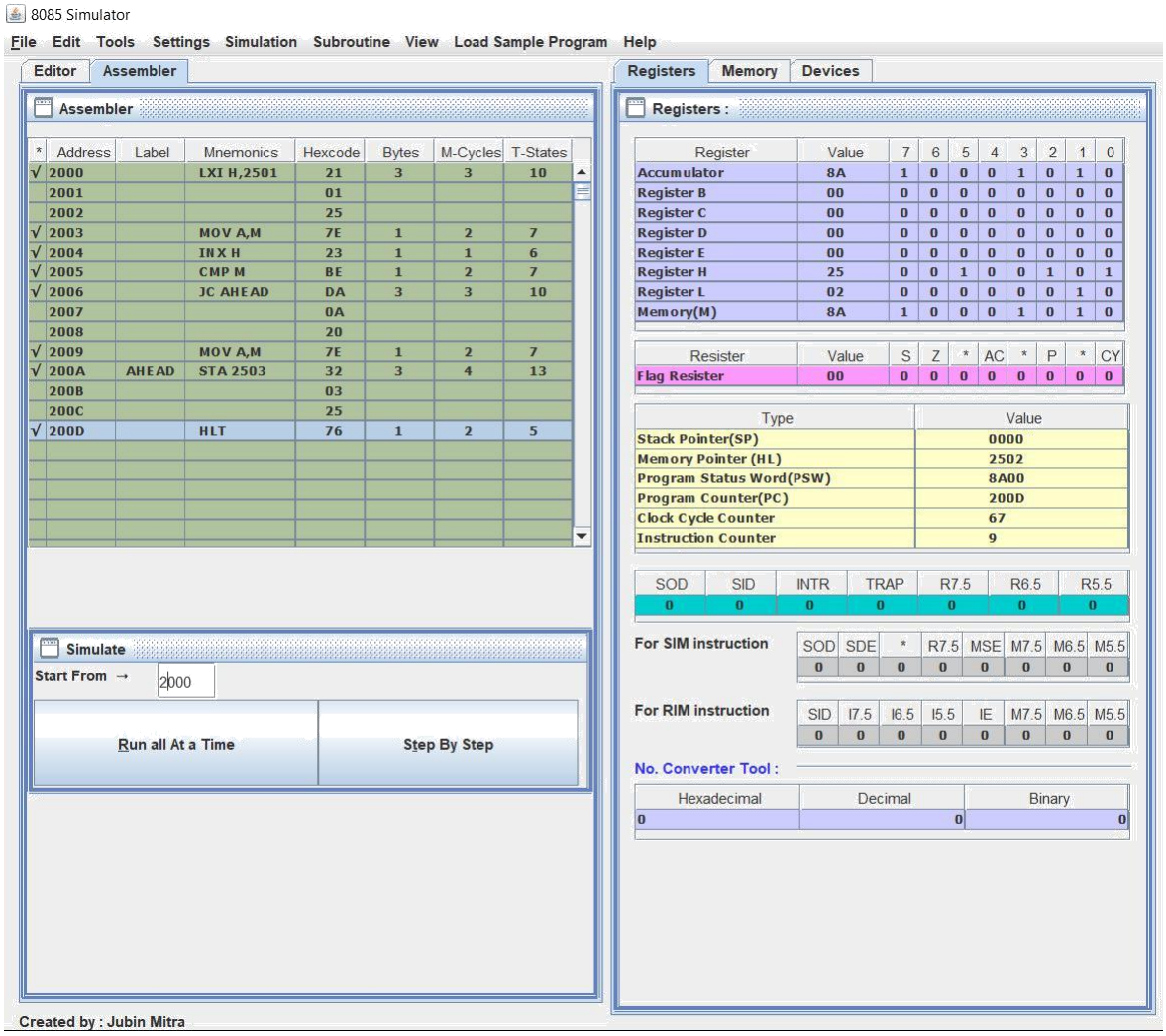


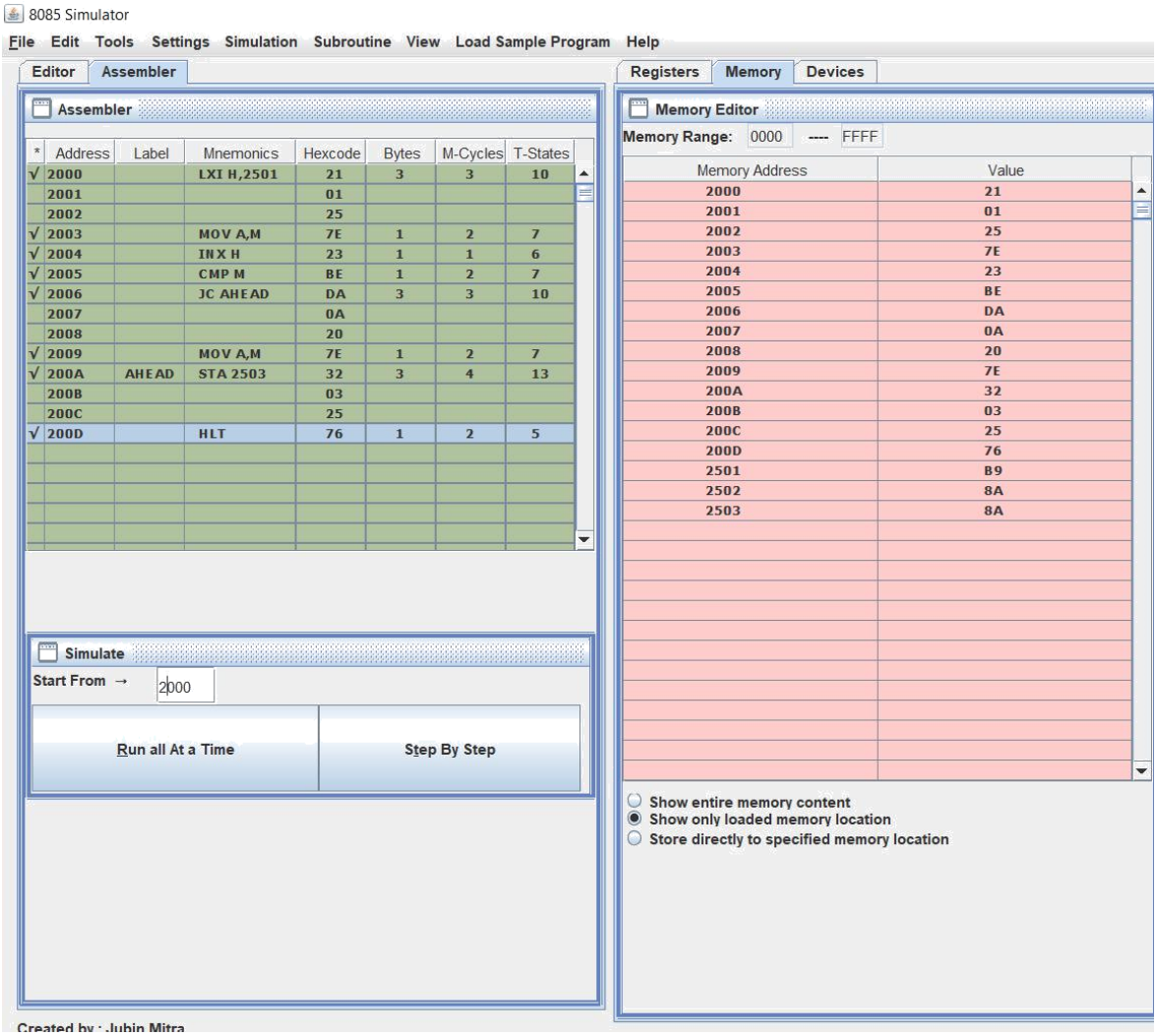
To find larger of two numbers.



