Fall Semester 2021-2022

Microprocessor and Interfacing

Lab Report

Digital Assignment-6

Experiment No: 7,8,9 Task No: 6

Course Code: CSE2006

Slot: L7+L8

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Reg. Numb: 19BCE2555

Submitted To: Dr. Abdul Majed KK

EXPERIMENT -7

Aim:

1)Convert Binary number corresponding to 0109H to BCD number.

2) Convert BCD number corresponding to 27H to Binary number.

Tools Required:

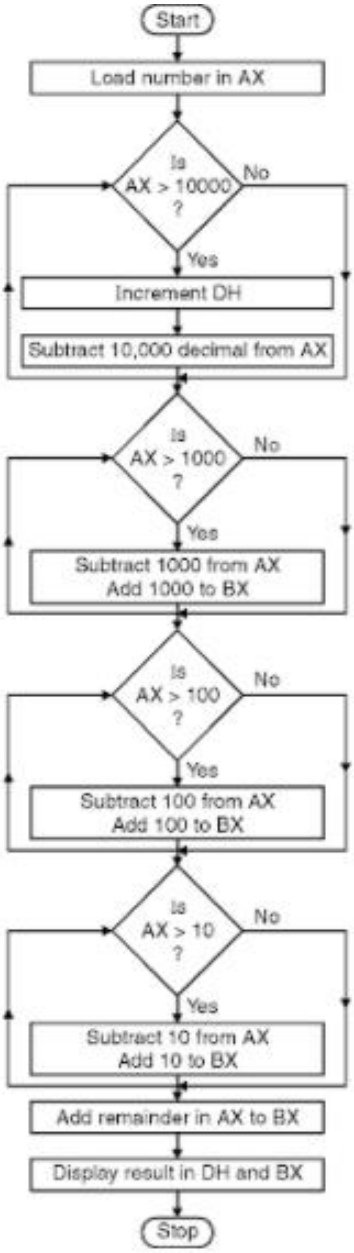
8086 Emulator

1) Convert Binary number corresponding to 0109H to BCD number.

ALGORITHM

Step I : Initialize the data segment.
Step II : Initialize BX = 0000 H and DH = 00H.
Step III : Load the number in AX.
Step IV : Compare number with 10000 decimal. If below goto step VII else goto step V.
Step V : Subtract 10,000 decimal from AX and add 1 decimal to DH
Step VI : Jump to step IV.
Step VII : Compare number in AX with 1000, if below goto step X else goto step VIII.
Step VIII : Subtract 1000 decimal from AX and add 1000 decimal to BX.
Step IX : Jump to step VII.
Step X : Compare the number in AX with 100 decimal if below goto step XIII
Step XI : Subtract 100 decimal from AX and add 100 decimal to BX.
Step XII : Jump to step X
Step XIII : Compare number in AX with 10. If below goto step XVI
Step XIV : Subtract 10 decimal from AX and add 10 decimal to BX..
Step XV : Jump to step XIII.
Step XVI : Add remainder in AX with result in BX.
Step XVII : Display the result in DH and BX.
Step XVIII : Stop.

Flow Chart:

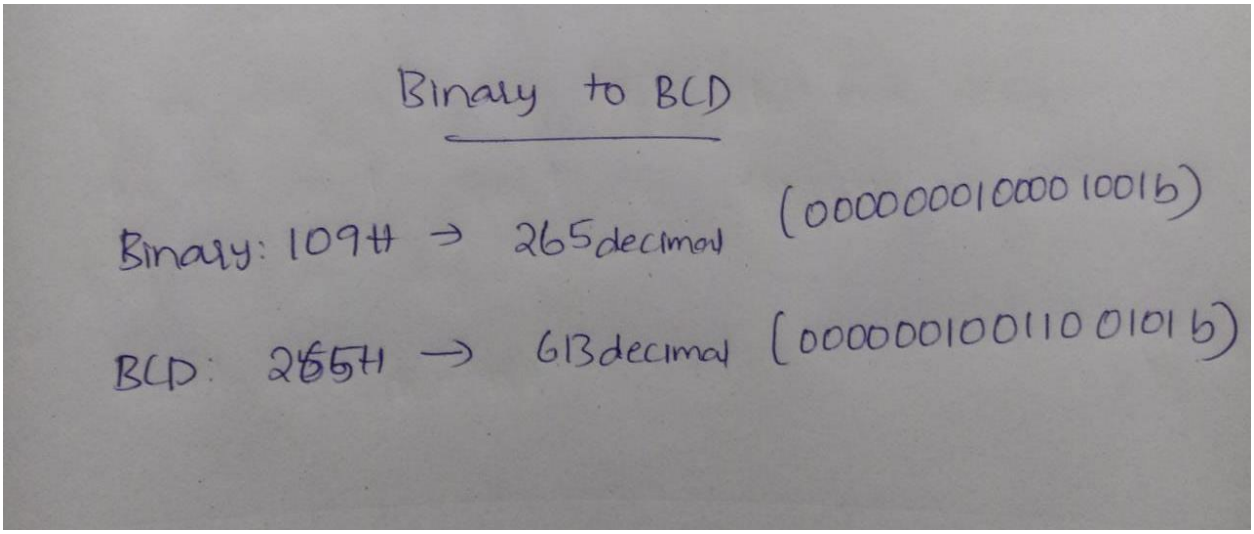


Design and Calculations:

Initialize the data segment. Initialize BX = 0000 H and DH = 00H. Load the number in AX. Compare number with 10000 decimal. Subtract 10,000 decimal from AX and add 1 decimal to DH.Jump to step IV. Compare number in AX with 1000, if below goto step Subtract 1000 decimal from AX and add 1000

decimal to BX. Jump to step VII. Compare the number in AX with 100 decimal.Subtract 100 decimal from AX and add 100 decimal to BX. number in AX with 10.Subtract 10 decimal from AX and add 10 decimal to BX. Add remainder in AX with result in BX. Display the result in DH and BX.

Calculations:



Program Code:

```
data segment
bin dw 0109h
bcd  dw ?
data ends
code segment
   assume  cs :code,  ds :data
start :
mov ax , data
mov ds ,ax
```

```
mov al ,bin
mov ah, 00h
mov cl, 64h
div cl
mov bh,al
mov al, ah
mov ah,00h
mov cl,0ah
div cl
mov cl,04h
rol al,cl
add al,ah
mov bl,al
mov bcd,bx
code ends
end start
```

edit: C:\emu8086\MySource\EXP7 1.asm

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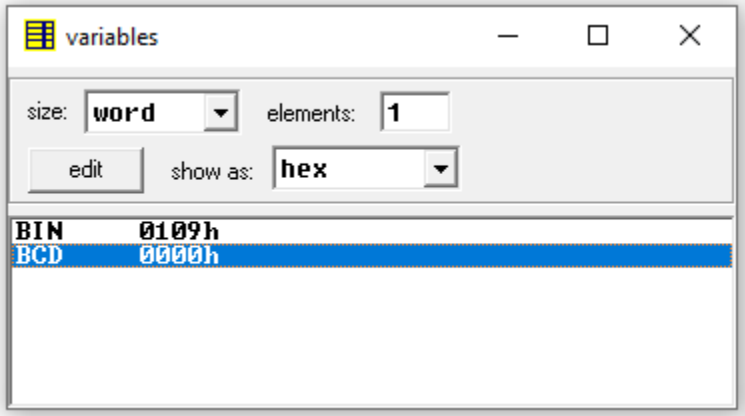
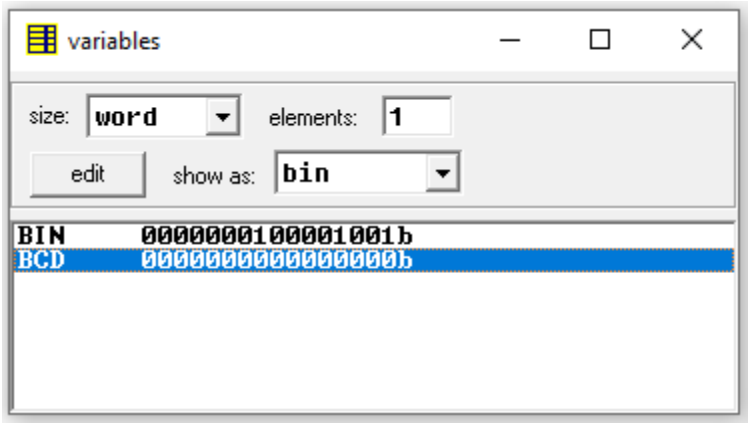
```
01 data segment
02 bin dw 0109h
03 bcd  dw ?
04 data ends
05 code segment
06     assume  cs :code,  ds :data
07 start :
08 mov ax , data
09 mov ds ,ax
10 mov al ,bin
11 mov ah, 00h
12 mov cl, 64h
13 div cl
14 mov bh,al
15 mov al, ah
16 mov ah,00h
17 mov cl,0ah
18 div cl
19 mov cl,04h
20 rol al,cl
21 add al,ah
22 mov bl,al
23 mov bcd,bx
24 code ends
25 end start
26
```

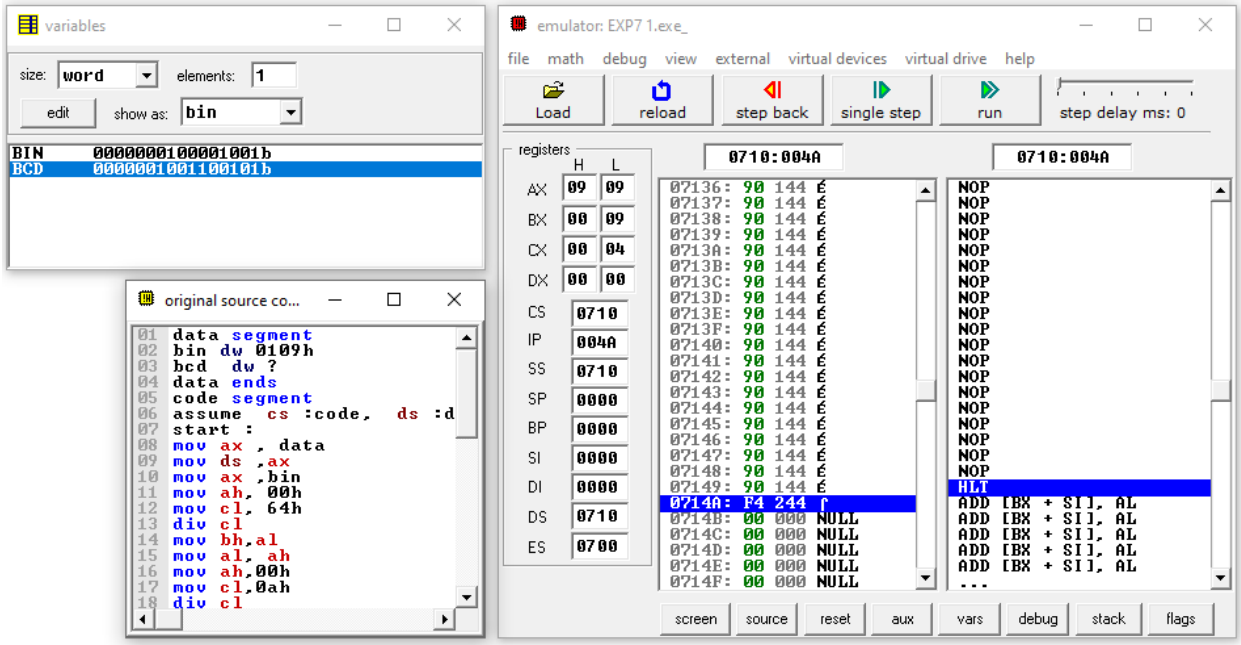
Output:

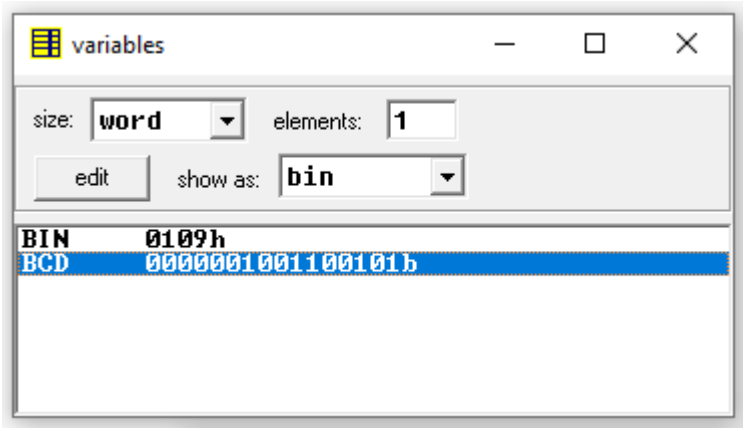
Before Execution:

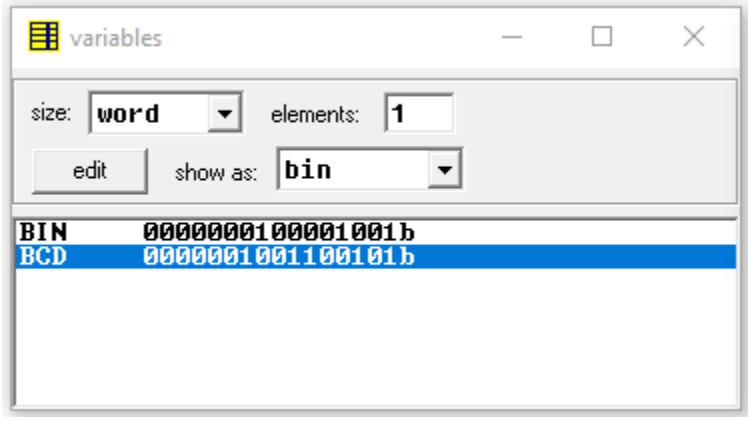




After Execution:







Result and Inference:

The BCD form of Binary number is obtained in Variables.

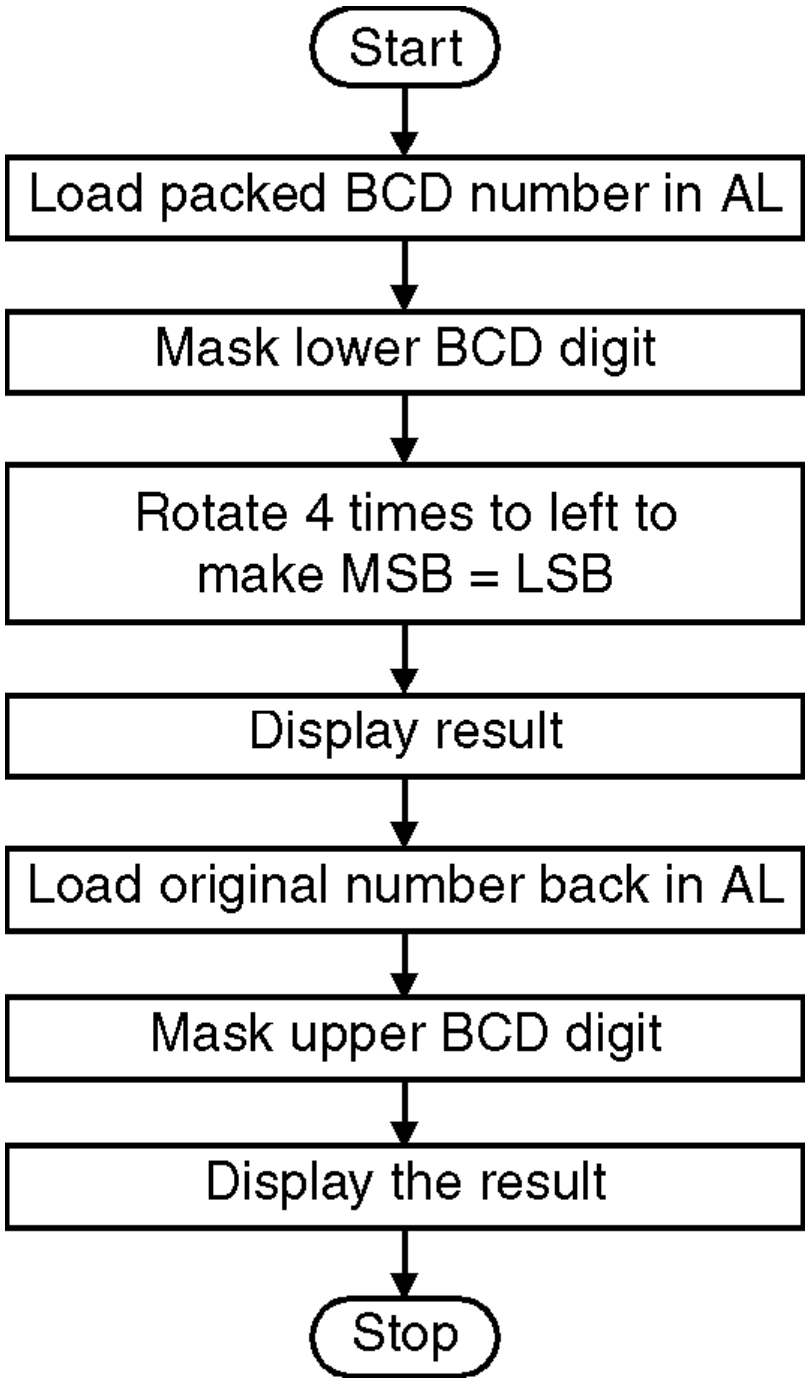
Bin : 0109h (0000000100001001b) to BCD: 0265h(0000001001100101b)

Question 2) Convert BCD number corresponding to 27H to Binary number.