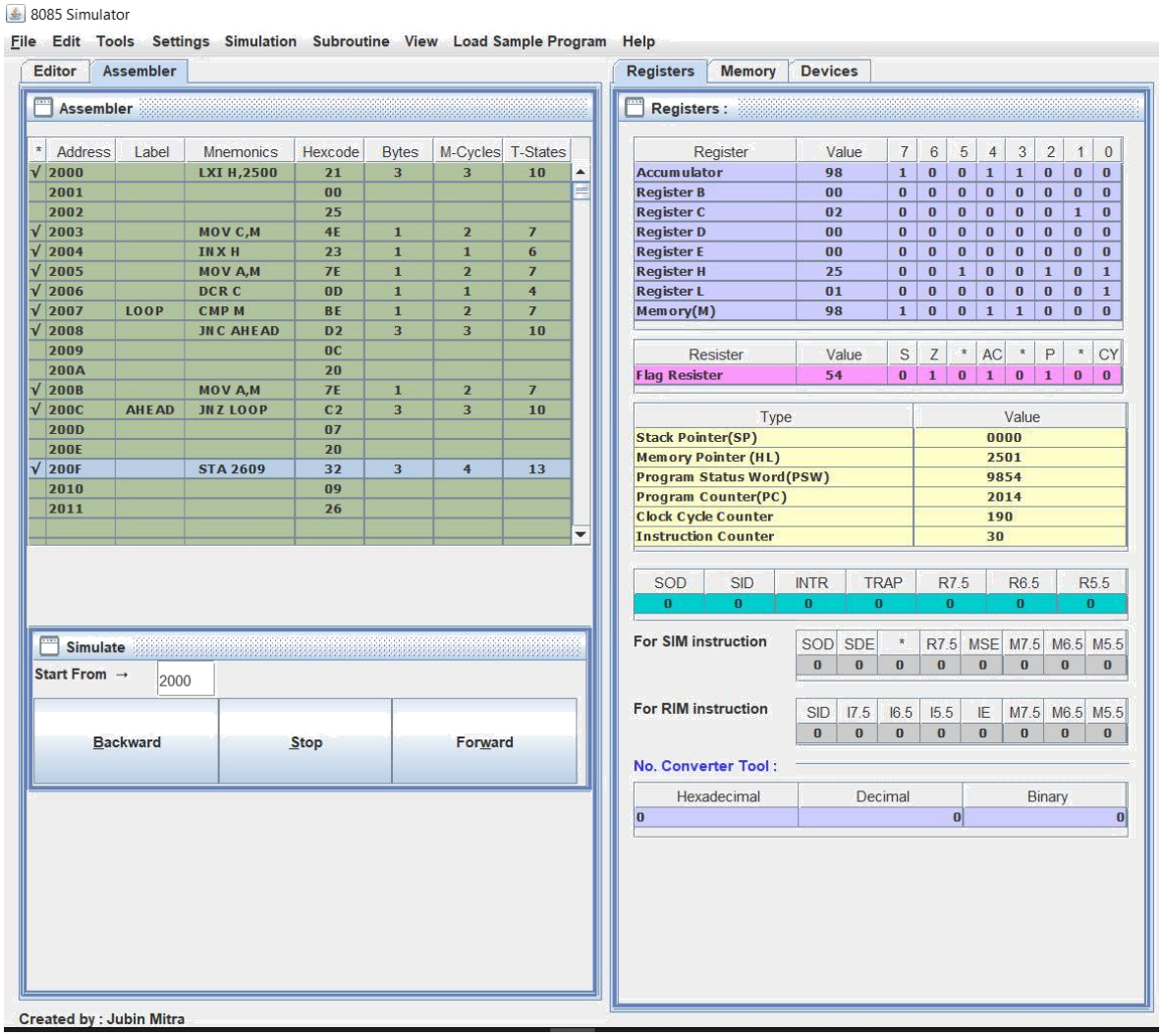


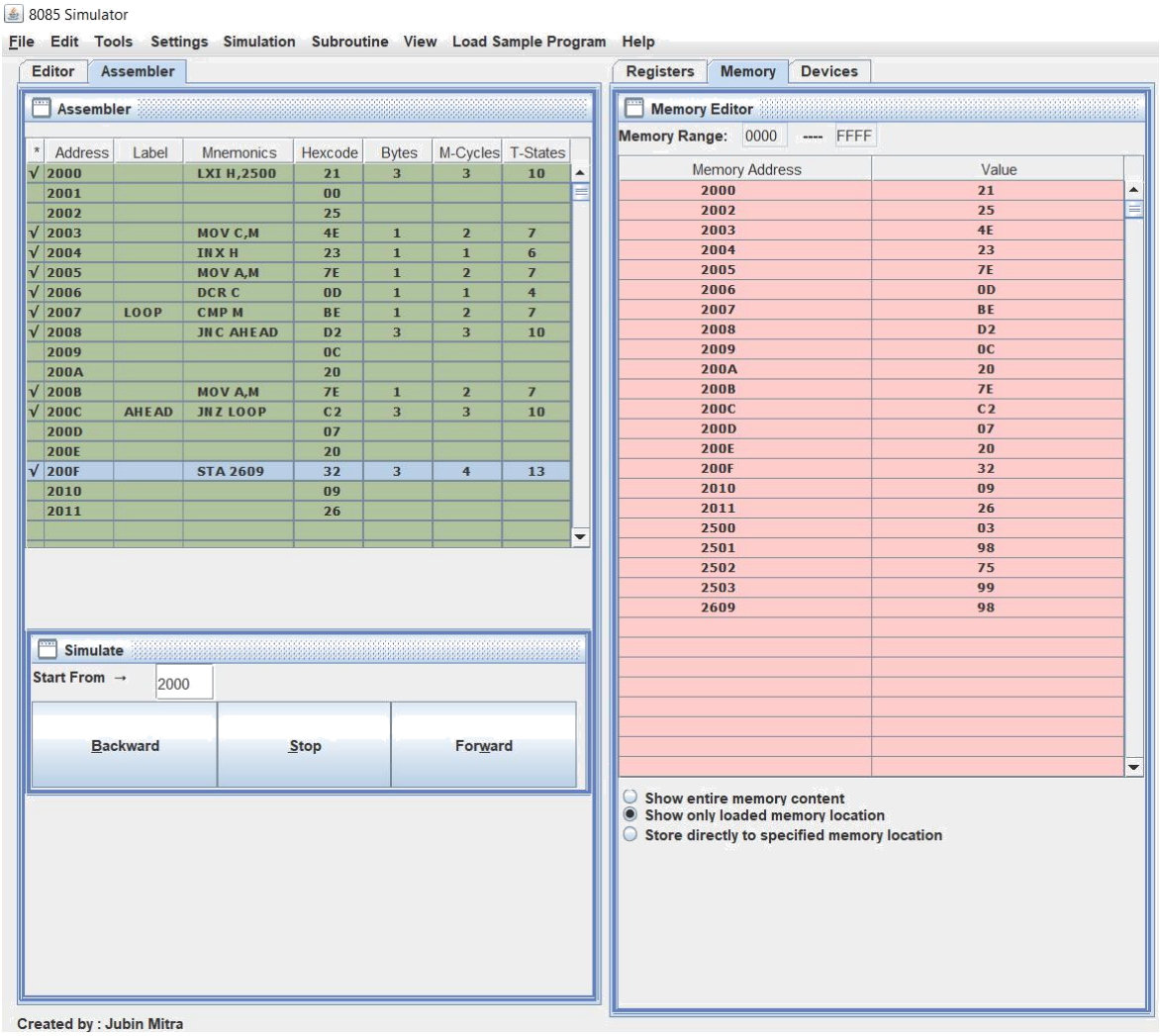
To find smaller of two numbers.


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 2000 LXI H,2501 21 3 3 10
2001 01
2002 25
√ 2003 MOV A,M 7E 1 2 7
√ 2004 INX H 23 1 1 6
√ 2005 CMP M BE 1 2 7
√ 2006 JC AHEAD DA 3 3 10
2007 0A
2008 20
√ 2009 MOV A,M 7E 1 2 7
√ 200A AHEAD STA 2503 32 3 4 13
200B 03
200C 25
√ 200D HLT 76 1 2 5
Simulate
Start From → 2000
Run all At a Time
Step By Step
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 8A 1 0 0 0 1 0 1 0
Register B 00 0 0 0 0 0 0 0 0
Register C 00 0 0 0 0 0 0 0 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 25 0 0 1 0 0 1 0 1
Register L 02 0 0 0 0 0 0 1 0
Memory(M) 8A 1 0 0 0 1 0 1 0
Resister Value S Z * AC * P * CY
Flag Resister 00 0 0 0 0 0 0 0 0
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 2502
Program Status Word(PSW) 8A00
Program Counter(PC) 200D
Clock Cycle Counter 67
Instruction Counter 9
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0
Created by : Jubin Mitra

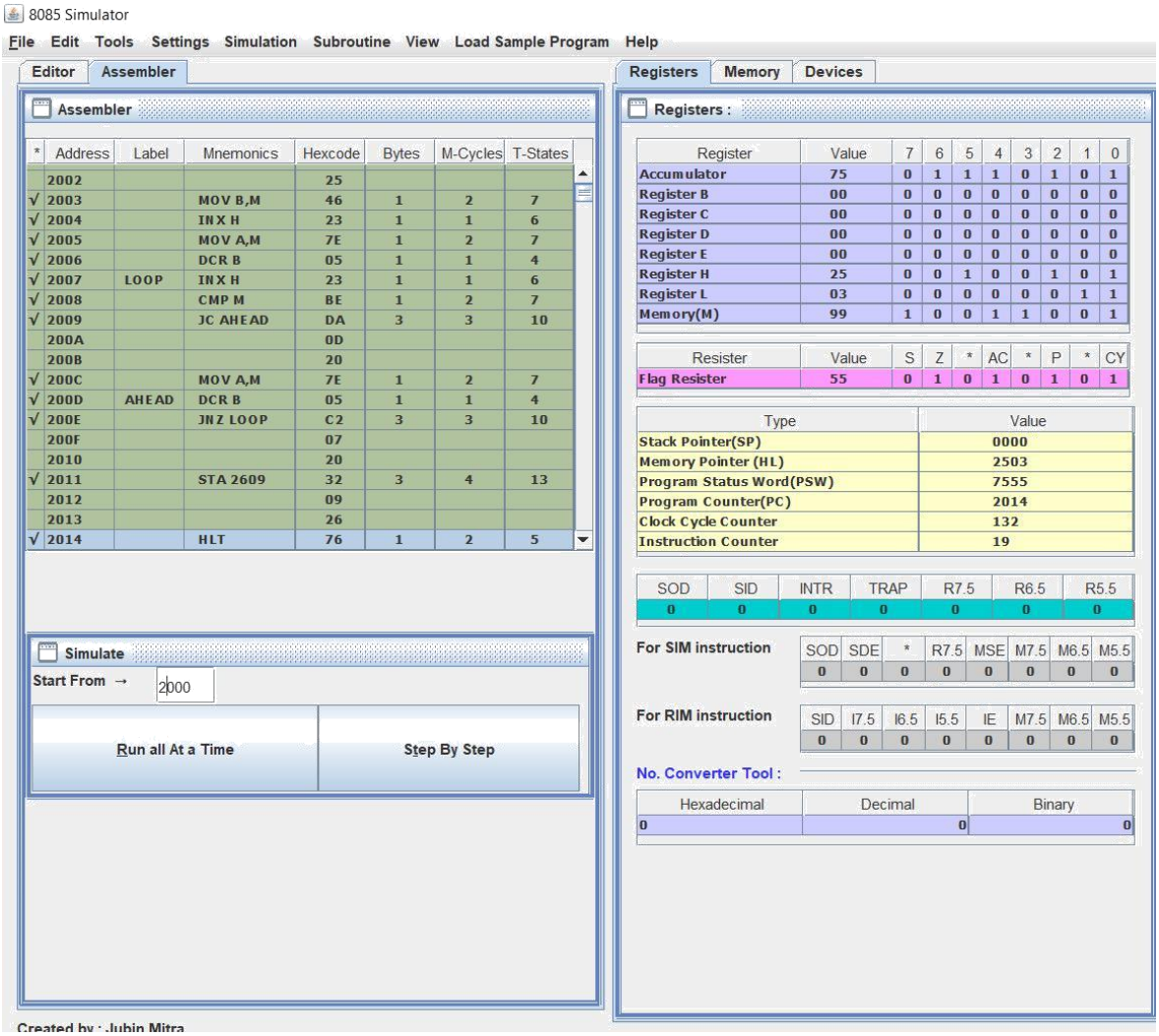


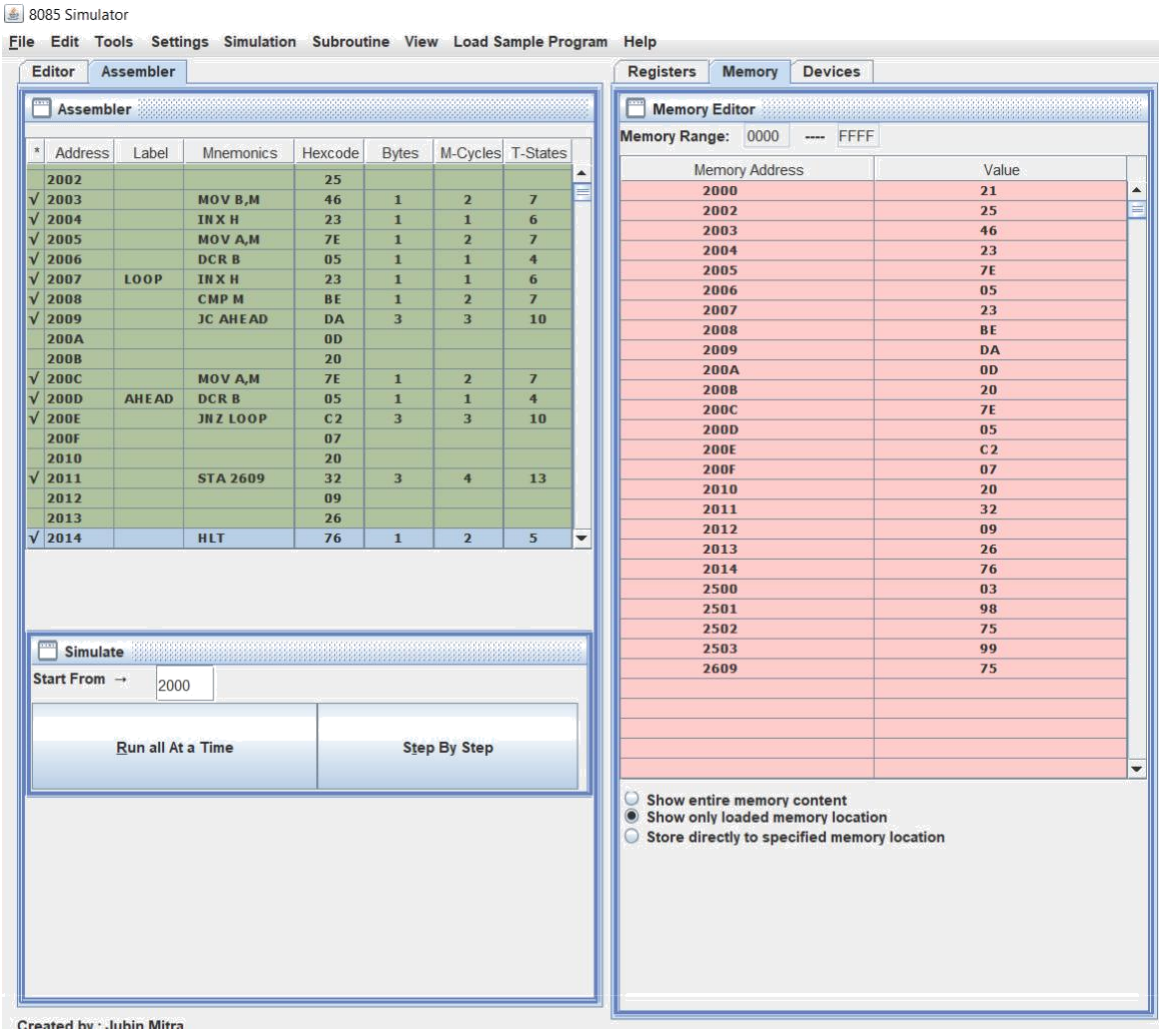
To find larger number in a data array.


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 2000 LXI H,2500 21 3 3 10
2001 00
2002 25
√ 2003 MOV C,M 4E 1 2 7
√ 2004 INX H 23 1 1 6
√ 2005 MOV A,M 7E 1 2 7
√ 2006 DCR C 0D 1 1 4
√ 2007 LOOP CMP M BE 1 2 7
√ 2008 JNC AHEAD D2 3 3 10
2009 0C
200A 20
√ 200B MOV A,M 7E 1 2 7
√ 200C AHEAD JNZ LOOP C2 3 3 10
200D 07
200E 20
√ 200F STA 2609 32 3 4 13
2010 09
2011 26
Simulate
Start From → 2000
Backward Stop Forward
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 98 1 0 0 1 1 0 0 0
Register B 00 0 0 0 0 0 0 0 0
Register C 02 0 0 0 0 0 0 1 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 25 0 0 1 0 0 1 0 1
Register L 01 0 0 0 0 0 0 0 1
Memory(M) 98 1 0 0 1 1 0 0 0
Resister Value S Z * AC * P * CY
Flag Resister 54 0 1 0 1 0 1 0 0
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 2501
Program Status Word(PSW) 9854
Program Counter(PC) 2014
Clock Cycle Counter 190
Instruction Counter 30
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0
Created by : Jubin Mitra