ALGORITHM

- Assign value 27H to BCD in Datset
- Move BCD into AH(Accumulator)
- Move the contents of [SI] in BL.
- Use AND instruction to calculate AND between 0F and contents of BL.
- Move the contents of [SI] in AL.
- Use AND instruction to calculate AND between F0 and contents of AL.
- Move 04 in CL.
- Use ROR instruction on AL.
- Move 0A in DL.
- Use MUL instruction to multiply AL with DL.
- Use ADD instruction to add AL with BL.
- Move the contents of AL in [DI].
- Halt the program.

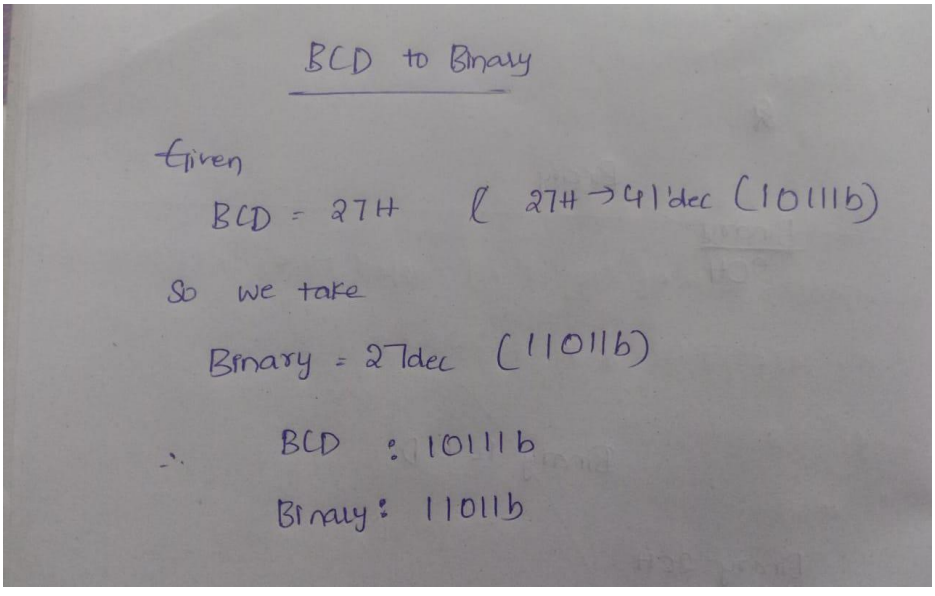
Flow Chart:


Start
Load packed BCD number in AL
Mask lower BCD digit
Rotate 4 times to left to make MSB = LSB
Display result
Load original number back in AL
Mask upper BCD digit
Display the result
Stop

Design and Calculations:

Assign value 27H to BCD in Datset.Move the contents of [SI] in BL.Use AND instruction to calculate AND between 0F and contents of BL.Move the contents of [SI] in AL.Use AND instruction to calculate AND between F0 and contents of AL.Move 04 in CL.Use ROR instruction on AL.Move 0A in DL.Use MUL instruction to multiply AL with DL.Use ADD instruction to add AL with BL.Move the contents of AL in [DI].Halt the program.

Calculation:



Program Code:

```
DATA_SEG SEGMENT
   BCD DB 27H              ; STORAGE FOR A BCD VALUE
   BIN DB ?                ; STORAGE FOR BINARY VALUE
DATA_SEG ENDS
 CODE_SEG SEGMENT
   ASSUME CS:CODE_SEG,DS:DATA_SEG
   START:
   MOV AX,DATA_SEG
   MOV DS,AX

   MOV AH,BCD
   MOV BH,AH
   AND BH,0FH
   AND AH,0F0H
   ROR AH,04
   MOV CL,10
   MOV AL,AH
   AND AX,00FFH
   MUL CL
   ADD AL,BH
   MOV BIN,AL
   MOV AH,04CH
```

INT 21H

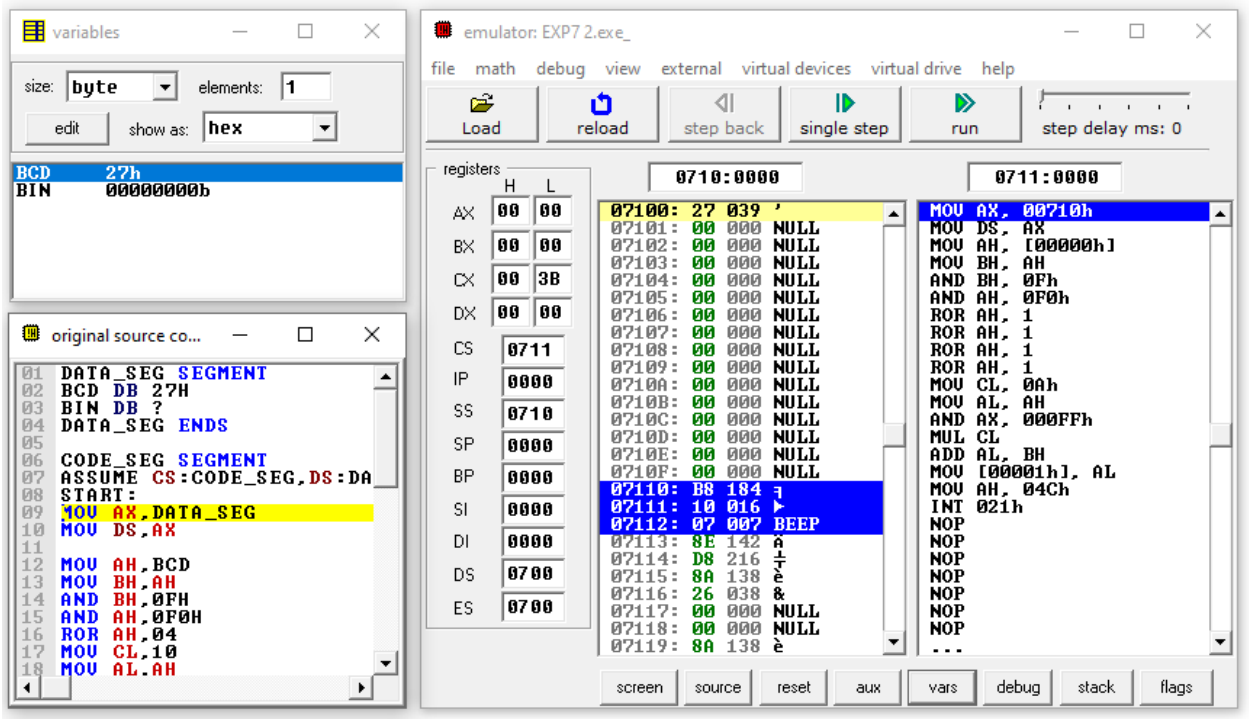
CODE_SEG ENDS

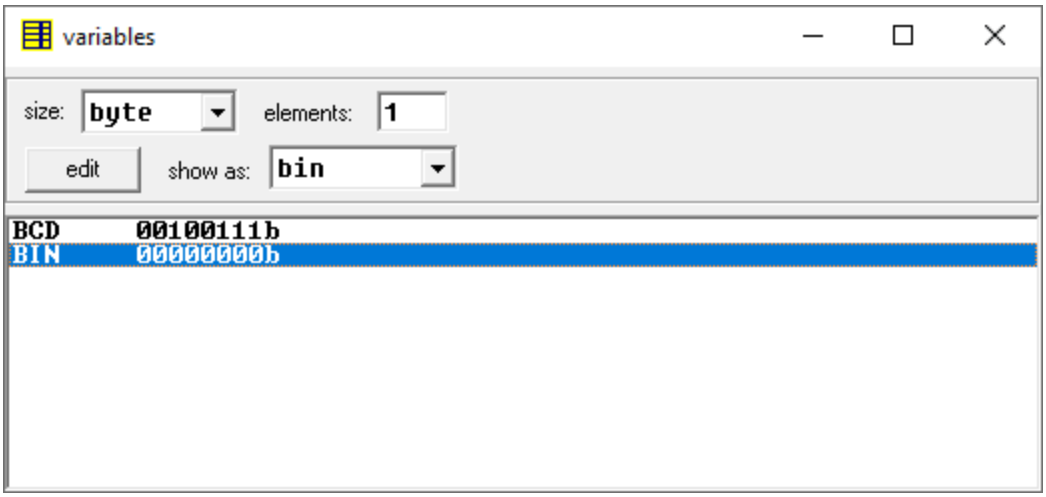
END START

```
01 DATA_SEG SEGMENT
02     BCD DB 27H                    ; STORAGE FOR A BCD VALUE
03     BIN DB ?                      ; STORAGE FOR BINARY VALUE
04 DATA_SEG ENDS
05
06 CODE_SEG SEGMENT
07     ASSUME CS:CODE_SEG,DS:DATA_SEG
08     START:
09     MOV AX,DATA_SEG
10     MOV DS,AX
11
12     MOV AH,BCD
13     MOV BH,AH
14     AND BH,0FH
15     AND AH,0F0H
16     ROR AH,04
17     MOV CL,10
18     MOV AL,AH
19     AND AX,00FFH
20     MUL CL
21     ADD AL,BH
22     MOV BIN,AL
23     MOV AH,04CH
24     INT 21H
25     CODE_SEG ENDS
26 END START
```

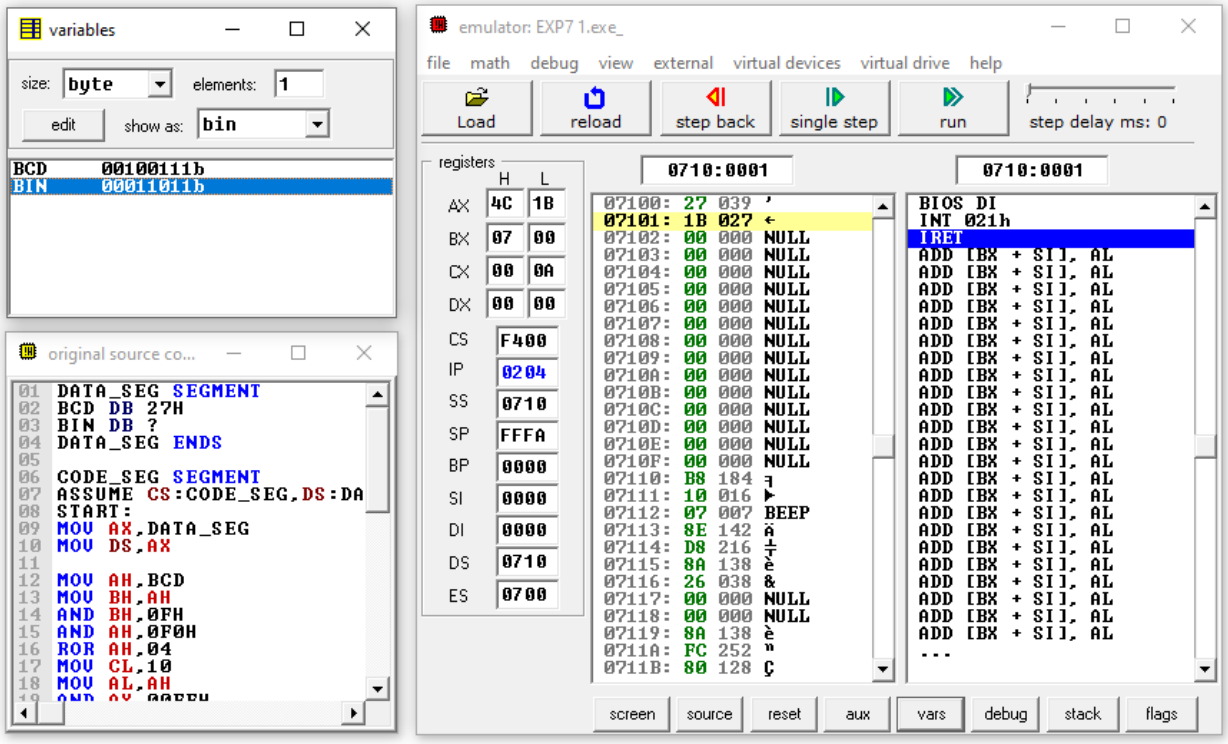
Output:

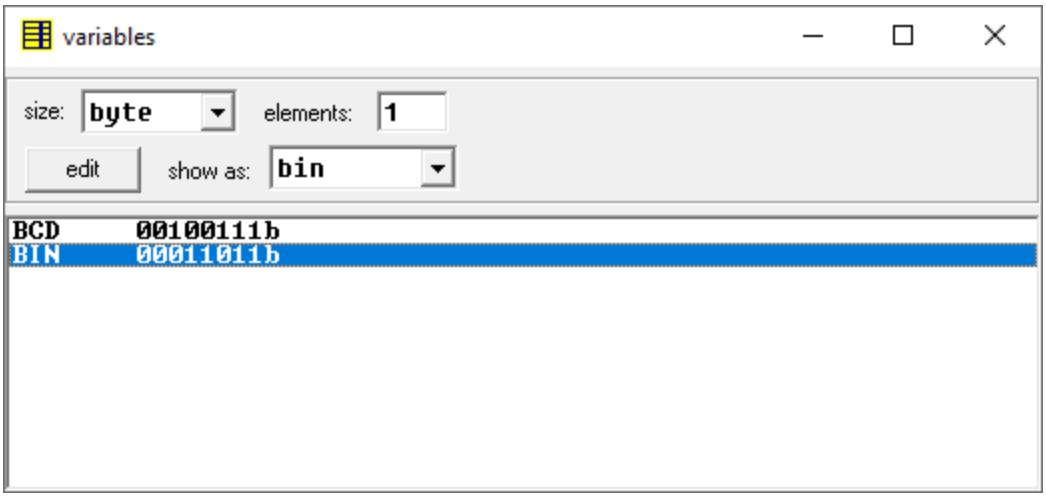
Before Execution:

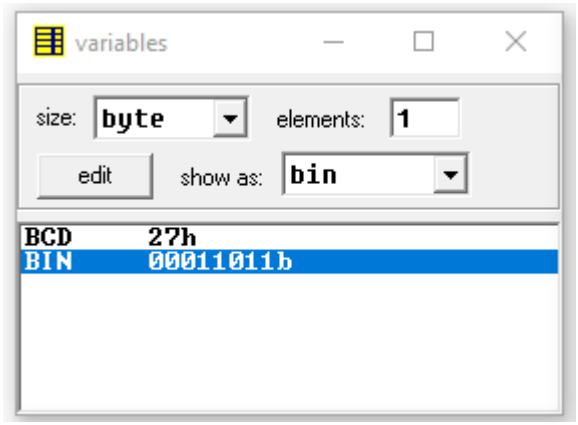




After Execution:







Result and Inference:

On execution we got the Binary of the given BCD(00100111b) 27H as 00011011b which is 1BH and the answer is stored in BIN variable.

EXPERIMENT -8.1

Aim:

1) **Write an ALP program to sort the numbers in ascending / descending order**
2) **Write an ALP to find square and cube of an 8 bit number**
3) **Write an ALP to check if the given number is even or odd.**

Tools Required:

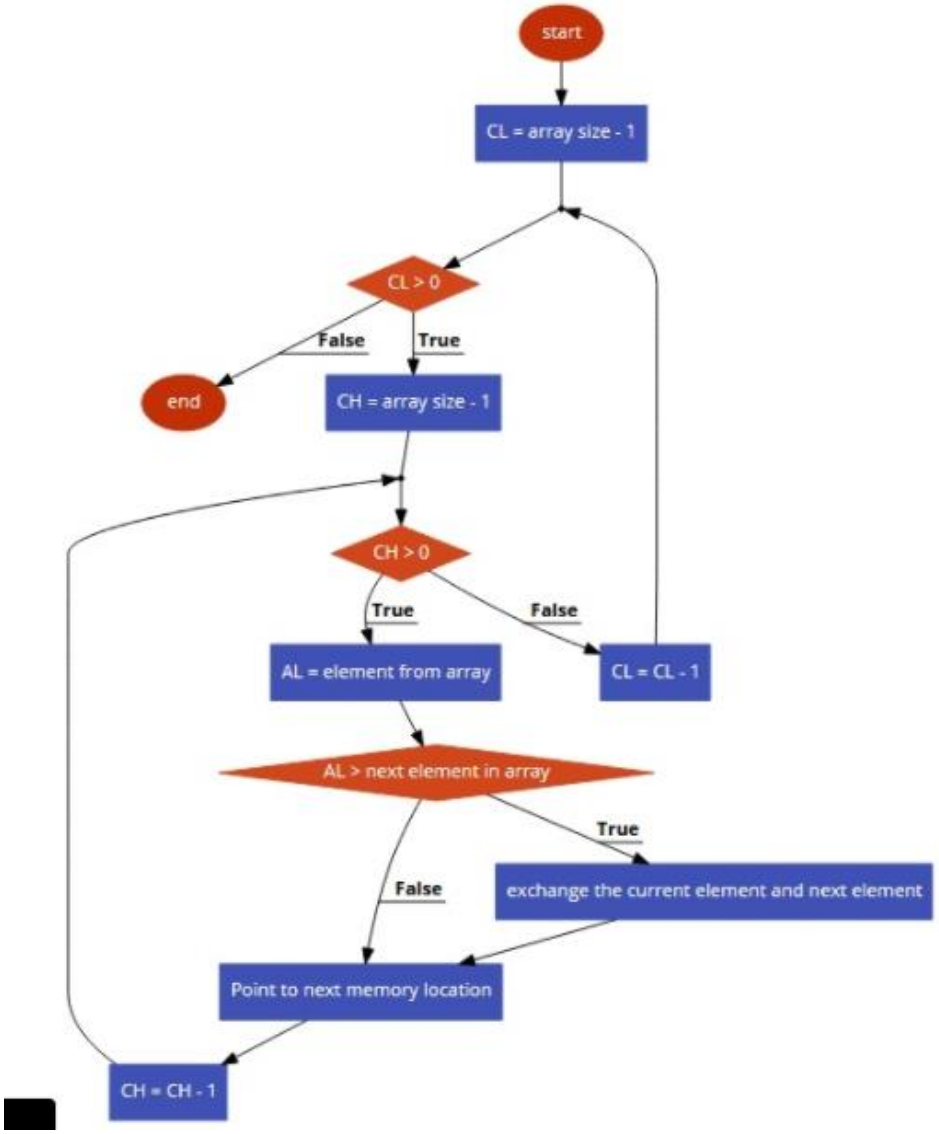
8086 Emulator

1. Write an ALP program to sort the numbers in ascending / descending order

ALGORITHM:

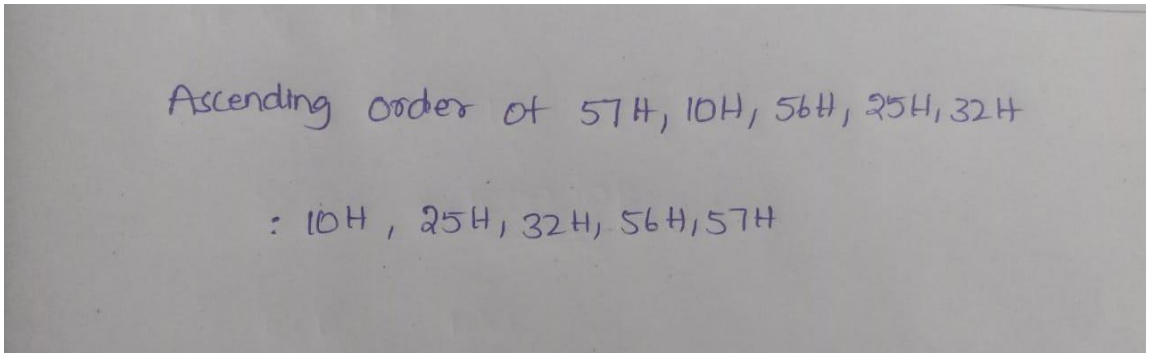
1. Load data from offset 0 to register CL (for count).
2. Travel from starting memory location to last and compare two numbers if first number is greater than second number then swap them.
3. First pass fix the position for last number.
4. Decrease the count by 1.
5. Again travel from starting memory location to (last-1, by help of count) and compare two numbers if first number is greater than second number then swap them.
6. Second pass fix the position for last two numbers.
7. Repeated.

FLOWCHART:


start
CL = array size - 1
CL > 0
False
True
end
CH = array size - 1
CH > 0
True
False
AL = element from array
CL = CL - 1
AL > next element in array
True
False
exchange the current element and next element
Point to next memory location
CH = CH - 1

DESIGN AND CALCULATIONS:

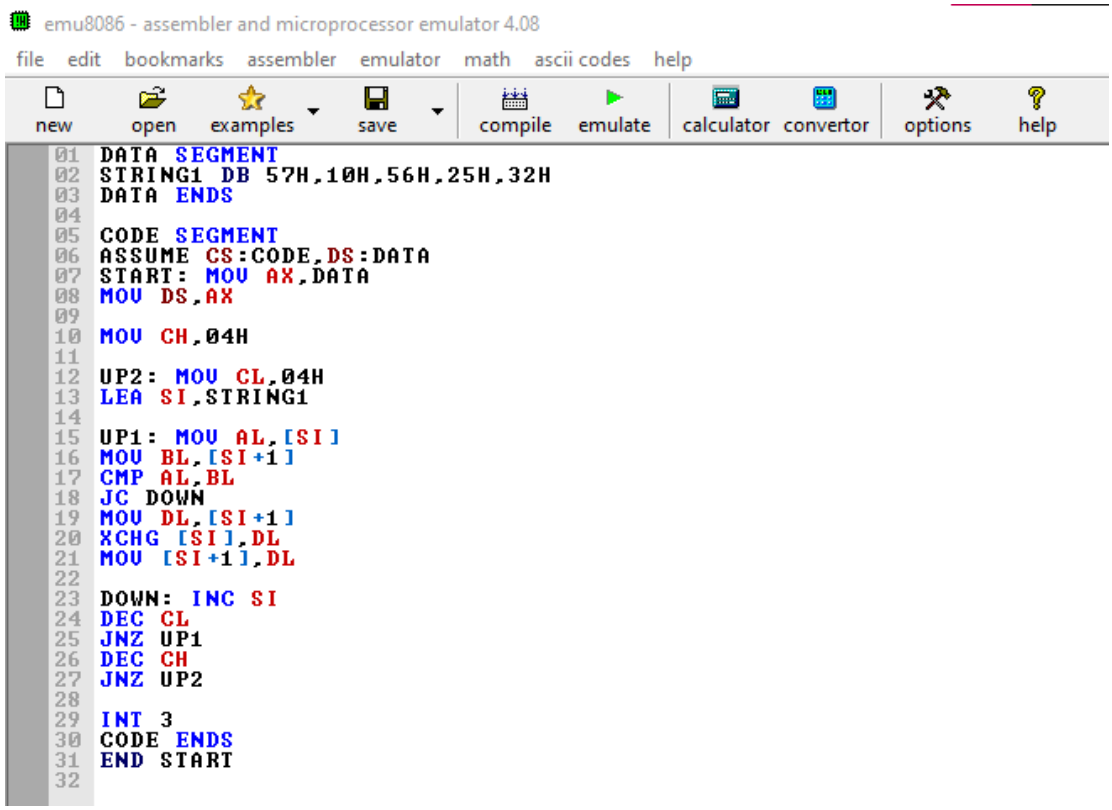
Load data from offset to register CL (for count).Travel from starting memory location to last and compare two numbers if first number is greater than second number then swap them.First pass fix the position for last number.Decrease the count by 1.Again travel from starting memory location to (last-1, by help of count) and compare two numbers if first number is greater than second number then swap them. Second pass fix the position for last two numbers Repeated.



PROGRAM CODE:

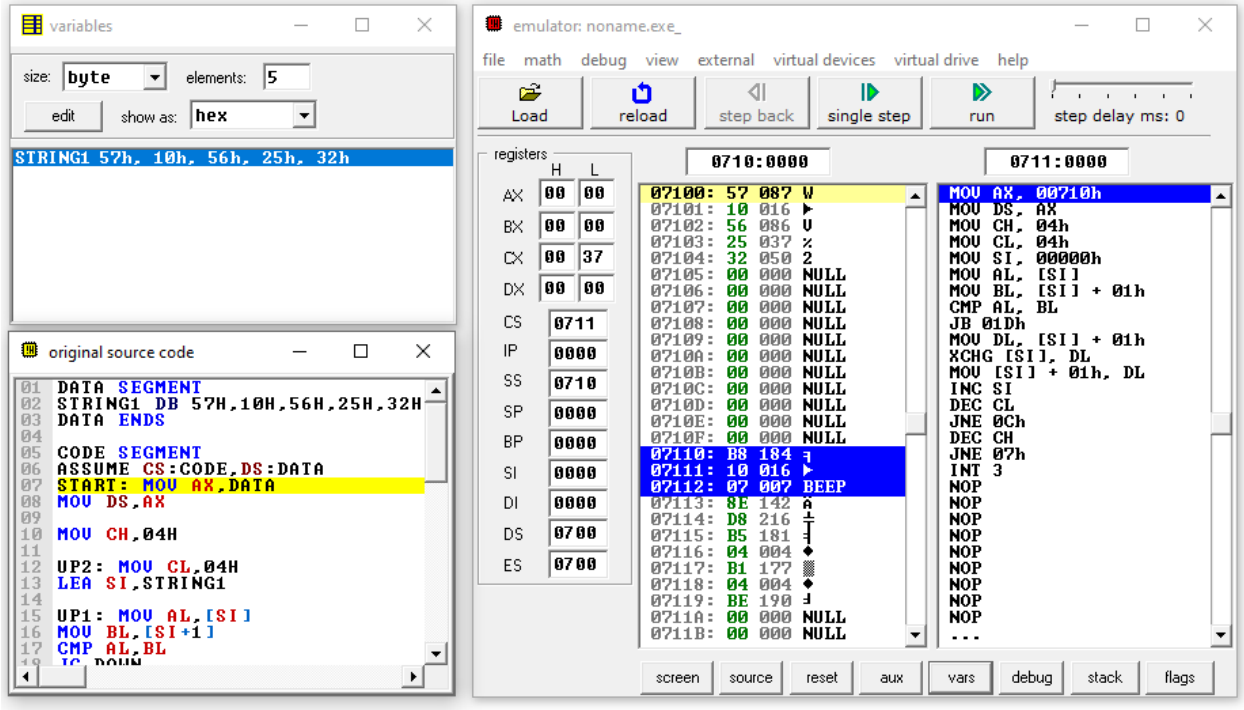
```
DATA SEGMENT
STRING1 DB 57H,10H,56H,25H,32H
DATA ENDS

CODE SEGMENT
ASSUME CS:CODE,DS:DATA
START: MOV AX,DATA
MOV DS,AX

MOV CH,04H

UP2: MOV CL,04H
```

```
LEA SI,STRING1

UP1: MOV AL,[SI]
MOV BL,[SI+1]
CMP AL,BL
JC DOWN
MOV DL,[SI+1]
XCHG [SI],DL
MOV [SI+1],DL

DOWN: INC SI
DEC CL
JNZ UP1
DEC CH
JNZ UP2

INT 3
CODE ENDS
END START
```

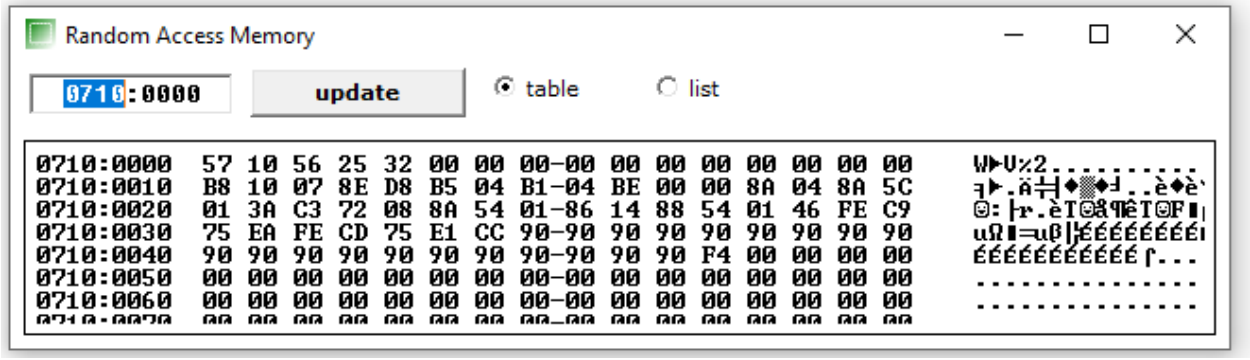


OUTPUT:

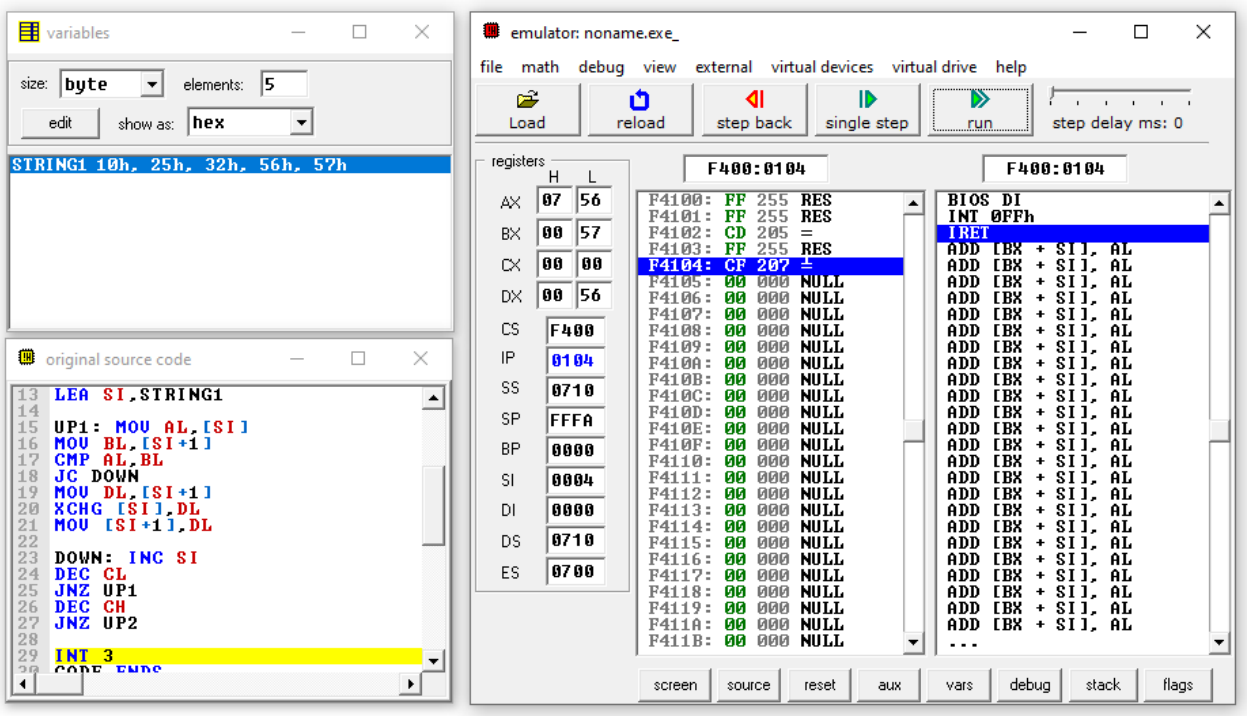
Before Execution:



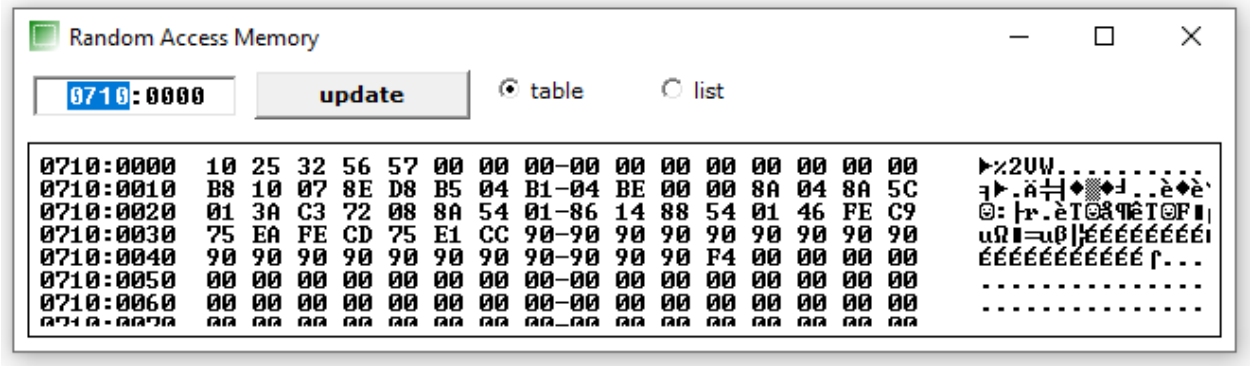
Memory Location



After Execution:



Memory Location



RESULTS & INFERENCE

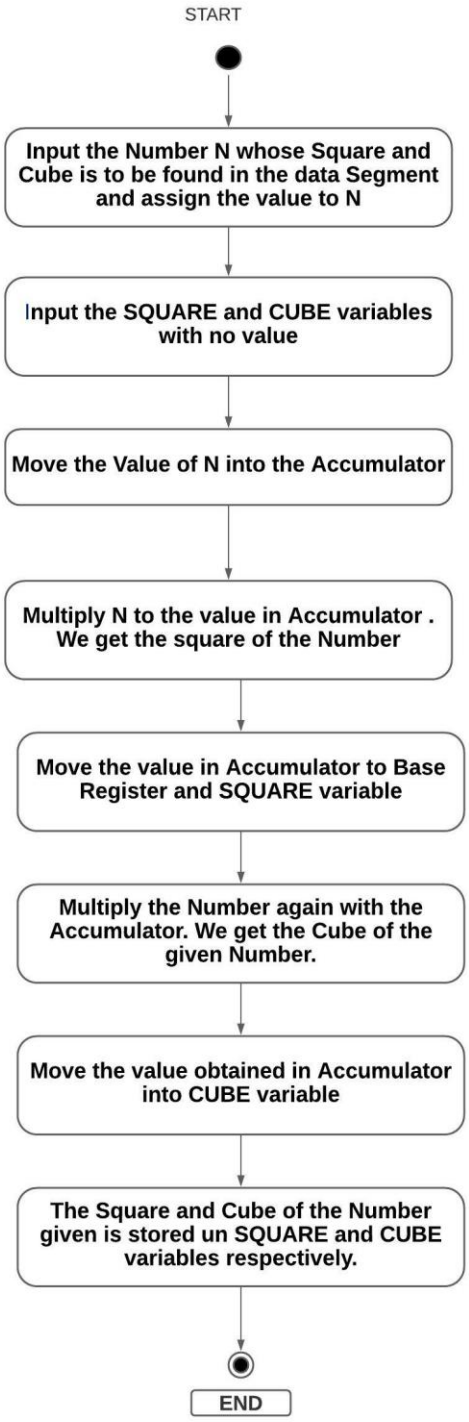
The sorted Array is stored in String1 which can be found in variables and the sorted values are present in location 0710:0000