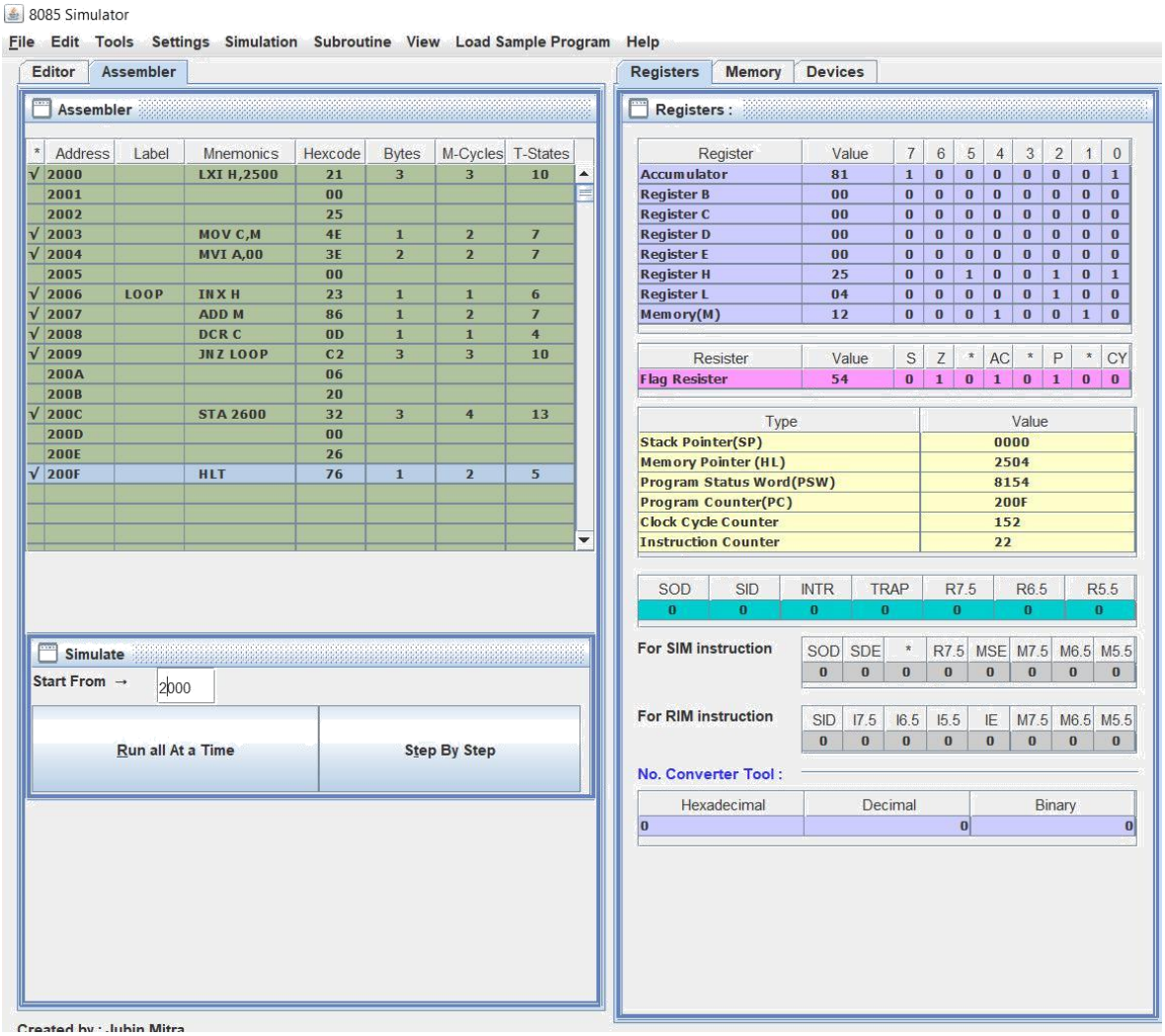


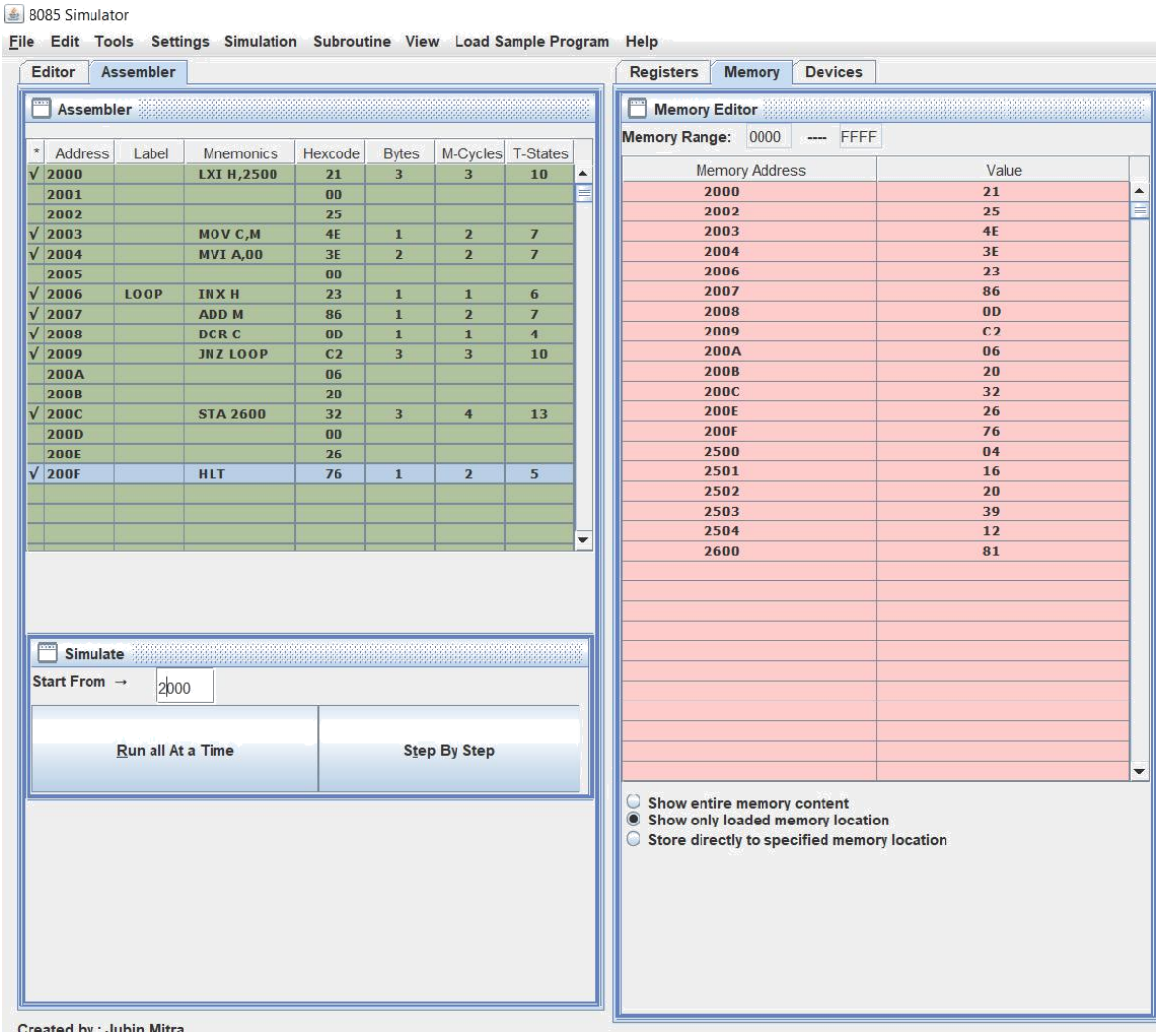
To find smaller number in a data array.


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
2002 25
√ 2003 MOV B,M 46 1 2 7
√ 2004 INX H 23 1 1 6
√ 2005 MOV A,M 7E 1 2 7
√ 2006 DCR B 05 1 1 4
√ 2007 LOOP INX H 23 1 1 6
√ 2008 CMP M BE 1 2 7
√ 2009 JC AHEAD DA 3 3 10
200A 0D
200B 20
√ 200C MOV A,M 7E 1 2 7
√ 200D AHEAD DCR B 05 1 1 4
√ 200E JNZ LOOP C2 3 3 10
200F 07
2010 20
√ 2011 STA 2609 32 3 4 13
2012 09
2013 26
√ 2014 HLT 76 1 2 5
Simulate
Start From → 2000
Run all At a Time
Step By Step
Created by : Jubin Mitra
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 75 0 1 1 1 0 1 0 1
Register B 00 0 0 0 0 0 0 0 0
Register C 00 0 0 0 0 0 0 0 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 25 0 0 1 0 0 1 0 1
Register L 03 0 0 0 0 0 0 1 1
Memory(M) 99 1 0 0 1 1 0 0 1
Resister Value S Z * AC * P * CY
Flag Resister 55 0 1 0 1 0 1 0 1
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 2503
Program Status Word(PSW) 7555
Program Counter(PC) 2014
Clock Cycle Counter 132
Instruction Counter 19
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0