2. Write an ALP to find square and cube of an 8 bit number

ALGORITHM

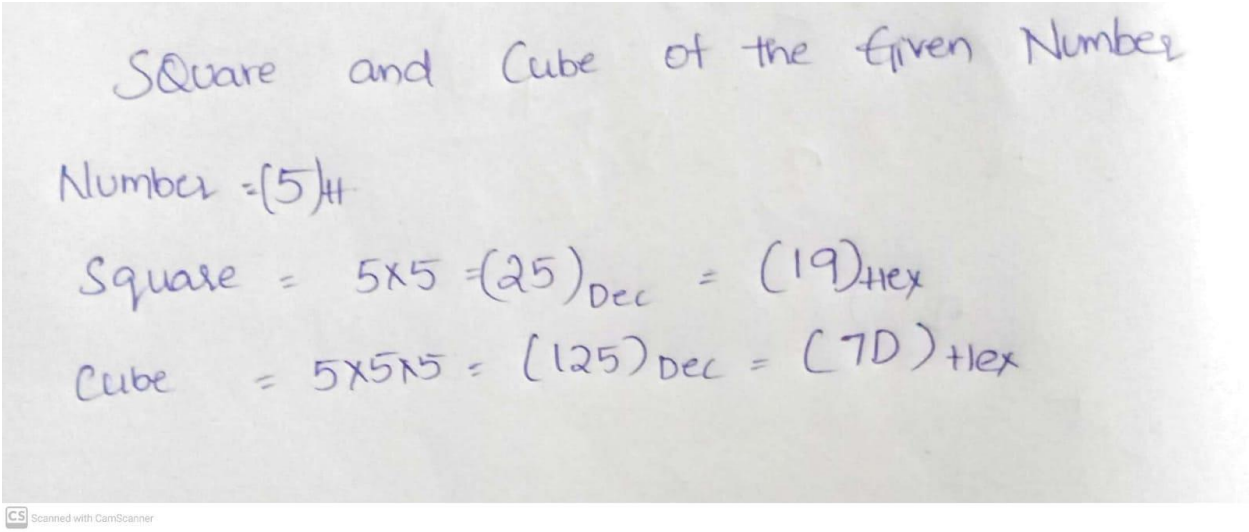
- Input the Number N whose Square and Cube is to be found in the data Segment and assign the value to N
- Input the SQUARE and CUBE variables with no value
- Move the Value of N into the Accumulator
- Multiply N to the value in Accumulator . We get the square of the Number
- Move the value in Accumulator to Base Register and SQUARE variable
- Multiply the Number again with the Accumulator. We get the Cube of the given Number.
- Move the value obtained in Accumulator into CUBE variable
- The Square and Cube of the Number given is stored in SQUARE and CUBE variables respectively.

FLOWCHART


START
Input the Number N whose Square and Cube is to be found in the data Segment and assign the value to N
Input the SQUARE and CUBE variables with no value
Move the Value of N into the Accumulator
Multiply N to the value in Accumulator . We get the square of the Number
Move the value in Accumulator to Base Register and SQUARE variable
Multiply the Number again with the Accumulator. We get the Cube of the given Number.
Move the value obtained in Accumulator into CUBE variable
The Square and Cube of the Number given is stored un SQUARE and CUBE variables respectively.
END

Design and Calculations:

Input the Number N whose Square and Cube is to be found in the data Segment and assign the value to N.Input the SQUARE and CUBE variables with no value.Move the Value of N into the Accumulator.Multiply N to the value in Accumulator . We get the square of the Number.Move the value in Accumulator to Base Register and SQUARE variable.Multiply the Number again with the Accumulator. We get the Cube of the given Number.Move the value obtained in Accumulator into CUBE variable.The Square and Cube of the Number given is stored in SQUARE and CUBE variables respectively.

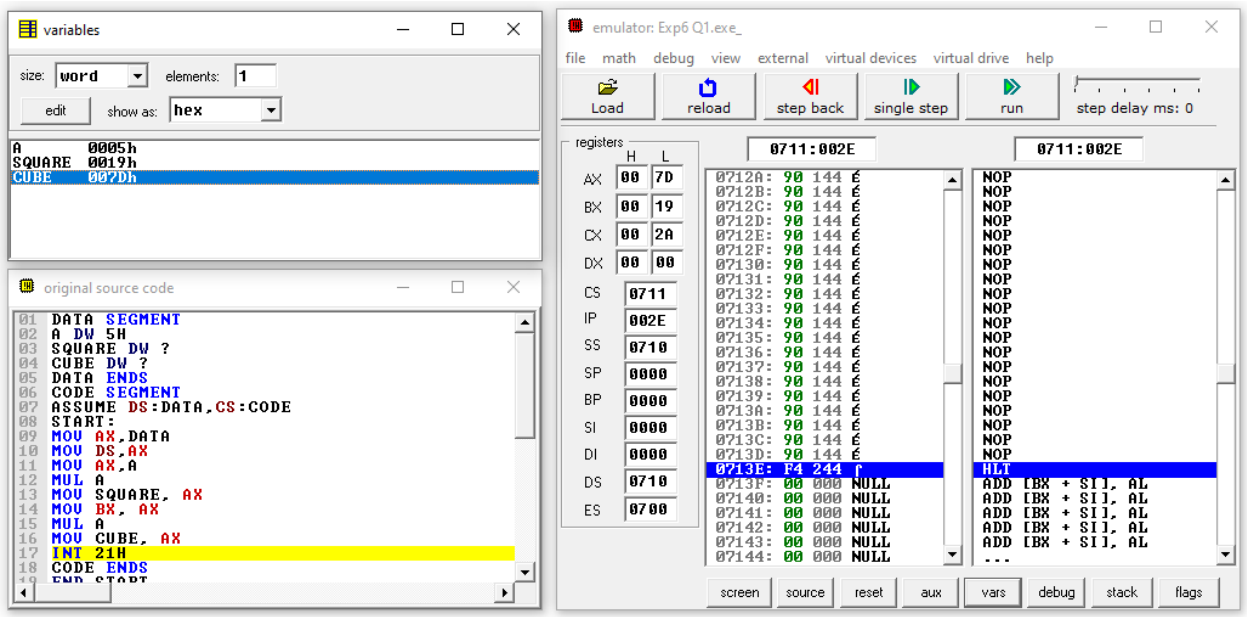


Program Code:

```
DATA SEGMENT
A DW 5H
SQUARE DW ?
CUBE DW ?
DATA ENDS
CODE SEGMENT
    ASSUME DS:DATA,CS:CODE
START:
    MOV AX,DATA
    MOV DS,AX
    MOV AX,A
    MUL A
    MOV SQUARE, AX
    MOV BX, AX
    MUL A
    MOV CUBE, AX
    INT 21H
CODE ENDS
END START
```

```
01  DATA SEGMENT
02  A DW 5H
03  SQUARE DW ?
04  CUBE DW ?
05  DATA ENDS
06  CODE SEGMENT
07          ASSUME DS:DATA,CS:CODE
08  START:
09          MOV AX,DATA
10          MOV DS,AX
11          MOV AX,A
12          MUL A
13          MOV SQUARE, AX
14          MOV BX, AX
15          MUL A
16          MOV CUBE, AX
17          INT 21H
18  CODE ENDS
19  END START
```

Output:



Result and Inference:

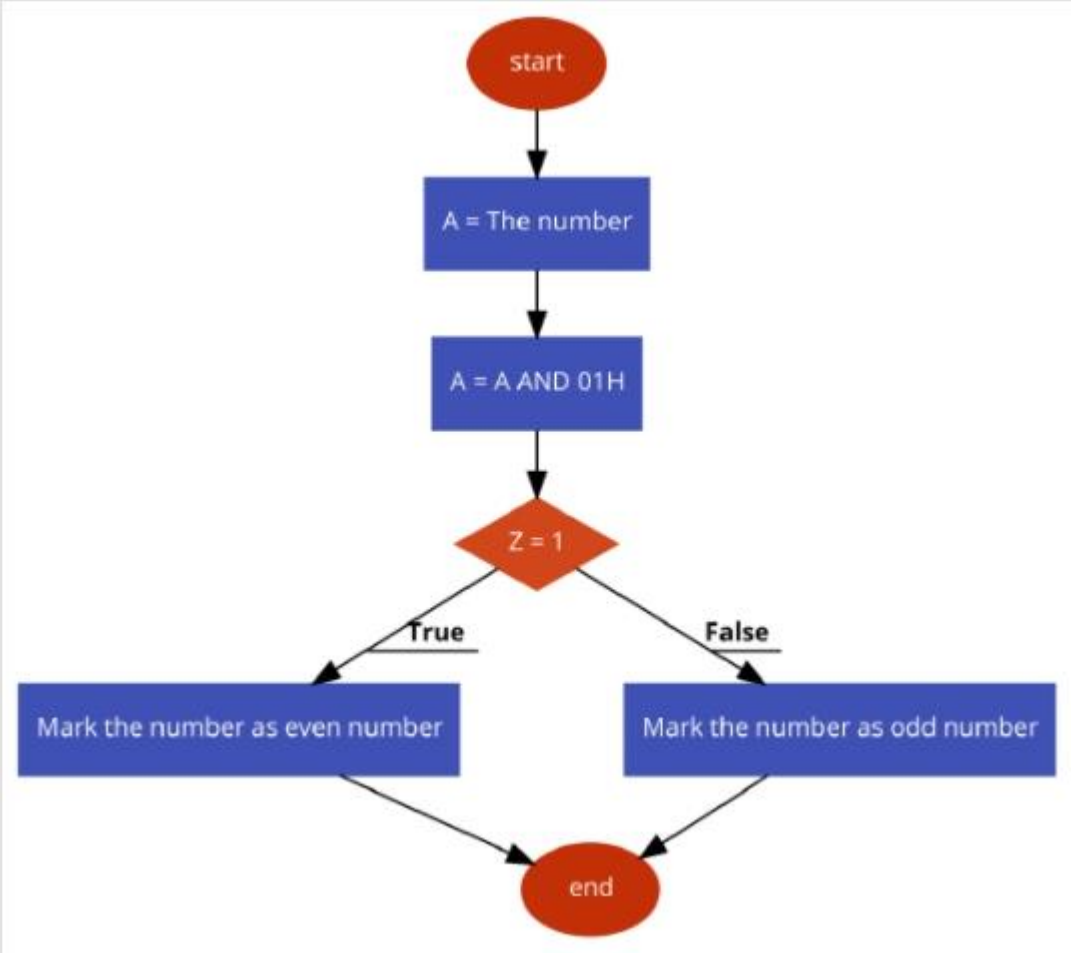
The value in the Accumulator is the Cube of the number given and Square of the number is stored in Counter Register. We can see that SQUARE(0019H) and CUBE (007DH) variables are filled with values of square andd cube of the number(0005H) given

3. Write an ALP to check if the given number is even or odd.

ALGORITHM:

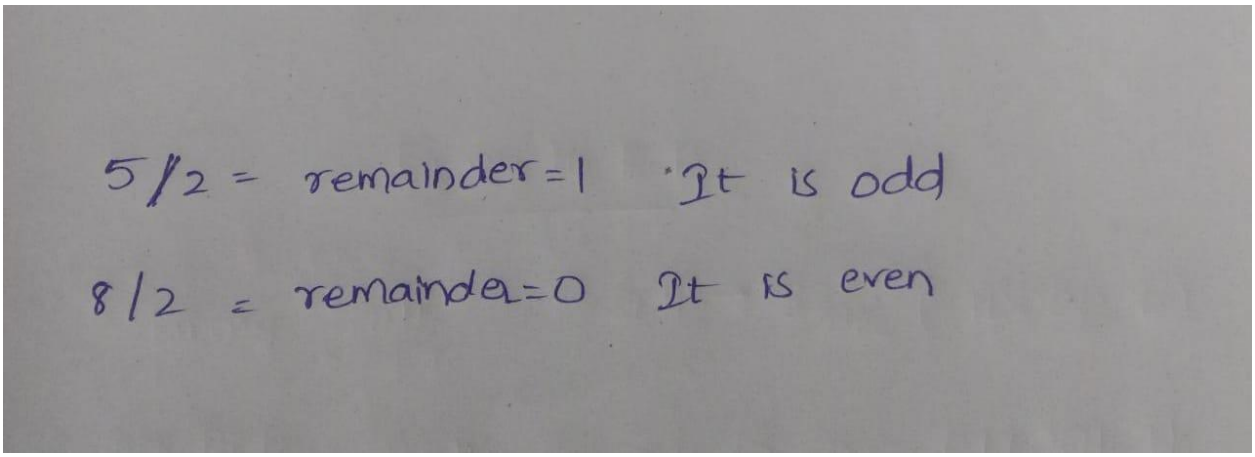
- Load the content of the input from screen in accumulator A.
- Perform AND operation with 01 in value of accumulator A by the help of ANI instruction.
- Check if zero flag is set, i.e if ZF = 1 then store 22 in accumulator A otherwise store 11 in A.
- Store the value of A in memory location
- If Number is Even print msg1 or else print message 2.

FLOWCHART:



DESIGN AND CALCULATIONS:

Load the content of the input from screen in accumulator A. Perform AND operation with 01 in value of accumulator A by the help of ANI instruction.Check if zero flag is set, i.e if ZF = 1 then store 22 in accumulator A otherwise store 11 in A. Store the value of A in memory location If Number is Even print msg1 or else print message 2.



PROGRAM CODE:

```
DATA SEGMENT
MSG1 DB 10,13,'ENTER NUMBER HERE :- $'
MSG2 DB 10,13,'ENTERED VALUE IS EVEN$'
MSG3 DB 10,13,'ENTERED VALUE IS ODD$'

DATA ENDS

DISPLAY MACRO MSG
MOV AH,9
LEA DX,MSG
INT 21H
ENDM
CODE SEGMENT
ASSUME CS:CODE,DS:DATA
START:
```

```
MOV AX,DATA
MOV DS,AX

DISPLAY MSG1

MOV AH,1
INT 21H
MOV AH,0

CHECK: MOV DL,2
DIV DL
CMP AH,0
JNE ODD

EVEN:
DISPLAY MSG2
JMP DONE

ODD:
DISPLAY MSG3

DONE:
MOV AH,4CH
INT 21H
CODE ENDS

END START
```

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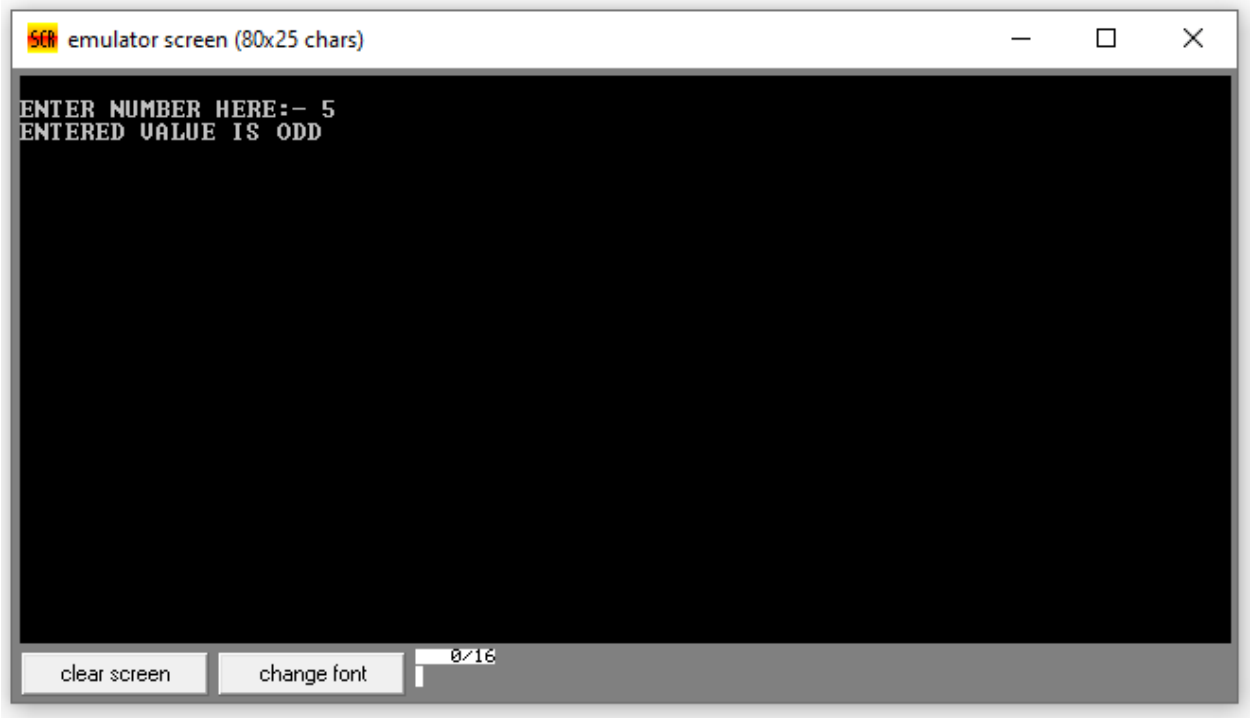
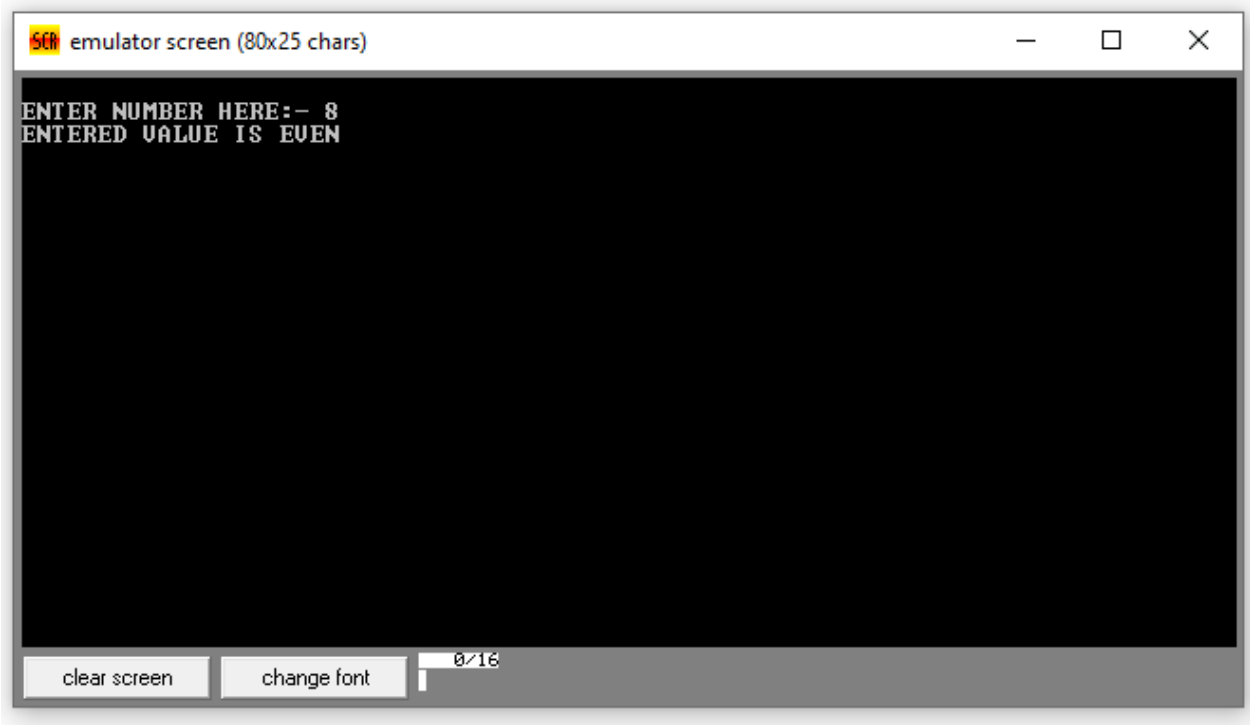
```
DATA SEGMENT
MSG1 DB 10,13,"ENTER NUMBER HERE :- $"
MSG2 DB 10,13,"ENTERED VALUE IS EVEN$"
MSG3 DB 10,13,"ENTERED VALUE IS ODD$"

DATA ENDS

DISPLAY MACRO MSG
MOV AH,9
LEA DX,MSG
INT 21H
ENDM
CODE SEGMENT
ASSUME CS:CODE,DS:DATA
START:
MOV AX,DATA
MOV DS,AX

DISPLAY MSG1

MOV AH,1
INT 21H
MOV AH,0

CHECK: MOV DL,2
DIV DL
CMP AH,0
JNE ODD

EVEN:
DISPLAY MSG2
JMP DONE

ODD:
DISPLAY MSG3

DONE:
MOV AH,4CH
INT 21H
CODE ENDS

END START
```

OUTPUT:





RESULTS & INFERENCE

When input is given as 5, since it is odd the second message is displayed in the screen. And when input is given as 8 since it is even number message 2 is displayed.

EXPERIMENT -9

STEPPER MOTOR

Types & Its Working

A stepper motor is an electromechanical device it converts electrical power into mechanical power. Also, it is a brushless, synchronous electric motor that can divide a full rotation into an expansive number of steps. The motor's position can be controlled accurately without any feedback mechanism, as long as the motor is carefully sized to the application. Stepper motors are similar to switched reluctance motors. The stepper motor uses the theory of operation for magnets to make the motor shaft turn a precise distance when a pulse of electricity is provided. The stator has eight poles, and the rotor has six poles. The rotor will require 24 pulses of electricity to move the 24 steps to make one complete revolution. Another way to say this is that the rotor will move precisely 15° for each pulse of electricity that the motor receives.

Construction & Working Principle

The **construction of a stepper motor** is fairly related to a DC motor. It includes a permanent magnet like Rotor which is in the middle & it will turn once force acts on it. This rotor is enclosed through a no. of the stator which is wound through a magnetic coil all over it. The stator is arranged near to rotor so that magnetic fields within the stators can control the movement of the rotor.
The stepper motor can be controlled by energizing every stator one by one. So the stator will magnetize & works like an electromagnetic pole which uses repulsive energy on the rotor to move forward. The stator's alternative magnetizing as well as demagnetizing will shift the rotor gradually &allows it to turn through great control.

The **stepper motor working principle** is Electro-Magnetism. It includes a rotor which is made with a permanent magnet whereas a stator is with electromagnets. Once the supply is provided to the winding of the stator then the magnetic field will be developed within the stator. Now rotor in the motor will start to move with the rotating magnetic field of the stator. So this is the fundamental working principle of this motor.
In this motor, there is a soft iron that is enclosed through the electromagnetic stators. The poles of the stator as well as the rotor don't depend on the kind of stepper. Once the stators of this motor are energized then the rotor will rotate to line up itself with the stator otherwise turns to have the least gap through the stator. In this way, the stators are activated in a series to revolve the stepper motor.

Driving Techniques

Stepper motor driving techniques can be possible with some special circuits due to their complex design. There are several methods to drive this motor, some of them are discussed below by taking an example of a four-phase stepper motor.

Single Excitation Mode

The basic method of driving a stepper motor is a single excitation mode. It is an old method and not used much at present but one has to know about this technique. In this technique every phase otherwise stator next to each other will be triggered one by one alternatively with a special circuit. This will magnetize & demagnetize the stator to move the rotor forward.

Stepper Motor Circuit & Its Operation

Stepper motors operate differently from DC brush motors, which rotate when voltage is applied to their terminals. Stepper motors, on the other hand, effectively have multiple toothed electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, for example, a microcontroller.

To make the motor shaft turn, first one electromagnet is given power, which makes the gear's teeth magnetically attracted to the electromagnet's teeth. At the point when the gear's teeth are thus aligned to the first electromagnet, they are slightly offset from the next electromagnet. So when the next electromagnet is turned ON and the first is turned OFF, the gear rotates slightly to align with the next one and from there the process is repeated. Each of those slight rotations is called a step, with an integer number of steps making a full rotation.

In that way, the motor can be turned by a precise. Stepper motor doesn't rotate continuously, they rotate in steps. There are 4 coils with a 90° angle between each other fixed on the stator. The stepper motor connections are determined by the way the coils are interconnected. In a stepper motor, the coils are not connected. The motor has a 90° rotation step with the coils being energized in a cyclic order, determining the shaft rotation direction.
The working of this motor is shown by operating the switch. The coils are activated in series in 1-sec intervals. The shaft rotates 90° each time the next coil is activated. Its low-speed torque will vary directly with current.
Types of Stepper Motor

There are three main types of stepper motors, they are:

- Permanent magnet stepper
- Hybrid synchronous stepper
- Variable reluctance stepper

Permanent Magnet Stepper Motor

Permanent magnet motors use a permanent magnet (PM) in the rotor and operate on the attraction or repulsion between the rotor PM and the stator electromagnets.

This is the most common type of stepper motor as compared with different types of stepper motors available in the market. This motor includes permanent magnets in the construction of the motor. This

kind of motor is also known as tin-can/can-stack motor. The main benefit of this stepper motor is less manufacturing cost. For every revolution, it has 48-24 steps.

Variable Reluctance Stepper Motor

Variable reluctance (VR) motors have a plain iron rotor and operate based on the principle that minimum reluctance occurs with minimum gap, hence the rotor points are attracted toward the stator magnet poles.

The stepper motor like variable reluctance is the basic type of motor and it is used for the past many years. As the name suggests, the rotor's angular position mainly depends on the magnetic circuit's reluctance that can be formed among the teeth of the stator as well as a rotor.

Hybrid Synchronous Stepper Motor

Hybrid stepper motors are named because they use a combination of permanent magnet (PM) and variable reluctance (VR) techniques to achieve maximum power in small package sizes.

The most popular type of motor is the hybrid stepper motor because it gives a good performance as compared with a permanent magnet rotor in terms of speed, step resolution, and holding torque. But, this type of stepper motor is expensive as compared with permanent magnet stepper motors. This motor combines the features of both the permanent magnet and variable reluctance stepper motors. These motors are used where less stepping angle is required like 1.5, 1.8 & 2.5 degrees.

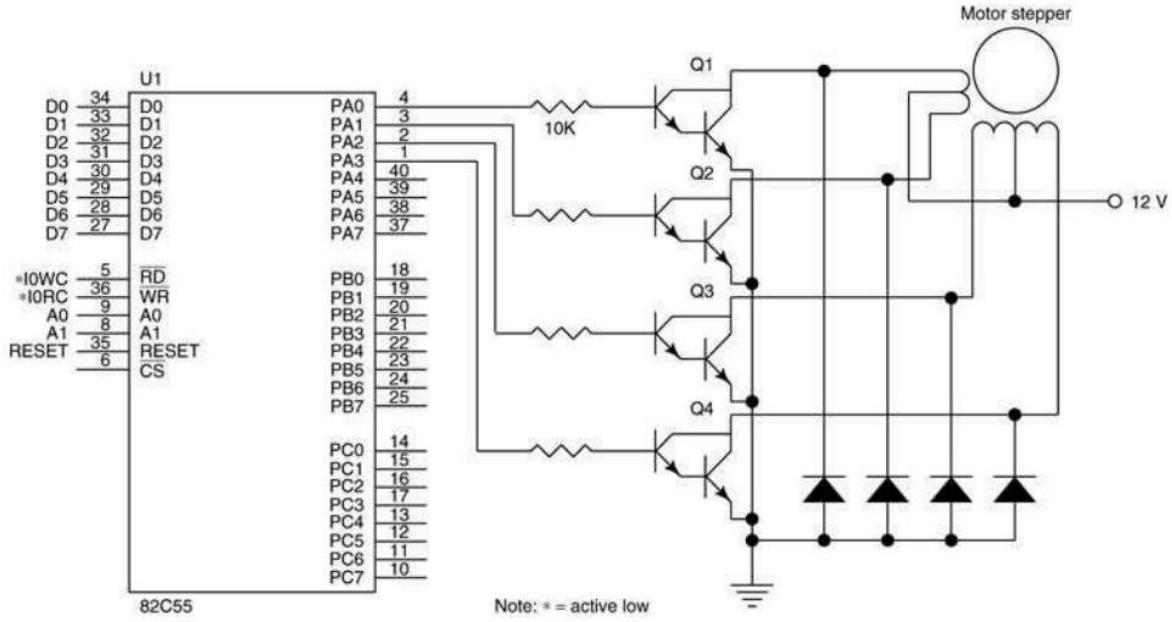
Applications

The **applications of stepper motor** include the following.

1. **Industrial Machines** – Stepper motors are used in automotive gauges and machine tooling automated production equipment.
2. **Security** – new surveillance products for the security industry.

3. **Medical** – Stepper motors are used inside medical scanners, samplers, and also found inside digital dental photography, fluid pumps, respirators, and blood analysis machinery.
4. **Consumer Electronics** – Stepper motors in cameras for automatic digital camera focus and zoom functions.

PIN DIAGRAM:



1. Stepper Motor in Clock-wise Direction:

Aim:

To construct the Interfacing of Stepper Motor in clock wise

Tools Required:

8086 Emulator

Apparatus:

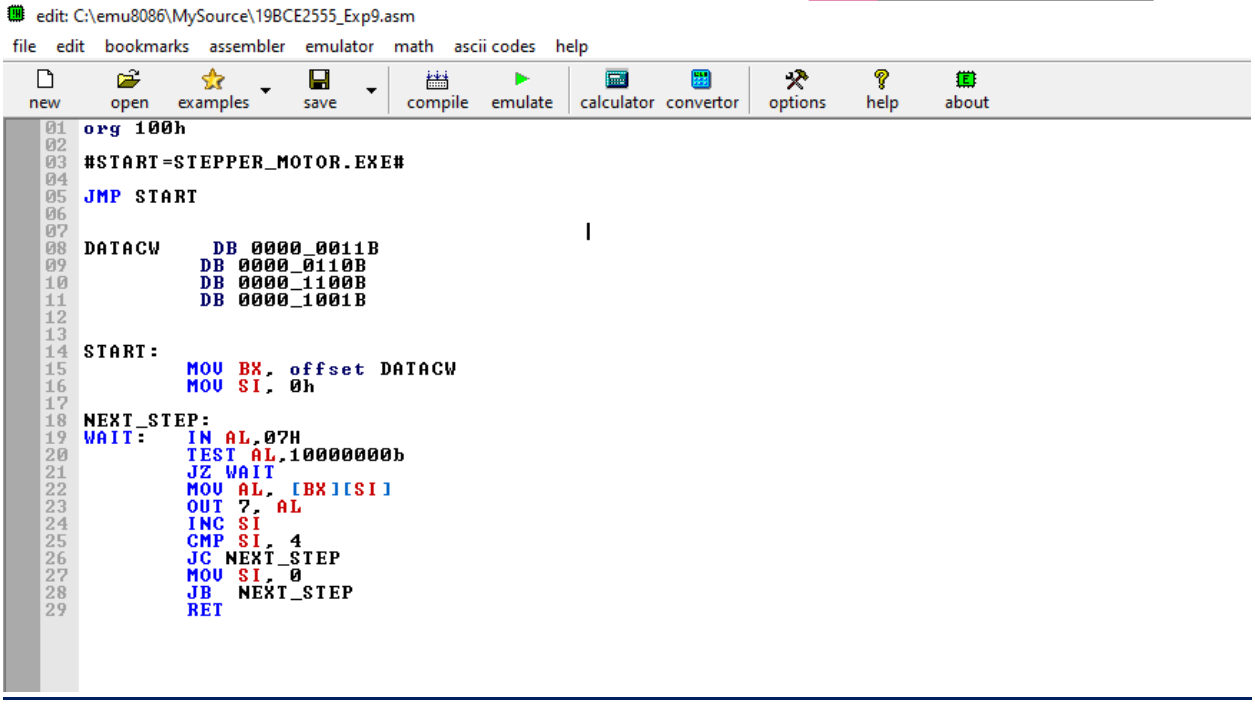
1. ADS-SDA-86-STA kit
2. Stepper motor interface card
3. 1 Amp Power Supply
4. Stepper Motor
5. Adapter, Keyboard, Cables, Connecting Wires Etc...