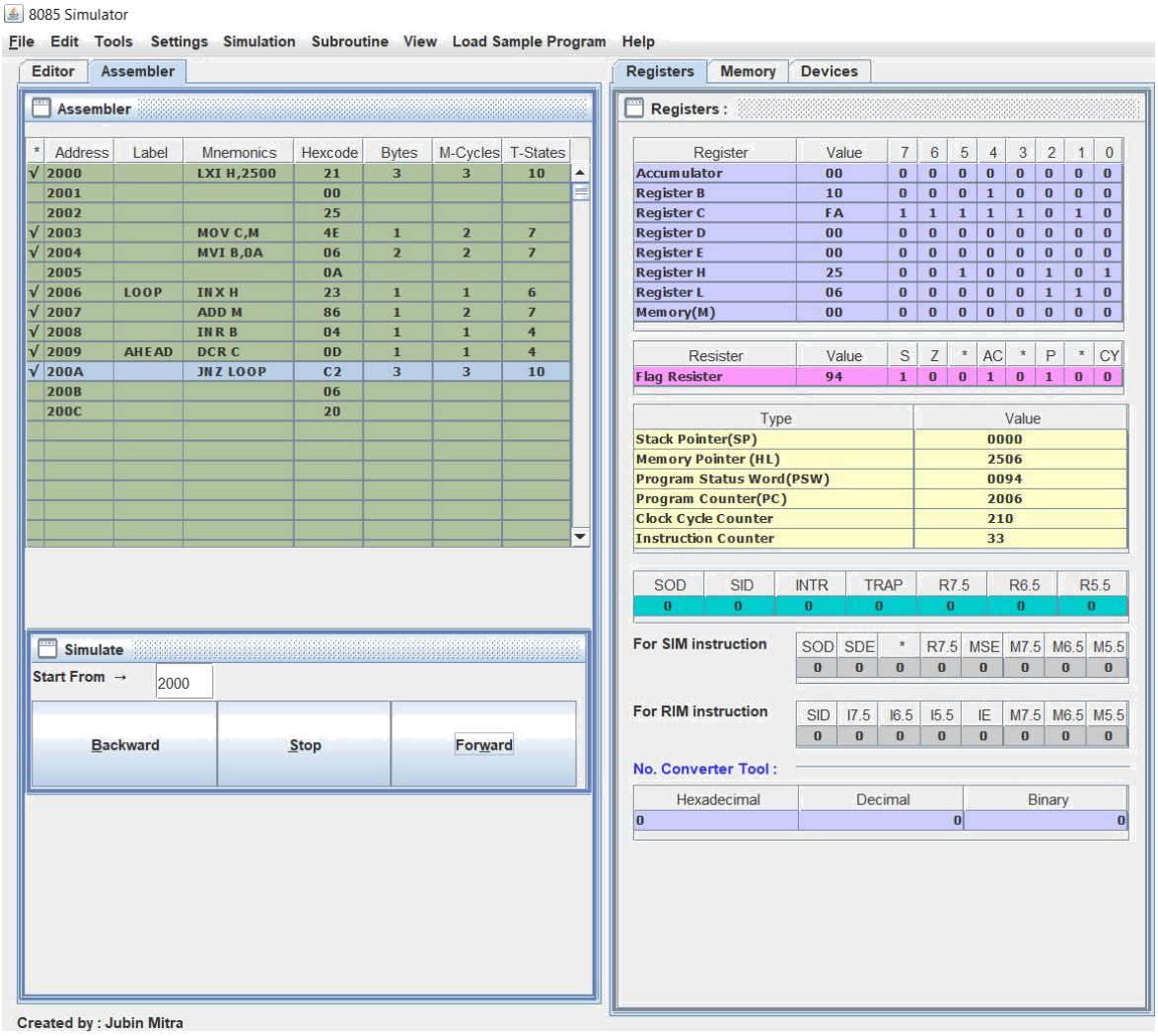


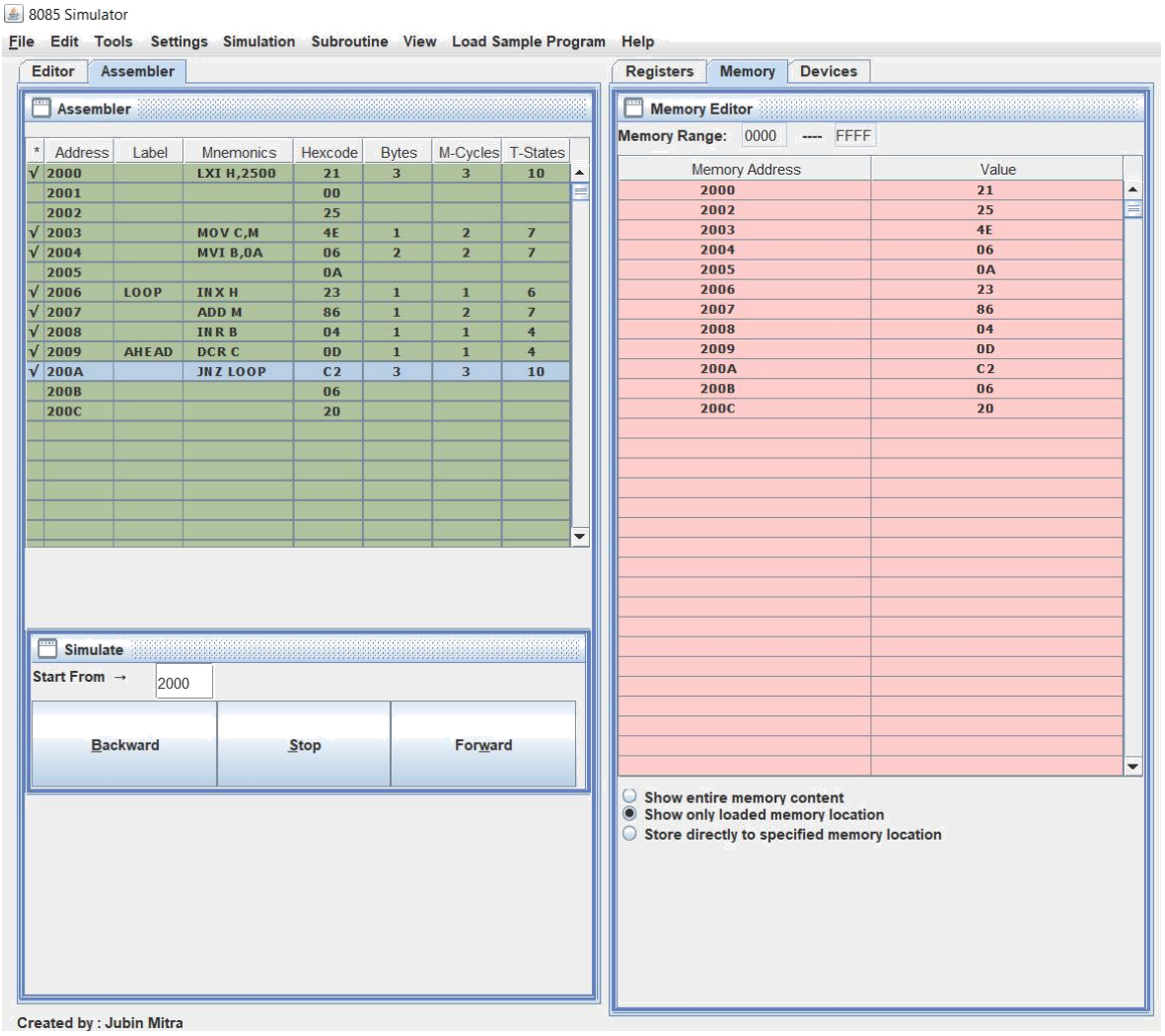
To find the sum of series of 8-bit numbers.


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 2000 LXI H,2500 21 3 3 10
2001 00
2002 25
√ 2003 MOV C,M 4E 1 2 7
√ 2004 MVI A,00 3E 2 2 7
2005 00
√ 2006 LOOP INX H 23 1 1 6
√ 2007 ADD M 86 1 2 7
√ 2008 DCR C 0D 1 1 4
√ 2009 JNZ LOOP C2 3 3 10
200A 06
200B 20
√ 200C STA 2600 32 3 4 13
200D 00
200E 26
√ 200F HLT 76 1 2 5
Simulate
Start From → 2000
Run all At a Time
Step By Step
Created by : Jubin Mitra
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 81 1 0 0 0 0 0 0 1
Register B 00 0 0 0 0 0 0 0 0
Register C 00 0 0 0 0 0 0 0 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 25 0 0 1 0 0 1 0 1
Register L 04 0 0 0 0 0 1 0 0
Memory(M) 12 0 0 0 1 0 0 1 0
Resister Value S Z * AC * P * CY
Flag Resister 54 0 1 0 1 0 1 0 0
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 2504
Program Status Word(PSW) 8154
Program Counter(PC) 200F
Clock Cycle Counter 152
Instruction Counter 22
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0



To find the sum of series of 8-bit numbers but sum is a 16-bit number.


8085 Simulator
File Edit Tools Settings Simulation Subroutine View Load Sample Program Help
Editor Assembler
Assembler
* Address Label Mnemonics Hexcode Bytes M-Cycles T-States
√ 2000 LXI H,2500 21 3 3 10
2001 00
2002 25
√ 2003 MOV C,M 4E 1 2 7
√ 2004 MVI B,0A 06 2 2 7
2005 0A
√ 2006 LOOP INX H 23 1 1 6
√ 2007 ADD M 86 1 2 7
√ 2008 INR B 04 1 1 4
√ 2009 AHEAD DCR C 0D 1 1 4
√ 200A JNZ LOOP C2 3 3 10
200B 06
200C 20
Simulate
Start From → 2000
Backward Stop Forward
Registers Memory Devices
Registers :
Register Value 7 6 5 4 3 2 1 0
Accumulator 00 0 0 0 0 0 0 0 0
Register B 10 0 0 0 1 0 0 0 0
Register C FA 1 1 1 1 1 0 1 0
Register D 00 0 0 0 0 0 0 0 0
Register E 00 0 0 0 0 0 0 0 0
Register H 25 0 0 1 0 0 1 0 1
Register L 06 0 0 0 0 0 1 1 0
Memory(M) 00 0 0 0 0 0 0 0 0
Resister Value S Z * AC * P * CY
Flag Resister 94 1 0 0 1 0 1 0 0
Type Value
Stack Pointer(SP) 0000
Memory Pointer (HL) 2506
Program Status Word(PSW) 0094
Program Counter(PC) 2006
Clock Cycle Counter 210
Instruction Counter 33
SOD SID INTR TRAP R7.5 R6.5 R5.5
0 0 0 0 0 0 0
For SIM instruction
SOD SDE * R7.5 MSE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
For RIM instruction
SID I7.5 I6.5 I5.5 IE M7.5 M6.5 M5.5
0 0 0 0 0 0 0 0
No. Converter Tool :
Hexadecimal Decimal Binary
0 0 0
Created by : Jubin Mitra



Sources of Error:

1. Select op-codes carefully whenever you doing programming.
2. Make space whenever you doing program on kit.
3. You should properly enter the program and exit through proper command.

EXPERIMENT: 6

Aim:

Interfacing of 8051 Micro-controller with a various LED's.

Apparatus Required:

- AT89C51 (8051 Microcontroller)
- 8 LEDs
- 8 Resistors – 1KΩ
- Crystal oscillator – 11.0592MHz
- 2 Capacitors – 33pF
- 2 Resistors – 10KΩ
- 1 Capacitor – 10μF
- 1 Push Button
- 8051 Programmer
- 5V Power Supply.

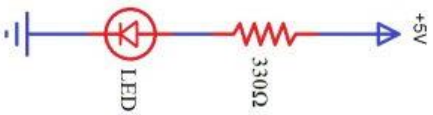
Theory:

1. ### A Led working:

Light Emitting Diodes are the semiconductor light sources. Commonly used LEDs will have a cut-off voltage of 1.7V and current of 10mA. When an LED is applied with its required voltage and current it glows with full intensity. The Light Emitting Diode is similar to the normal PN diode but it emits energy in the form of light. The colour of light depends on the band gap of the semiconductor. The following figure shows "how an LED glows?" Thus, LED is connected to the AT89C51 microcontroller with the help of a current limiting resistor. The value of this resistor is calculated using the following formula.

R= (V-1.7)/10mA, where V is the input voltage.

Generally, microcontrollers output a maximum voltage of 5V. Thus, the value of resistor calculated for this is 330 Ohms. This resistor can be connected to either

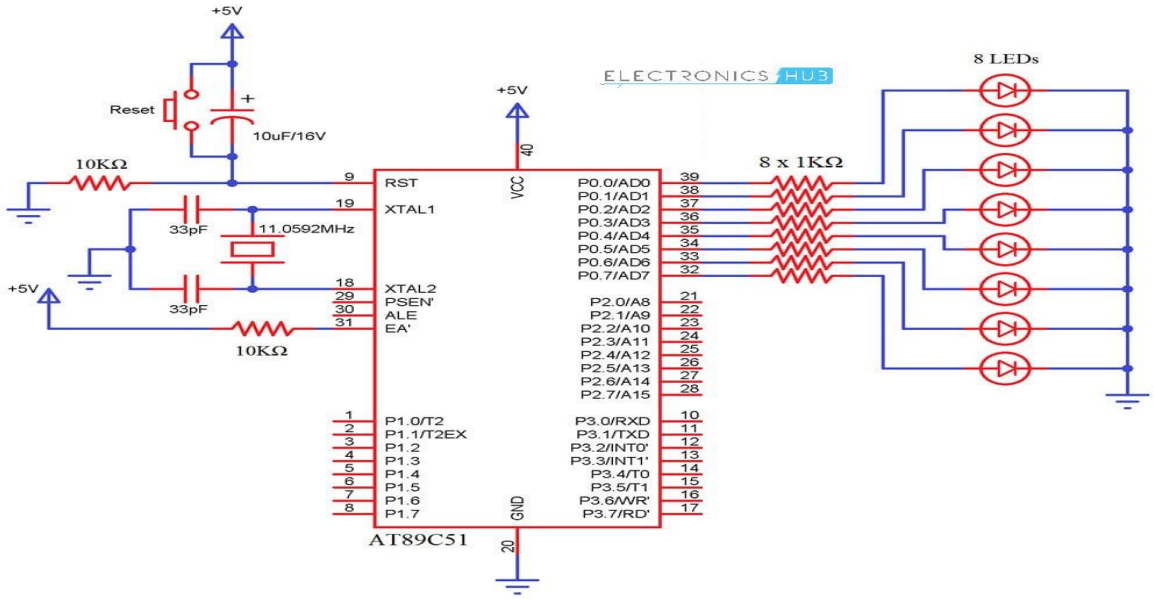


the cathode or the anode of the LED.