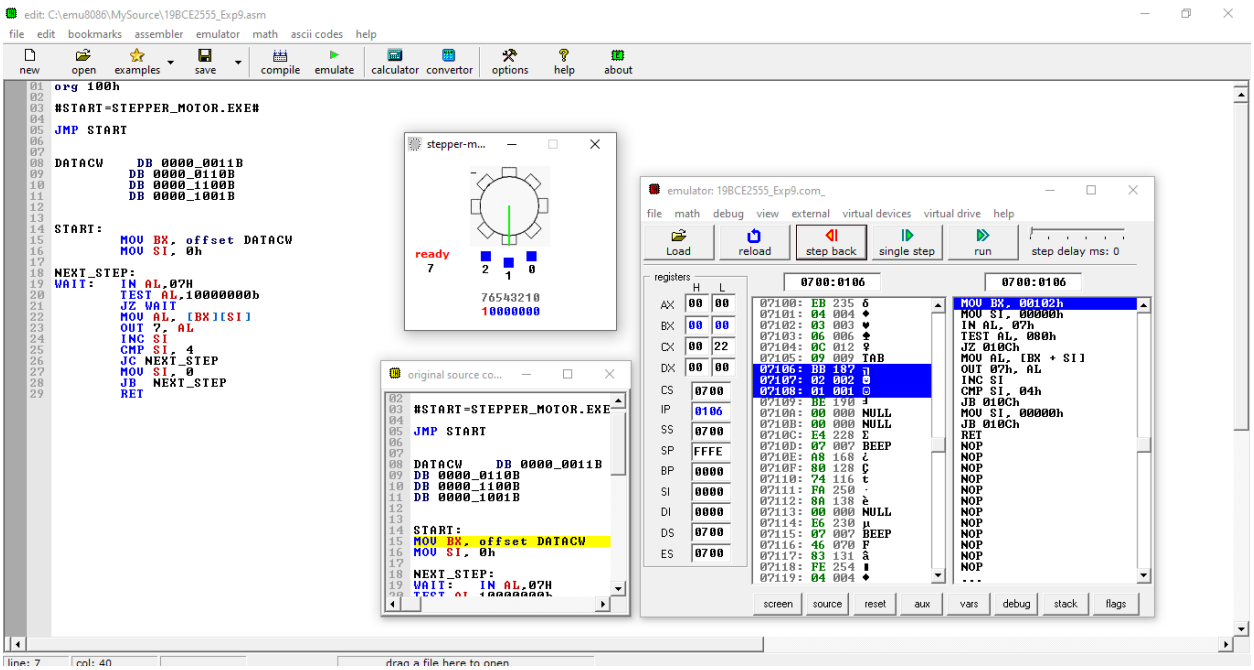
Procedure:

1. Connect 8086 kit PC using RS232 cable.
2. Connect Power supply to 8086 kit
3. Connect 1Amp Power Supply to the Stepper Motor
4. Connect 8255 to CN4 of 8086 using 26 pin bus.
5. Keep the DIP switch in 1 & 7 on (8086kit), open TALK, and go to options select target device as 8086 and Connect.
6. Change dip switch into 1 & 5on, once reset 8086 kit.
7. Go to file →Download hex file
8. Keep the DIP switch in 1 & 7 on (8086kit)
9. G-4000(on kit keyboard), now the stepper motor will be rotating in clockwise direction

Program Code:

```
org 100h

#START=STEPPER_MOTOR.EXE#

JMP START


DATACW    DB 0000_0011B
          DB 0000_0110B
          DB 0000_1100B
          DB 0000_1001B


START:
        MOV BX, offset DATACW
        MOV SI, 0h

NEXT_STEP:
WAIT:   IN AL,07H
        TEST AL,10000000b
        JZ WAIT
        MOV AL, [BX][SI]
        OUT 7, AL
        INC SI
        CMP SI, 4
        JC NEXT_STEP
        MOV SI, 0
        JB  NEXT_STEP
        RET
```


edit: C:\emu8086\MySource\19BCE2555_Exp9.asm
file edit bookmarks assembler emulator math ascii codes help
new open examples save compile emulate calculator convertor options help about
01 org 100h
02
03 #START=STEPPER_MOTOR.EXE#
04
05 JMP START
06
07
08 DATACW DB 0000_0011B
09 DB 0000_0110B
10 DB 0000_1100B
11 DB 0000_1001B
12
13
14 START:
15 MOV BX, offset DATACW
16 MOV SI, 0h
17
18 NEXT_STEP:
19 WAIT: IN AL,07H
20 TEST AL,10000000b
21 JZ WAIT
22 MOV AL, [BX][SI]
23 OUT 7, AL
24 INC SI
25 CMP SI, 4
26 JC NEXT_STEP
27 MOV SI, 0
28 JB NEXT_STEP
29 RET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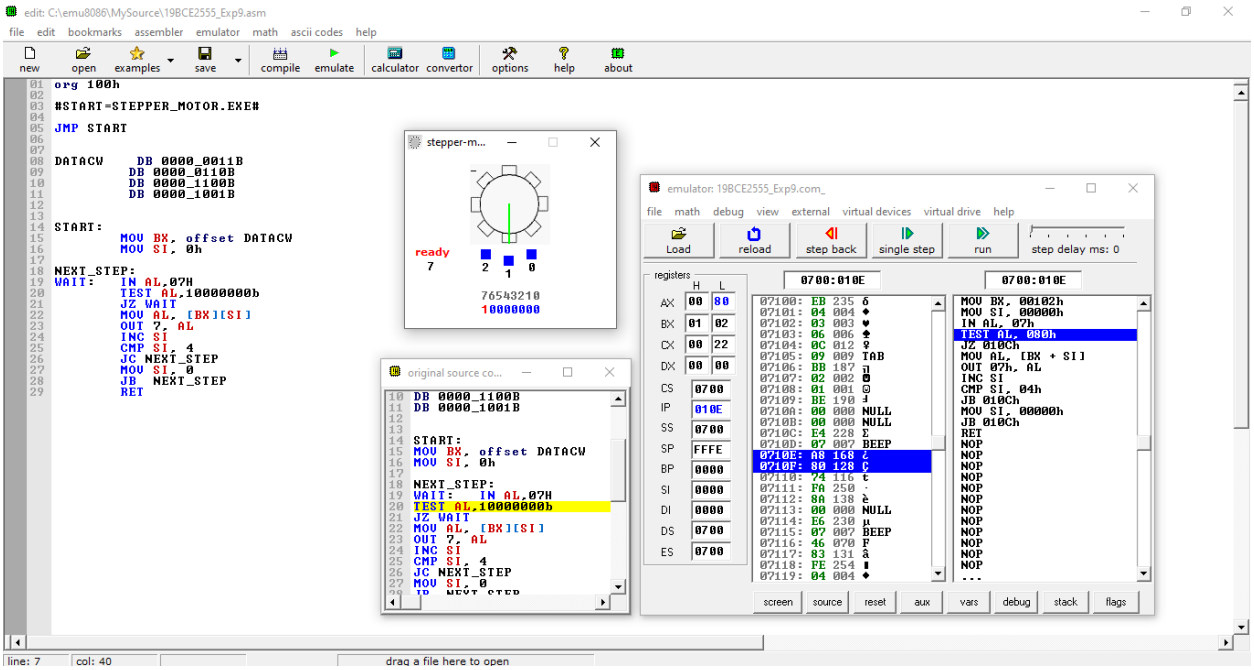
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0000_0011B
DB 0000_0110B
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
JB NEXT_STEP
RET
stepper-m...
ready
7 2 1 0
76543210
10000000
original source co...
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0000_0011B
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step run step delay ms: 0
registers
H L
AX 00 00
BX 00 00
CX 00 22
DX 00 00
CS 0700
IP 0106
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:0106
0700:0106
screen source reset aux vars debug stack flags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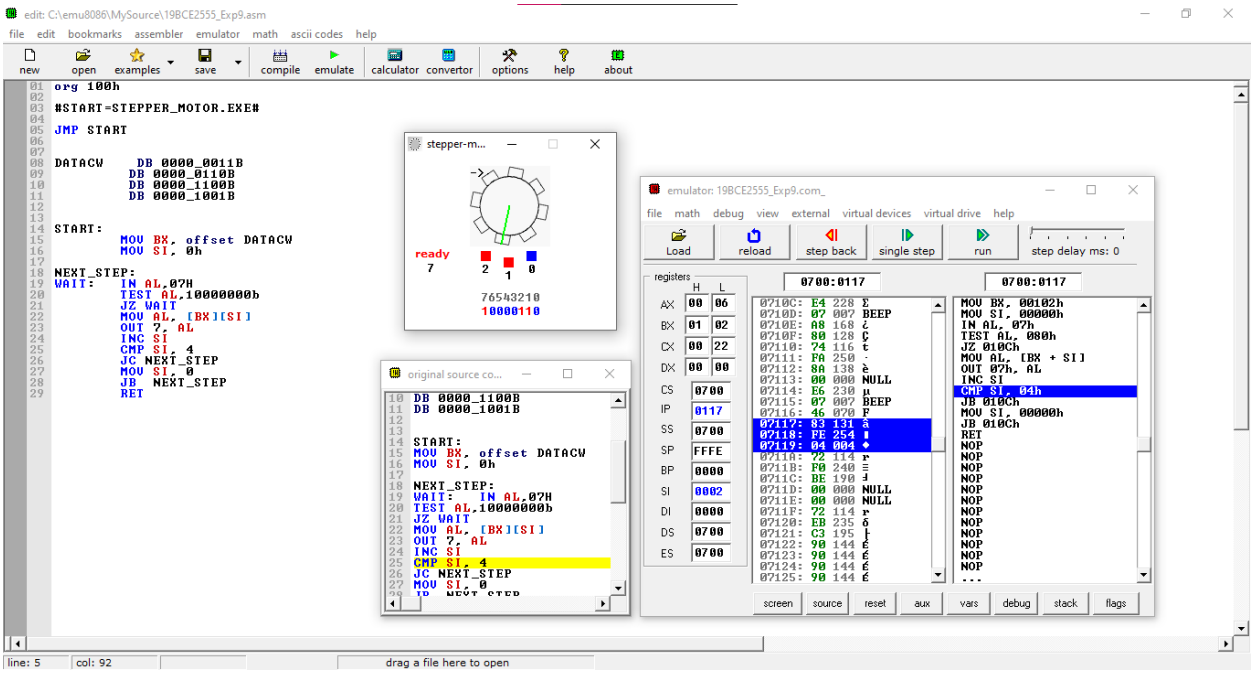
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0000_0011B
DB 0000_0110B
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
JB NEXT_STEP
RET
stepper-m...
ready
7 2 1 0
76543210
10000000
original source co...
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step run step delay ms: 0
registers
H L
AX 00 80
BX 01 02
CX 00 22
DX 00 00
CS 0700
IP 010E
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:010E
0700:010E
screen source reset aux vars debug stack flags

Output: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new open examples save compile emulate calculator convertor options help about
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0000_0011B
DB 0000_0110B
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
JB NEXT_STEP
RET
stepper-m...
ready
7 2 1 0
76543210
10000110
original source co...
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step run step delay ms: 0
registers
AX 00 06
BX 01 02
CX 00 22
DX 00 00
CS 0700
IP 0117
SS 0700
SP FFFE
BP 0000
SI 0002
DI 0000
DS 0700
ES 0700
0700:0117
0700:0117
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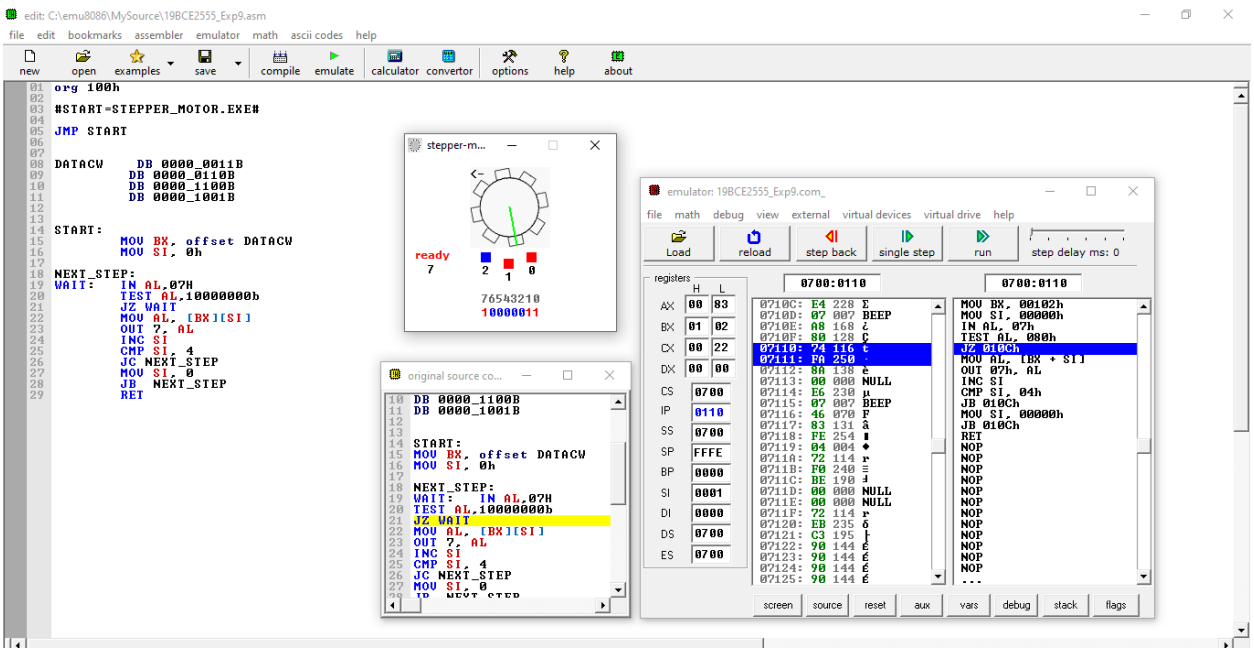
line: 5 col: 92
drag a file here to open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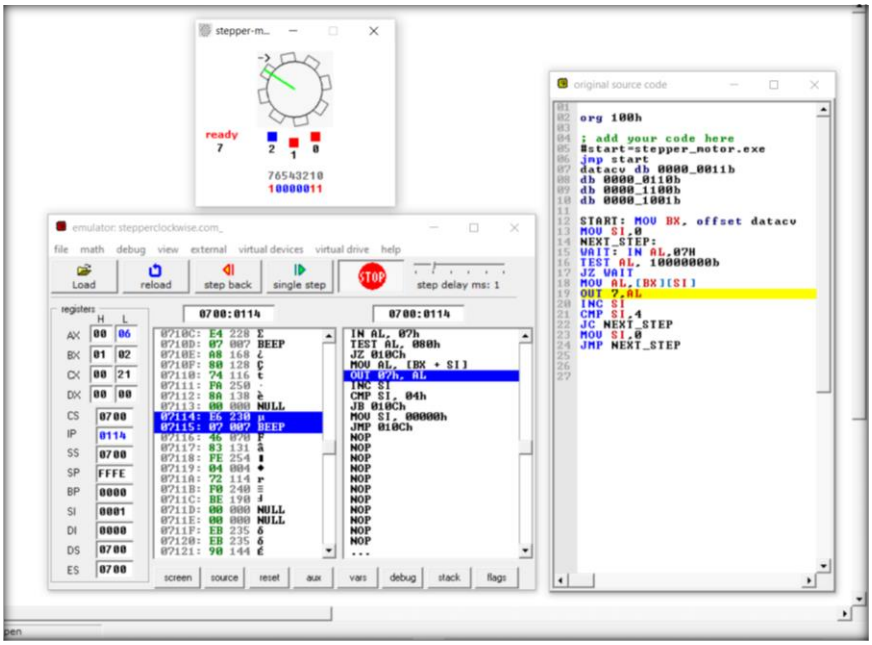
file edit bookmarks assembler emulator math ascii codes help
new open examples save compile emulate calculator convertor options help about
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0000_0011B
DB 0000_0110B
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
JB NEXT_STEP
RET
stepper-m...
ready
7 2 1 0
76543210
10000011
original source co...
DB 0000_1100B
DB 0000_1001B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step run step delay ms: 0
registers
AX 00 83
BX 01 02
CX 00 22
DX 00 00
CS 0700
IP 0110
SS 0700
SP FFFE
BP 0000
SI 0001
DI 0000
DS 0700
ES 0700
0700:0110
0700:0110
screen source reset aux vars debug stack flags



Results and Inference:

We can see that the Stepper Motor is running in Clock Wise Direction

2. Stepper Motor in AntiClock-wise Direction:

Aim:

To construct the Interfacing of Stepper Motor in Anti clock wise Direction

Tools Required:

8086 Emulator

Apparatus:

1. ADS-SDA-86-STA kit
2. Stepper motor interface card
3. 1 Amp Power Supply.
4. Stepper Motor
5. Adapter, Keyboard, Cables, Connecting Wires Etc...

Procedure :

1. Connect 8086 kit PC using RS232 cable.
2. Connect Power supply to 8086 kit
3. Connect 1Amp Power Supply to the Stepper Motor
4. Connect 8255 to CN4 of 8086 using 26 pin bus.
5. Keep the DIP switch in 1 & 7 on (8086kit), open TALK, and go to options select target device as 8086 and Connect.
6. Change dip switch into 1 & 5on, once reset 8086 kit.
7. Go to file →Download hex file
8. Keep the DIP switch in 1 & 7 on (8086kit)
9. G-4000(on kit keyboard), now the stepper motor will be rotating in clockwise direction

Program Code:

```
org 100h

#START=STEPPER_MOTOR.EXE#

JMP START


DATACW   DB 0011_0011B
         DB 0000_1001B
         DB 0000_1100B
         DB 0000_0110B


START:
        MOV BX, offset DATACW
        MOV SI, 0h

NEXT_STEP:
WAIT:   IN AL,07H
        TEST AL,10000000b
        JZ WAIT
        MOV AL, [BX][SI]
        OUT 7, AL
        INC SI
        CMP SI, 4
        JC NEXT_STEP
        MOV SI, 0
        JB  NEXT_STEP
```

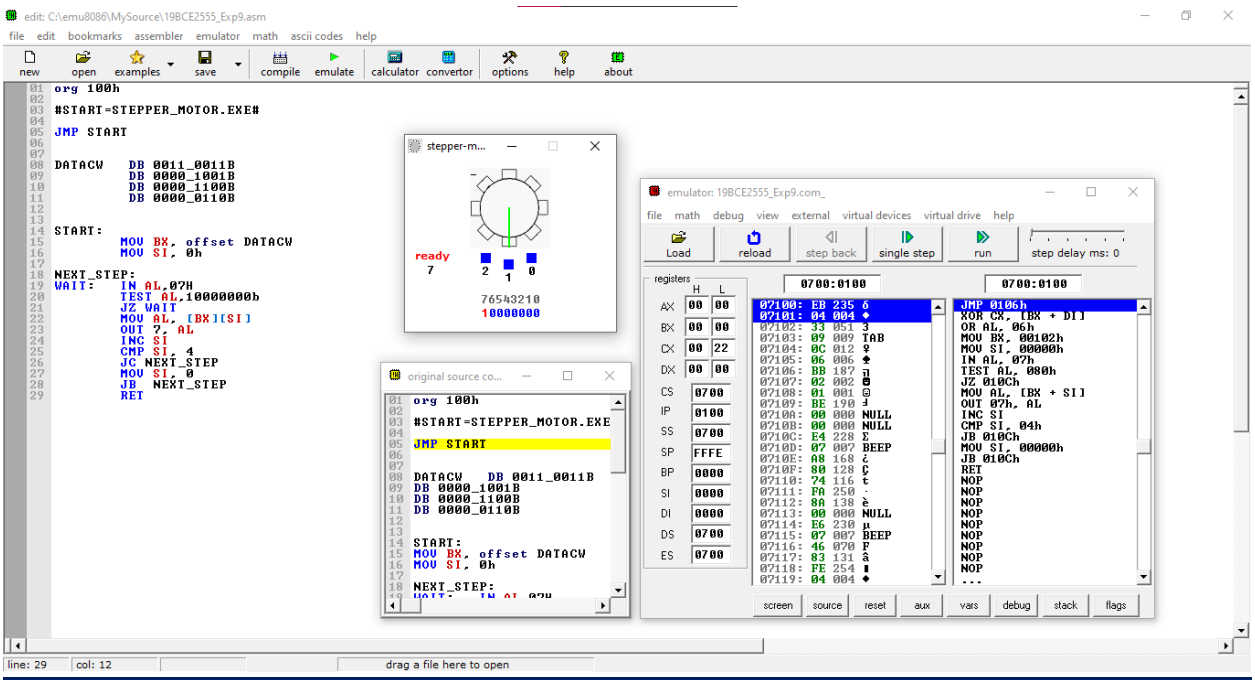
RET

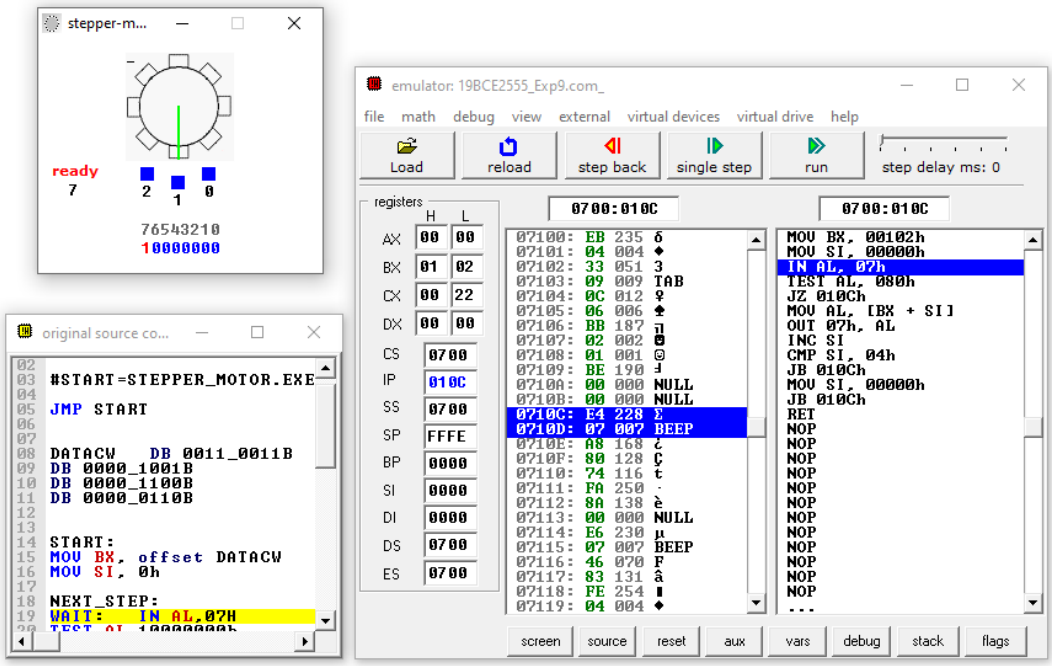
edit: C:\emu8086\MySource\19BCE2555_Exp9.asm

file edit bookmarks assembler emulator math ascii codes help

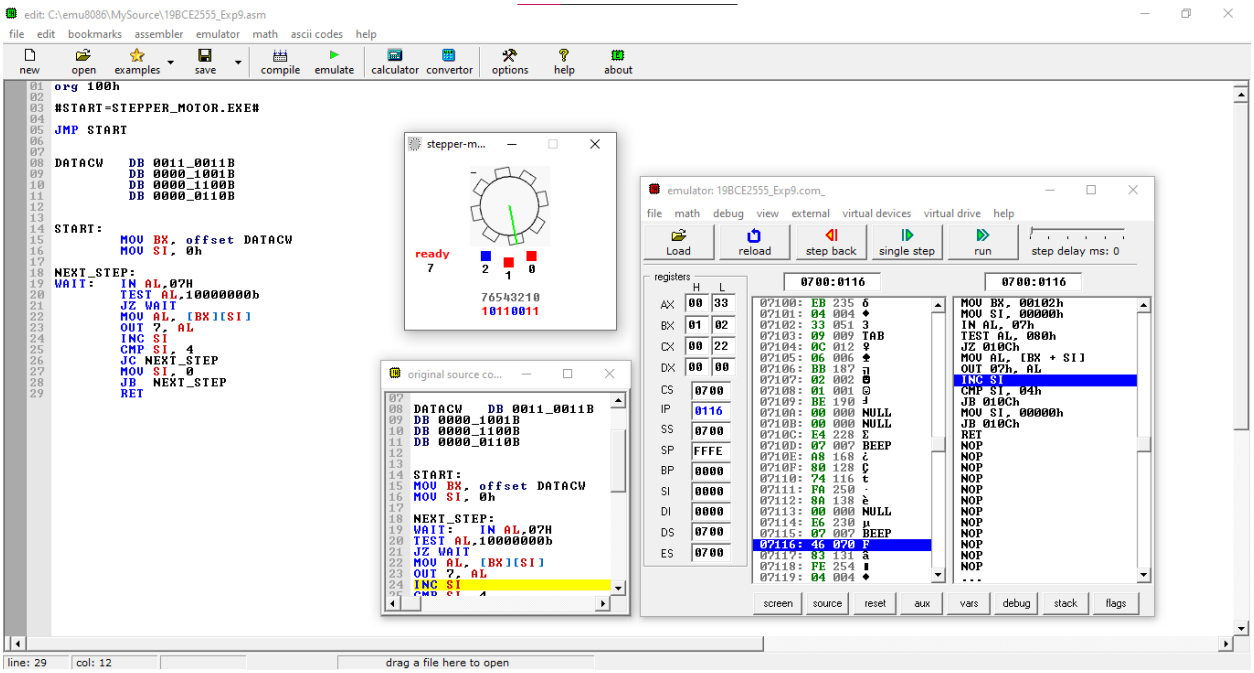
new open examples save compile emulate calculator convertor options help about

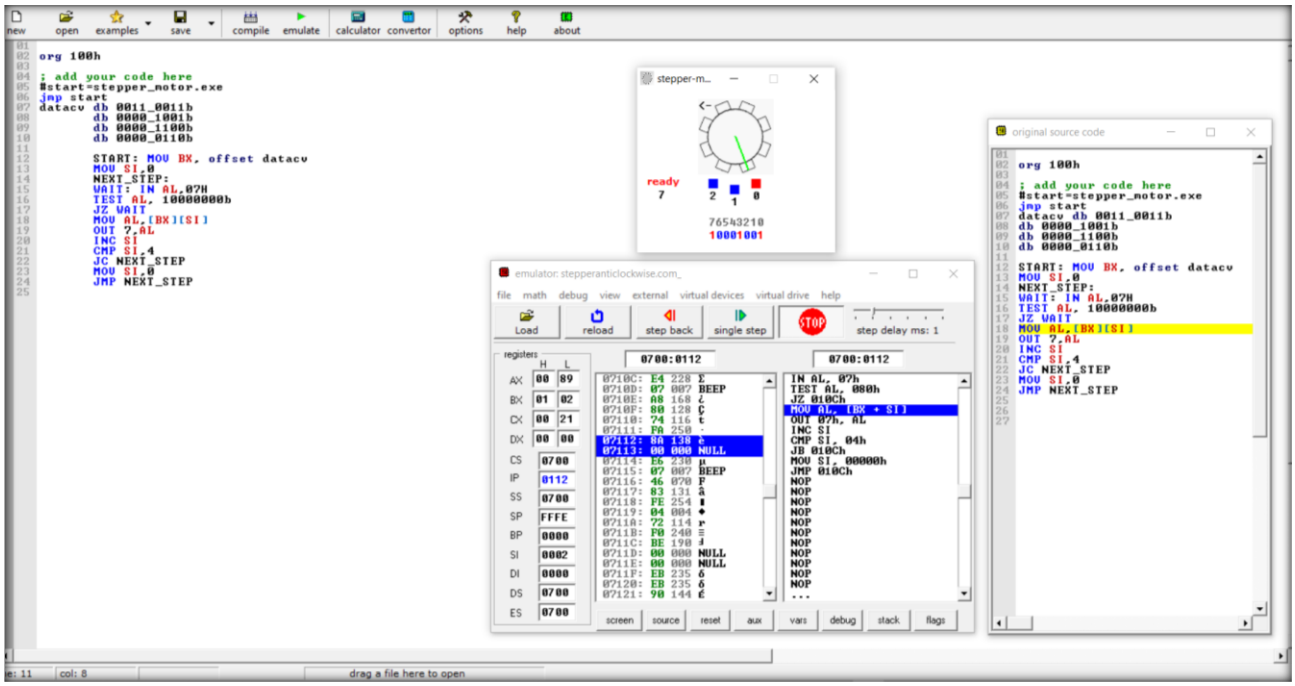
```
01 org 100h
02
03 #START=STEPPER_MOTOR.EXE#
04
05 JMP START
06
07
08 DATACW    DB 0011_0011B
09           DB 0000_1001B
10           DB 0000_1100B
11           DB 0000_0110B
12
13
14 START:
15           MOV BX, offset DATACW
16           MOV SI, 0h
17
18 NEXT_STEP:
19 WAIT:     IN AL,07H
20           TEST AL,10000000b
21           JZ WAIT
22           MOV AL, [BX][SI]
23           OUT 7, AL
24           INC SI
25           CMP SI, 4
26           JC NEXT_STEP
27           MOV SI, 0
28           JB  NEXT_STEP
29           RET
```

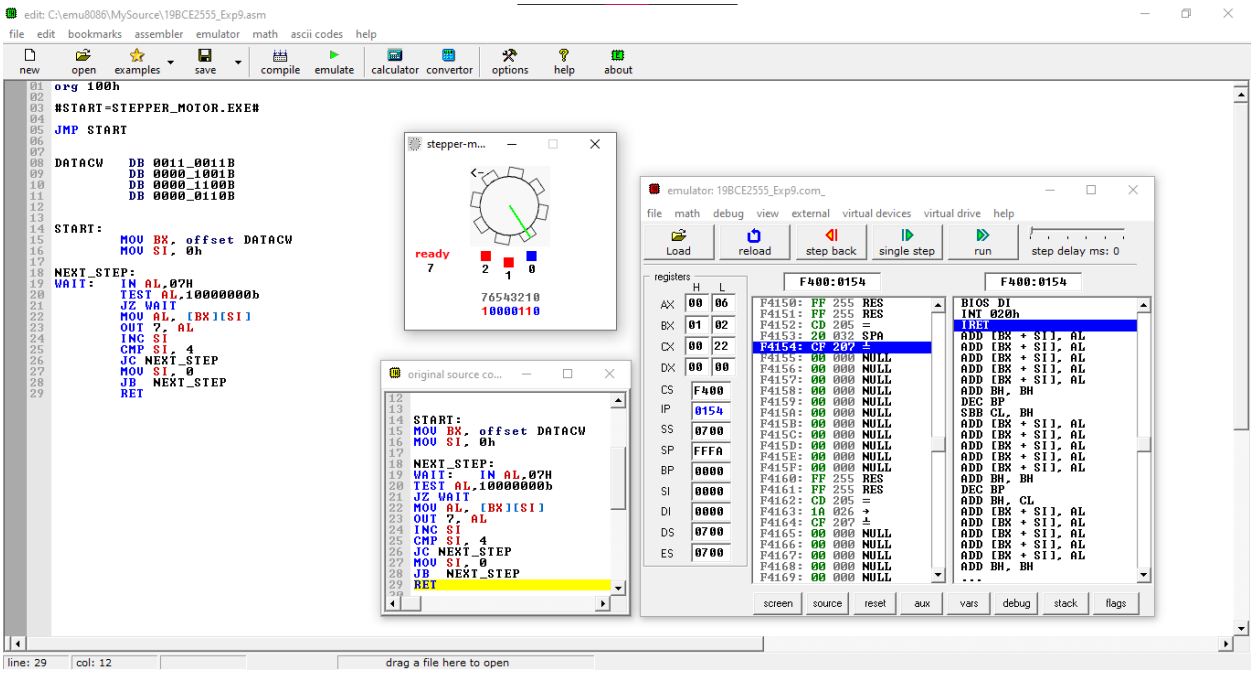



stepper-m...
ready
7
2
1
0
76543210
10000000
original source co...
#START=STEPPER_MOTOR.EXE
JMP START
DATACW DB 0011_0011B
DB 0000_1001B
DB 0000_1100B
DB 0000_0110B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load
reload
step back
single step
run
step delay ms: 0
registers
AX 00 00
BX 01 02
CX 00 22
DX 00 00
CS 0700
IP 010C
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:010C
0700:010C
07100: EB 235 δ
07101: 04 004 ♦
07102: 33 051 3
07103: 09 009 TAB
07104: 0C 012 ♀
07105: 06 006 ♠
07106: BB 187 ╗
07107: 02 002 ☻
07108: 01 001 ☺
07109: BE 190 ╛
0710A: 00 000 NULL
0710B: 00 000 NULL
0710C: E4 228 Σ
0710D: 07 007 BEEP
0710E: A8 168 ¿
0710F: 80 128 Ç
07110: 74 116 t
07111: FA 250 ·
07112: 8A 138 è
07113: 00 000 NULL
07114: E6 230 µ
07115: 07 007 BEEP
07116: 46 070 F
07117: 83 131 â
07118: FE 254 ■
07119: 04 004 ♦
MOV BX, 00102h
MOV SI, 00000h
IN AL, 07h
TEST AL, 080h
JZ 010Ch
MOV AL, [BX + SI]
OUT 07h, AL
INC SI
CMP SI, 04h
JB 010Ch
MOV SI, 00000h
JB 010Ch
RET
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
screen
source
reset
aux
vars
debug
stack
flags

Output:


edit: C:\emu8086\MySource\19BCE2555_Exp9.asm
file edit bookmarks assembler emulator math ascii codes help
new
open
examples
save
compile
emulate
calculator
convertor
options
help
about
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START
DATACW DB 0011_0011B
DB 0000_1001B
DB 0000_1100B
DB 0000_0110B
START:
MOV BX, offset DATACW
MOV SI, 0h
NEXT_STEP:
WAIT: IN AL,07H
TEST AL,10000000b
JZ WAIT
MOV AL, [BX][SI]
OUT 7, AL
INC SI
CMP SI, 4
JC NEXT_STEP
MOV SI, 0
JB NEXT_STEP
RET
stepper-m...
ready
7
2
1
0
76543210
10110011
original source co...
emulator: 19BCE2555_Exp9.com_
file math debug view external virtual devices virtual drive help
Load
reload
step back
single step
run
step delay ms: 0
registers
AX 00 33
BX 01 02
CX 00 22
DX 00 00
CS 0700
IP 0116
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:0116
0700:0116
07116: 46 070 F
MOV BX, 00102h
MOV SI, 00000h
IN AL, 07h
TEST AL, 080h
JZ 010Ch
MOV AL, [BX + SI]
OUT 07h, AL
INC SI
CMP SI, 04h
JB 010Ch
MOV SI, 00000h
JB 010Ch
RET
screen
source
reset
aux
vars
debug
stack
flags
line: 29
col: 12
drag a file here to open





Results and Inference:

We can see that the Stepper Motor is running in Anti Clock Wise Direction

3. Stepper Motor in Clock-wise Direction with a Random Delay:

Aim:

To construct the Interfacing of Stepper Motor in Clock wise Direction with a Random Delay.