2. Principle behind Interfacing LED with 8051

The main principle of this circuit is to interface LEDs to the 8051-family micro controller. Commonly, used LEDs will have voltage drop of 1.7v and current of 10mA to glow at full intensity. This is applied through the output pin of the micro controller

Circuit Diagram



Procedure:

- Go to the simulator section to perform and experiment.
- Read all the instructions.
- Copy the below one of the codes to enlighten a LED in the program section and generate an output.
- Use debug for a line by line verification and use Run to see an Output.
- Use the below written code or make a new yourself.

Serial number:	Digit	Code
1	0	SETB P0.6 SETB P0.5 SETB P0.3 SETB P0.4 SETB P0.2 SETB P0.1

2	1	//SETB P0.6 //A
		SETB P0.5 //B
		SETB P0.4 //C
		//SETB P0.3 //D
		//SETB P0.2 //E
		//SETB P0.1 //F
		//SETB P0.0 //G

3	2	///For Zero
		SETB P0.6 //A
		SETB P0.5 //B
		//SETB P0.4 //C
		SETB P0.3 //D
		SETB P0.2 //E
		//SETB P0.1 //F
		SETB P0.0 //G

4	3	SETB P0.6 //A
		SETB P0.5 //B
		SETB P0.4 //C
		SETB P0.3 //D
		//SETB P0.2 //E
		//SETB P0.1 //F
		SETB P0.0 //G

5	4	//SETB P0.6 //A
		SETB P0.5 //B
		SETB P0.4 //C
		//SETB P0.3 //D
		//SETB P0.2 //E
		SETB P0.1 //F
		SETB P0.0 //G

6	5	SETB P0.6 //A
		//SETB P0.5 //B
		SETB P0.4 //C
		SETB P0.3 //D
		//SETB P0.2 //E
		SETB P0.1 //F
		SETB P0.0 //G

7	6	SETB P0.6 //A //SETB P0.5 //B SETB P0.4 //C SETB P0.3 //D SETB P0.2 //E SETB P0.1 //F SETB P0.0 //G

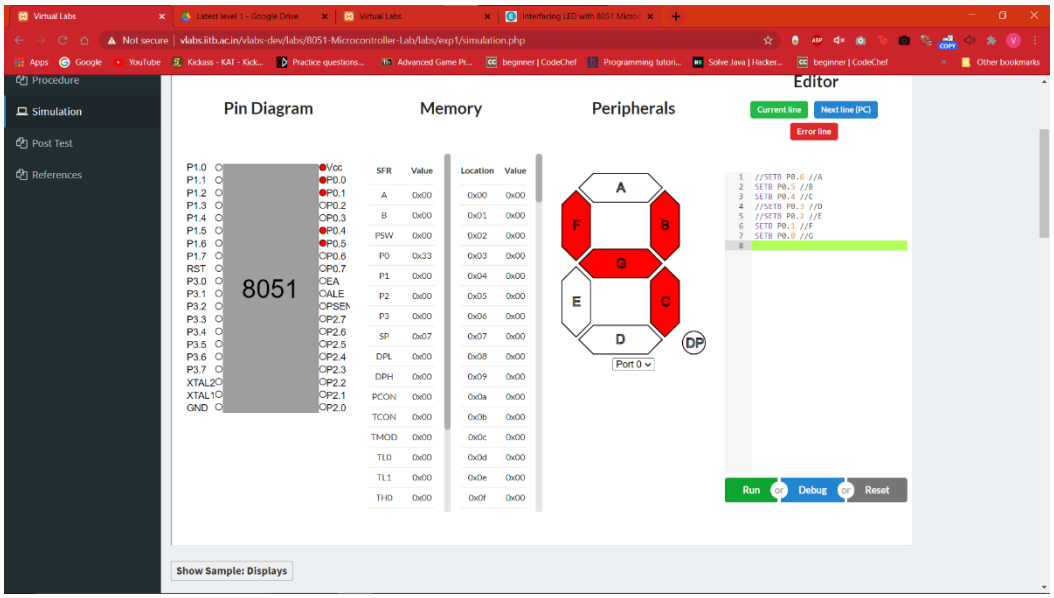
8	7	SETB P0.6 //A
		SETB P0.5 //B
		SETB P0.4 //C
		//SETB P0.3 //D
		//SETB P0.2 //E
		//SETB P0.1 //F
		//SETB P0.0 //G

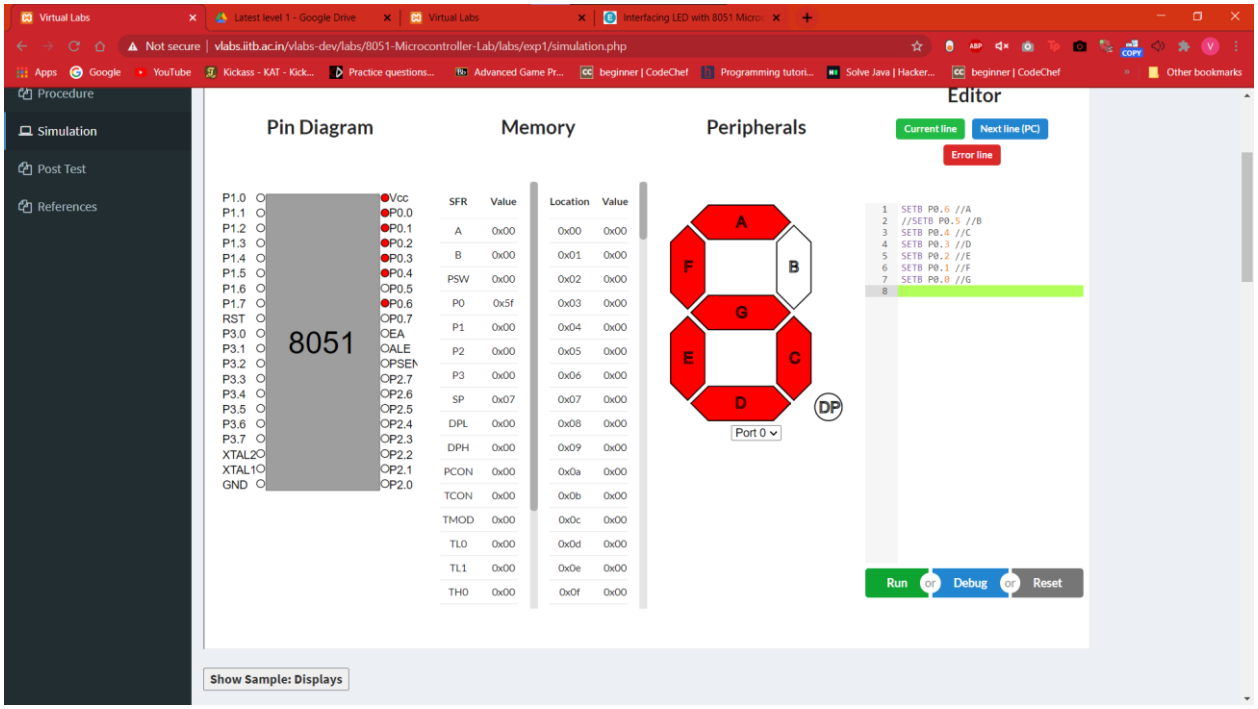
9	8	SETB P0.6 //A SETB P0.5 //B SETB P0.4 //C SETB P0.3 //D SETB P0.2 //E SETB P0.1 //F SETB P0.0 //G
10	9	SETB P0.6 //A SETB P0.5 //B SETB P0.4 //C SETB P0.3 //D //SETB P0.2 //E SETB P0.1 //F SETB P0.0 //G

Common Code:

```
MOV P0,#7Eh     //to display 0
MOV P0,#30h     //to display 1
MOV P0,#6Dh     //to display 2
MOV P0,#79h     //to display 3
MOV P0,#33h     //to display 4
MOV P0,#5Bh     //to display 5
MOV P0,#5Fh     //to display 6
MOV P0,#70h     //to display 7
MOV P0,#7Fh     //to display 8
MOV P0,#7Bh     //to display 9
MOV P0,#77h     //to display A
MOV P0,#4Eh     //to display C
MOV P0,#4Fh     //to display E
MOV P0,#47h     //to display F
```

Output:





Sources of Error:

1. Select op-codes carefully whenever you doing programming.
2. Make space whenever you doing program on kit.
3. You should properly enter the program and exit through proper command.

EXPERIMENT: 7

Aim:

Display the integers 2,9 and Character A using SETB and CLR instructions by interfacing a Micro-Controller 8051.

Apparatus Required:

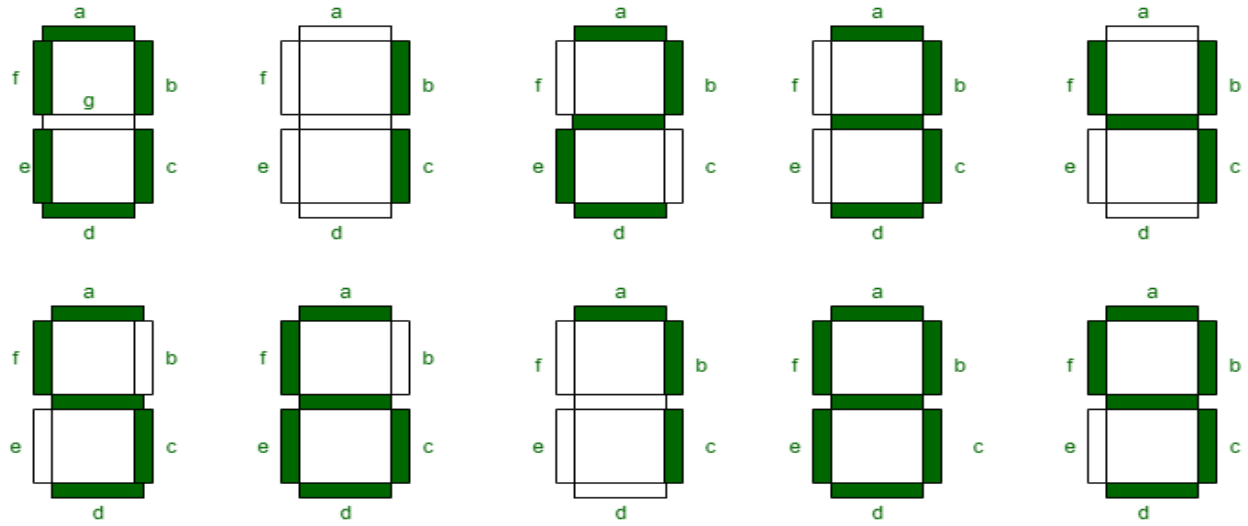
- Virtual lab simulator.