Tools Required:

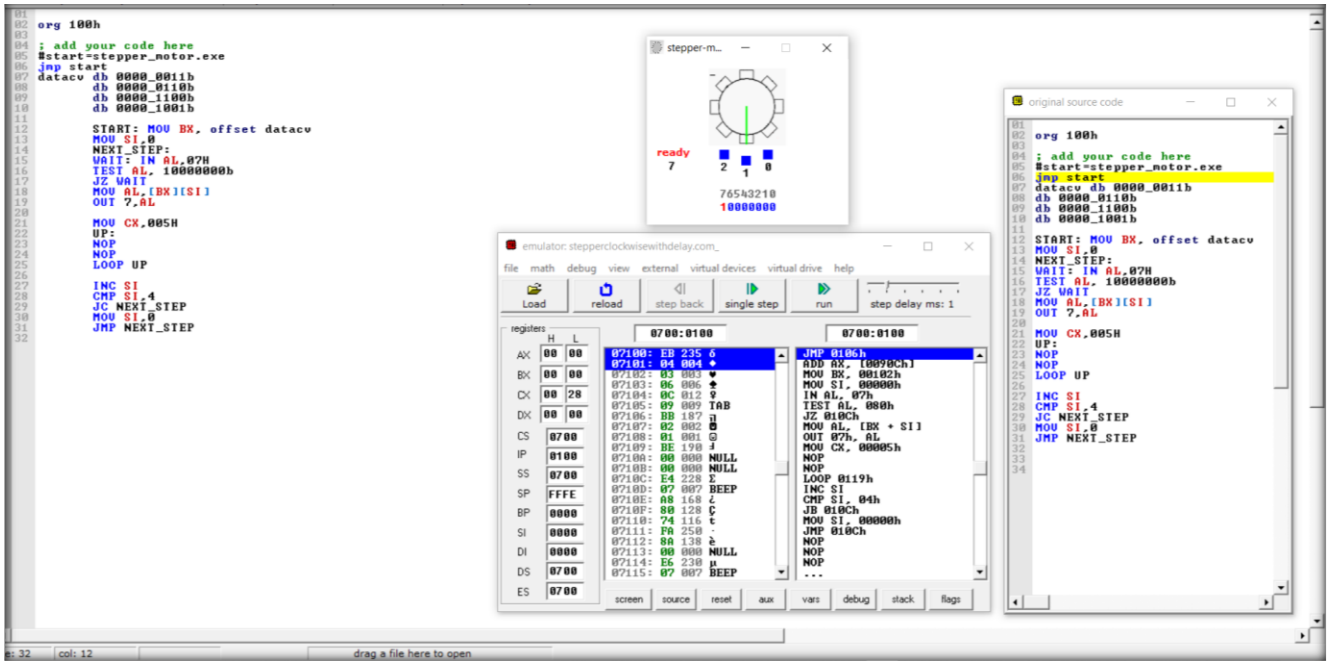
8086 Emulator

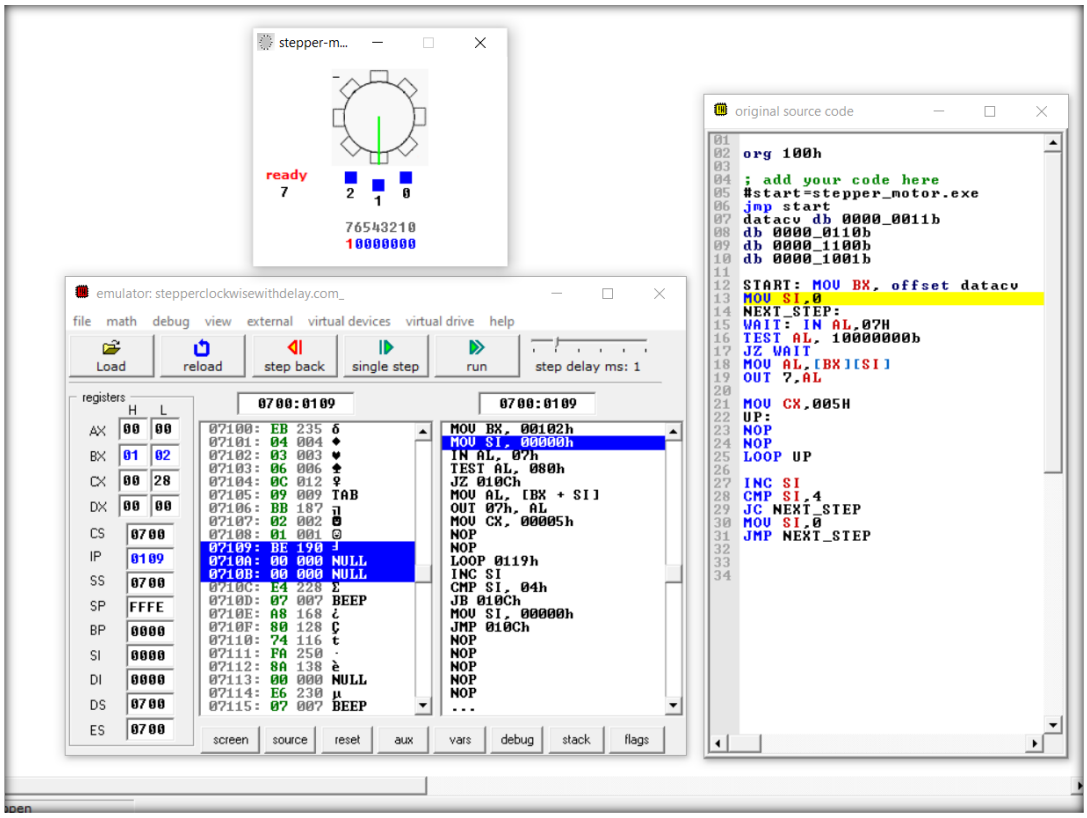
Program Code:

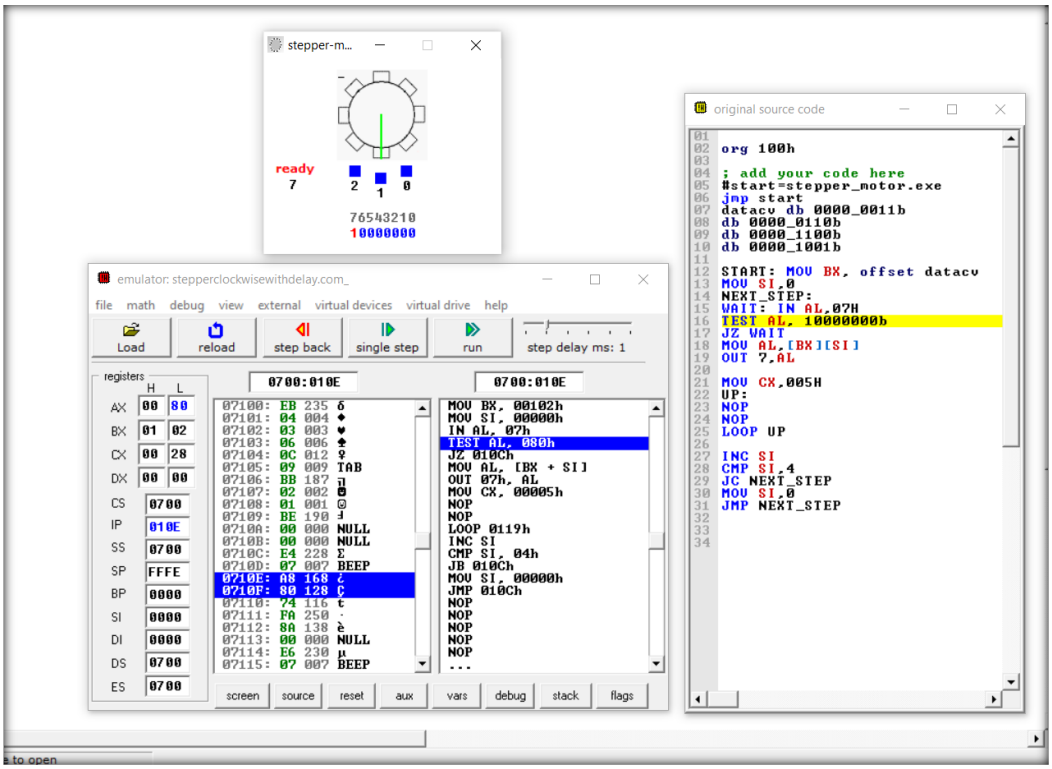
```
org 100h
#START=STEPPER_MOTOR.EXE#
JMP START


DATACW   DB 0011_0011B
         DB 0000_1001B
         DB 0000_1100B
         DB 0000_0110B
```

```
org 100h

; add your code here
#start=stepper_motor.exe
jmp start
datacv db 0000_0011b
       db 0000_0110b
       db 0000_1100b
       db 0000_1001b

       START: MOV BX, offset datacv
       MOV SI,0
       NEXT_STEP:
       WAIT: IN AL,07H
       TEST AL, 10000000b
       JZ WAIT
       MOV AL,[BX][SI]
       OUT 7,AL

       MOV CX,005H
       UP:
       NOP
       NOP
       LOOP UP

       INC SI
       CMP SI,4
       JC NEXT_STEP
       MOV SI,0
       JMP NEXT_STEP
```

line: 32 col: 12 drag a file here to open




stepper-m...
ready
7
2
1
0
76543210
10000000
emulator: stepperclockwisewithdelay.com_
file math debug view external virtual devices virtual drive help
Load
reload
step back
single step
run
step delay ms: 1
registers
H L
AX 00 00
BX 01 02
CX 00 28
DX 00 00
CS 0700
IP 0109
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:0109
0700:0109
07100: EB 235 δ
07101: 04 004 ♦
07102: 03 003 ♥
07103: 06 006 ♠
07104: 0C 012 ♀
07105: 09 009 TAB
07106: BB 187 ╗
07107: 02 002 ☻
07108: 01 001 ☺
07109: BE 190 ╛
0710A: 00 000 NULL
0710B: 00 000 NULL
0710C: E4 228 Σ
0710D: 07 007 BEEP
0710E: A8 168 ¿
0710F: 80 128 Ç
07110: 74 116 t
07111: FA 250 ·
07112: 8A 138 è
07113: 00 000 NULL
07114: E6 230 µ
07115: 07 007 BEEP
MOV BX, 00102h
MOV SI, 00000h
IN AL, 07h
TEST AL, 080h
JZ 010Ch
MOV AL, [BX + SI]
OUT 07h, AL
MOV CX, 00005h
NOP
NOP
LOOP 0119h
INC SI
CMP SI, 04h
JB 010Ch
MOV SI, 00000h
JMP 010Ch
NOP
NOP
NOP
NOP
NOP
...
screen source reset aux vars debug stack flags
original source code
org 100h
; add your code here
#start=stepper_motor.exe
jmp start
datacv db 0000_0011b
db 0000_0110b
db 0000_1100b
db 0000_1001b
START: MOV BX, offset datacv
MOV SI,0
NEXT_STEP:
WAIT: IN AL,07H
TEST AL, 10000000b
JZ WAIT
MOV AL,[BX][SI]
OUT 7,AL
MOV CX,005H
UP:
NOP
NOP
LOOP UP
INC SI
CMP SI,4
JC NEXT_STEP
MOV SI,0
JMP NEXT_STEP


stepper-m...
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7
2
1
0
76543210
10000000
emulator: stepperclockwisewithdelay.com_
file math debug view external virtual devices virtual drive help
Load
reload
step back
single step
run
step delay ms: 1
registers
H L
AX 00 80
BX 01 02
CX 00 28
DX 00 00
CS 0700
IP 010E
SS 0700
SP FFFE
BP 0000
SI 0000
DI 0000
DS 0700
ES 0700
0700:010E
0700:010E
07100: EB 235 δ
07101: 04 004 ♦
07102: 03 003 ♥
07103: 06 006 ♠
07104: 0C 012 ♀
07105: 09 009 TAB
07106: BB 187 ╗
07107: 02 002 ☻
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JZ WAIT
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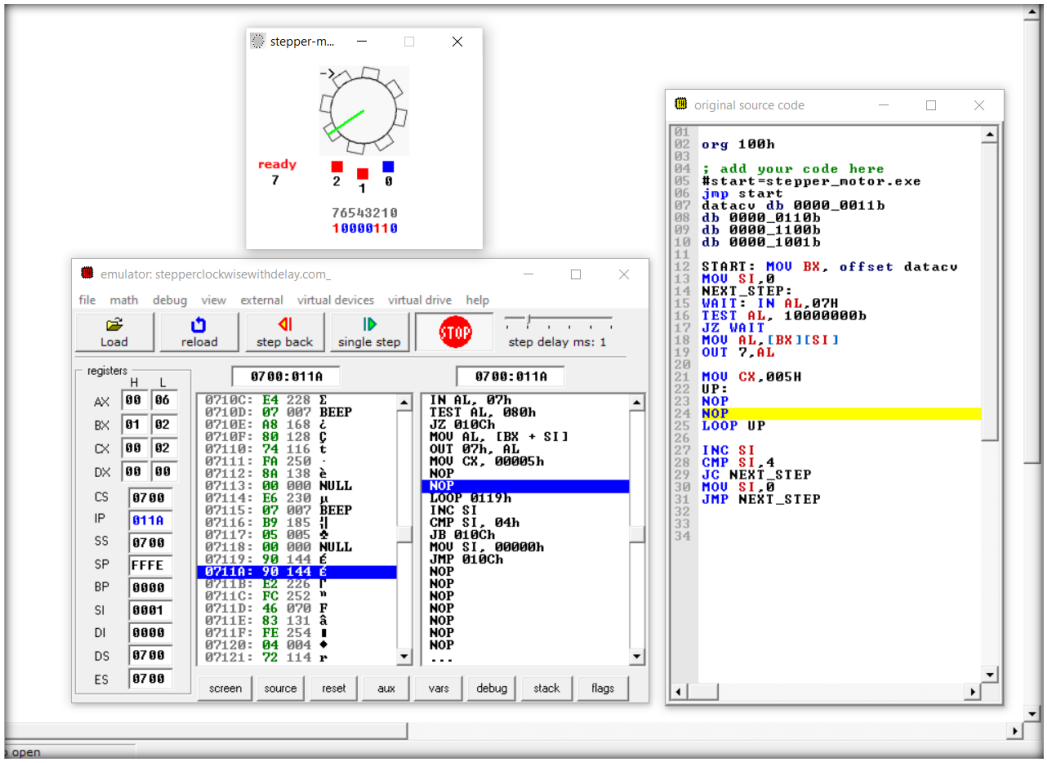
OUT 7,AL
MOV CX,005H
UP:
NOP
NOP
LOOP UP
INC SI
CMP SI,4
JC NEXT_STEP
MOV SI,0
JMP NEXT_STEP

Output:


stepper-m...
ready
7 2 1 0
76543210
10000110
emulator: stepperclockwisewithdelay.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step STOP step delay ms: 1
registers
0700:011A
0700:011A
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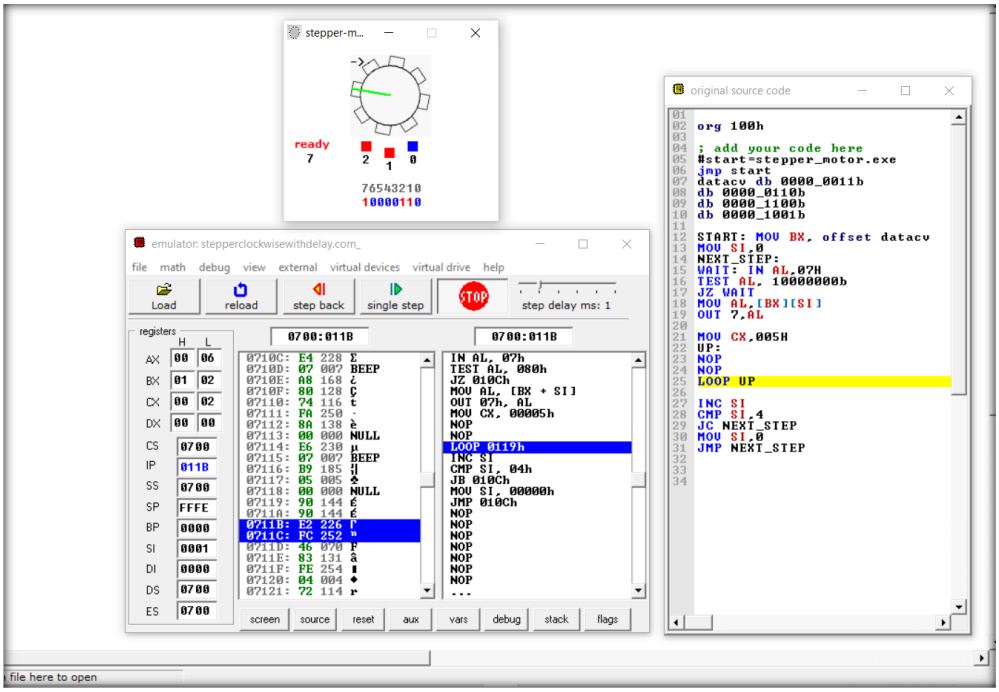
TEST AL, 10000000b
JZ WAIT
MOV AL,[BX][SI]
OUT 7,AL
MOV CX,005H
UP:
NOP
NOP
LOOP UP
INC SI
CMP SI,4
JC NEXT_STEP
MOV SI,0
JMP NEXT_STEP
open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ready
7 2 1 0
76543210
10000110
emulator: stepperclockwisewithdelay.com_
file math debug view external virtual devices virtual drive help
Load reload step back single step STOP step delay ms: 1
registers
0700:011B
0700:011B
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original source code
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MOV CX,005H
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NOP
NOP
LOOP UP
INC SI
CMP SI,4
JC NEXT_STEP
MOV SI,0
JMP NEXT_STEP
file here to open

Results and Inference:

We can see that the Stepper Motor is running in Clock Wise Direction with a Random Delay.