Theory:

Light Emitting Diode (LED) is the most widely used semiconductor which emits either visible light or invisible infrared light when forward biased. Remote controls generate invisible light. A Light emitting diode (LED) is an optical electrical energy into light energy when voltage is applied.

Seven Segment Displays:
Seven segment displays are the output display device that provide a way to display information in the form of image or text or decimal numbers which is an alternative to the more complex dot matrix displays. It is widely used in digital clocks, basic calculators, electronic meters, and other electronic devices that display numerical information. It consists of seven segments of light emitting diodes (LEDs) which is assembled like numerical 8.

Diagram:

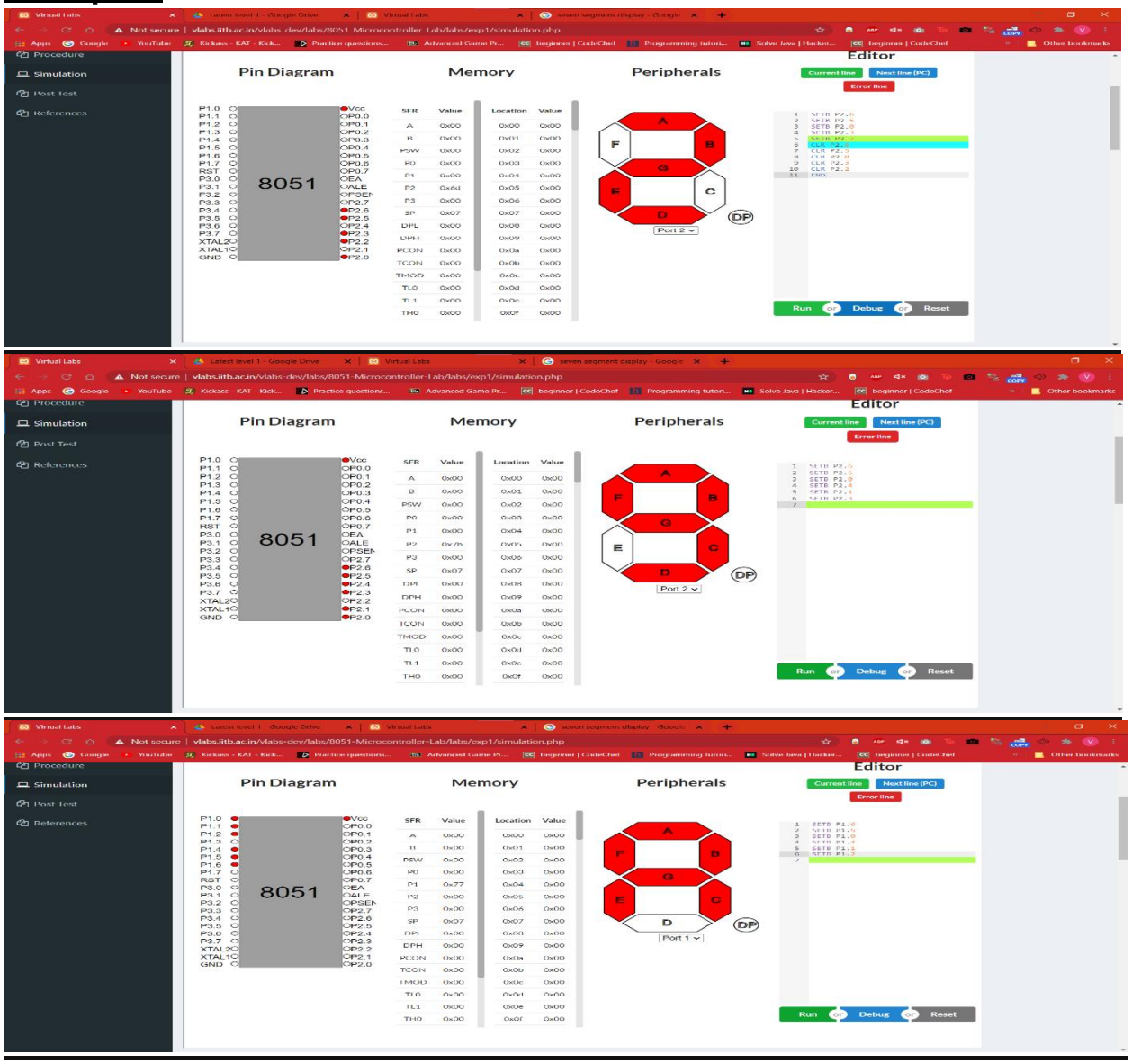


Procedure:

- Go to the simulator
- Go to the text editor.
- Paste the codes below in the text editor.

Serial no.	Digit	Code
1.	2	**SETB P2.6** **SETB P2.5** **SETB P2.0** **SETB P2.3** **SETB P2.2** **CLR P2.6** **CLR P2.5** **CLR P2.0** **CLR P2.3** **CLR P2.2**
2.	9	**SETB P2.6** **SETB P2.5** **SETB P2.0** **SETB P2.4** **SETB P2.1** **SETB P2.3**
3.	A	**SETB P1.6** **SETB P1.5** **SETB P1.0** **SETB P1.4** **SETB P1.1** **SETB P1.2**

Output



Sources of Error:

1. Select op-codes carefully whenever you doing programming.
2. Make space whenever you doing program on kit.
3. You should properly enter the program and exit through proper command.

EXPERIMENT: 8

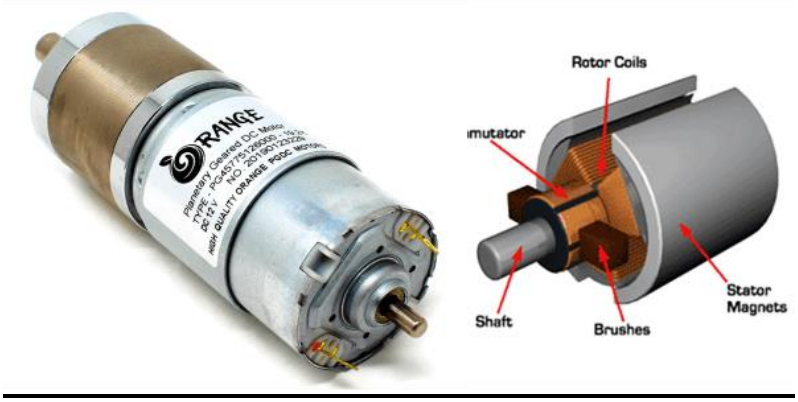
Aim:

To interface a DC motor with a microcontroller using virtual lab simulator.

Apparatus Required:

Virtual Simulator.

Theory:



The DC motor is the motor which converts the direct current into the mechanical work. It works on the principle of Lorentz Law, which states that “the current carrying conductor placed in a magnetic and electric field experience a force”. And that force is the Lorentz force.

Types of DC Motor

There are 4 majors types of DC motor and they are,

- Series DC Motor
- Permanent Magnet DC Motor
- Shunt/Parallel DC Motor
- Compound DC Motors

MUST READ ON DC MOTORS:

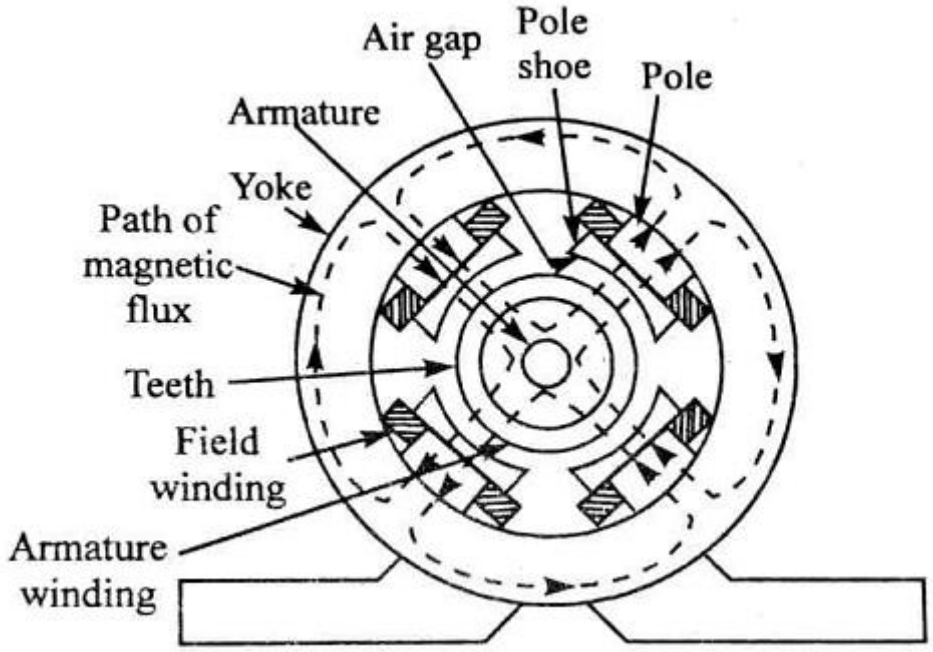
- Different Types of DC Motor
- Difference Between AC and DC Motor
- Speed Control of DC Motor
- Applications of Dc motor

Construction of DC Motor

Before understanding the working of DC motor first, we have to know about their construction. There are two main parts of the DC motor.

- Armature
- Stator

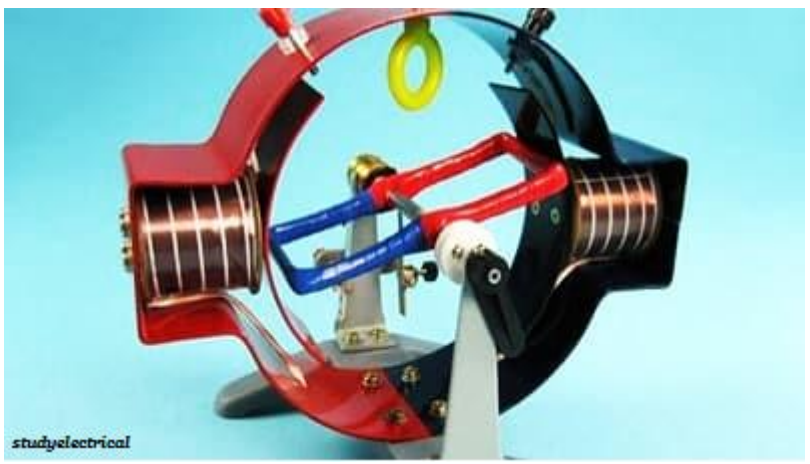
The rotating part is the armature and the Stator is their stationary part. The armature coil is connected to the DC supply.



The armature coil consists the commutators and brushes. The commutator converts the AC induces in the armature into DC and brushes transfer the current from rotating part of the motor to the stationary external load. The armature places between the north and south pole of the permanent or electromagnet.

Working Principle of DC Motor

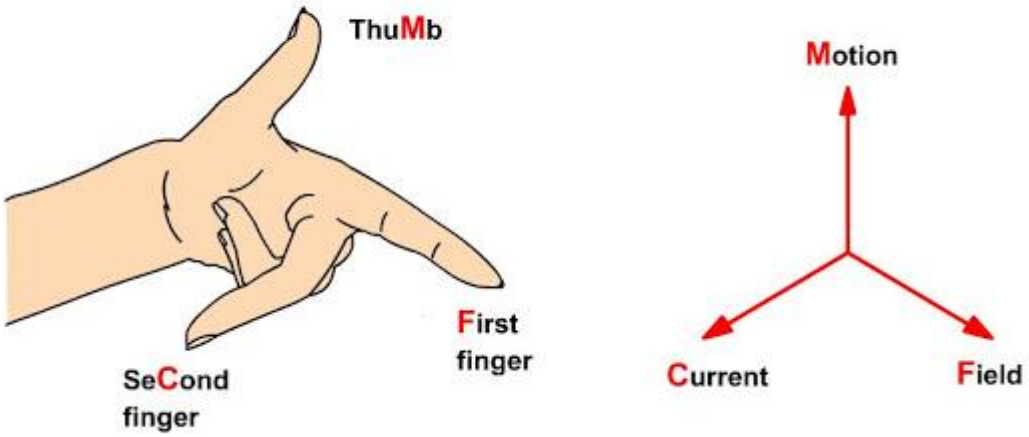
A DC motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force.



Fleming’s left-hand rule and its magnitude decide the direction of this force.

Fleming’s Left-Hand Rule:

If we stretch the first finger, second finger and thumb of our left hand to be perpendicular to each other, and first finger represents the direction of the magnetic field, the second finger represents the direction of the current, then the thumb represents the direction of the force experienced by the current carrying



conductor.

F = BIL Newtons

Where,
B = magnetic flux density,
I = current and
L = length of the conductor within the magnetic field.
When armature winding is connected to a DC supply, an electric current sets up in the winding. Permanent magnets or field winding (electromagnetism) provides the magnetic field. In this case, current carrying armature conductors experience a force due to the magnetic field, according to the principle stated above.

The Commutator is made segmented to achieve unidirectional torque. Otherwise, the direction of force would have reversed every time when the direction of movement of the conductor is reversed in the magnetic field. This is how a DC motor works!

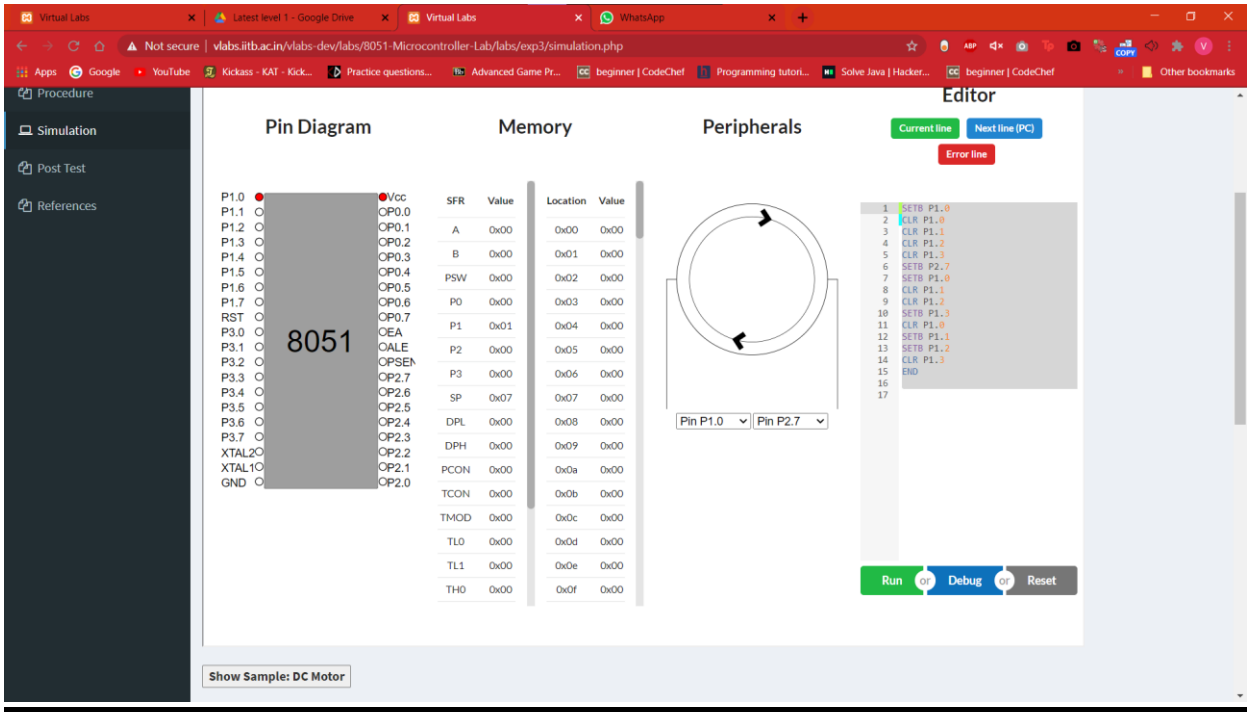
Procedure:

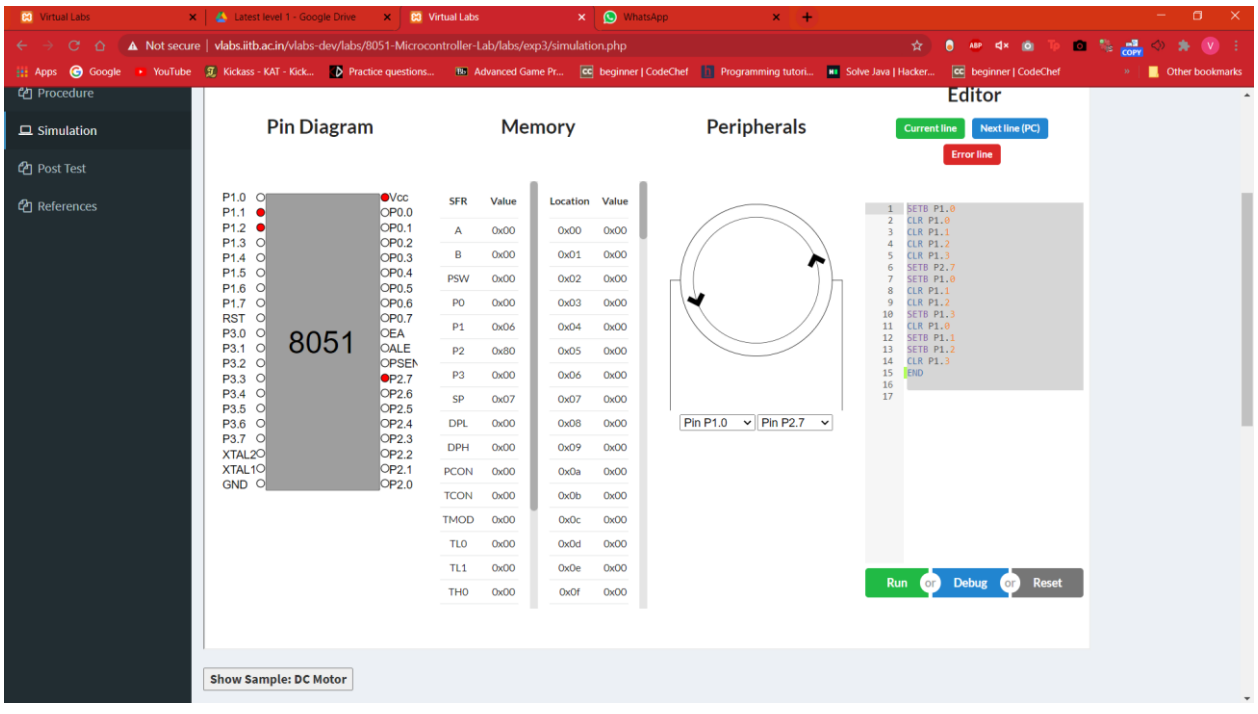
- Go to the simulator
- Use the below written code to rotate the motor anti-clockwise.

```
SETB P1.0
CLR P1.0
CLR P1.1
CLR P1.2
CLR P1.3
SETB P2.7
SETB P1.0
CLR P1.1
```

CLR P1.2
SETB P1.3
CLR P1.0
SETB P1.1
SETB P1.2
CLR P1.3
END

Output





Sources of Error:

- Select op-codes carefully whenever you doing programming.
- Make space whenever you doing program on kit.
- You should properly enter the program and exit through proper command.