Name:	Yash Ravindra Kerkar
Roll No:	67
Class/Sem:	SE/IV
Experiment No.:	4
Title:	Program to display character in uppercase and lowercase.
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Marks:	
Sign of Faculty:	

Aim: Assembly Language Program to display character A to z in both uppercase and lowercase

Theory:

DOS provide various interrupt services that are used by the system programmer. The most commonly used interrupt is INT 21H. It invokes inbuilt DOS functions which can be used to perform various tasks. The most common tasks are reading a user input character from the screen, displaying result on the exiding program etc.

In this program, we display the characters A to Z on the DOS prompt. DOS interrupt function 02 displays the contents of DL (ASCII code) on the screen. By loading the ASCII code of 'A' in the DL register, loading AH register with 02h and calling INT 21h it is possible to display character from A to Z on the screen.

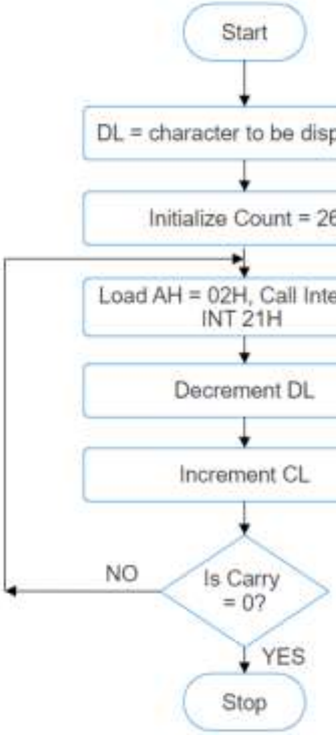
INT 21h/AH = 2 - write character to standard output.

Entry: DL = character to write, after execution AL = DL.

Example :-

```
mov ah , 2

mov dl , 'a'

int 21h
```

Flowchart:



Algorithm:

1. Start.

2. Initialize DL with 'A'.

3. Load CL with count = 26.

4. Load AH = 02H and call INT 21H.

5. Increment DL, to next character.

6. Decrement the count.

7. Repeat steps 4,5,6 till CL is not zero.

8. To end the program use DOS interrupt:

   1) Load AH = 41H.

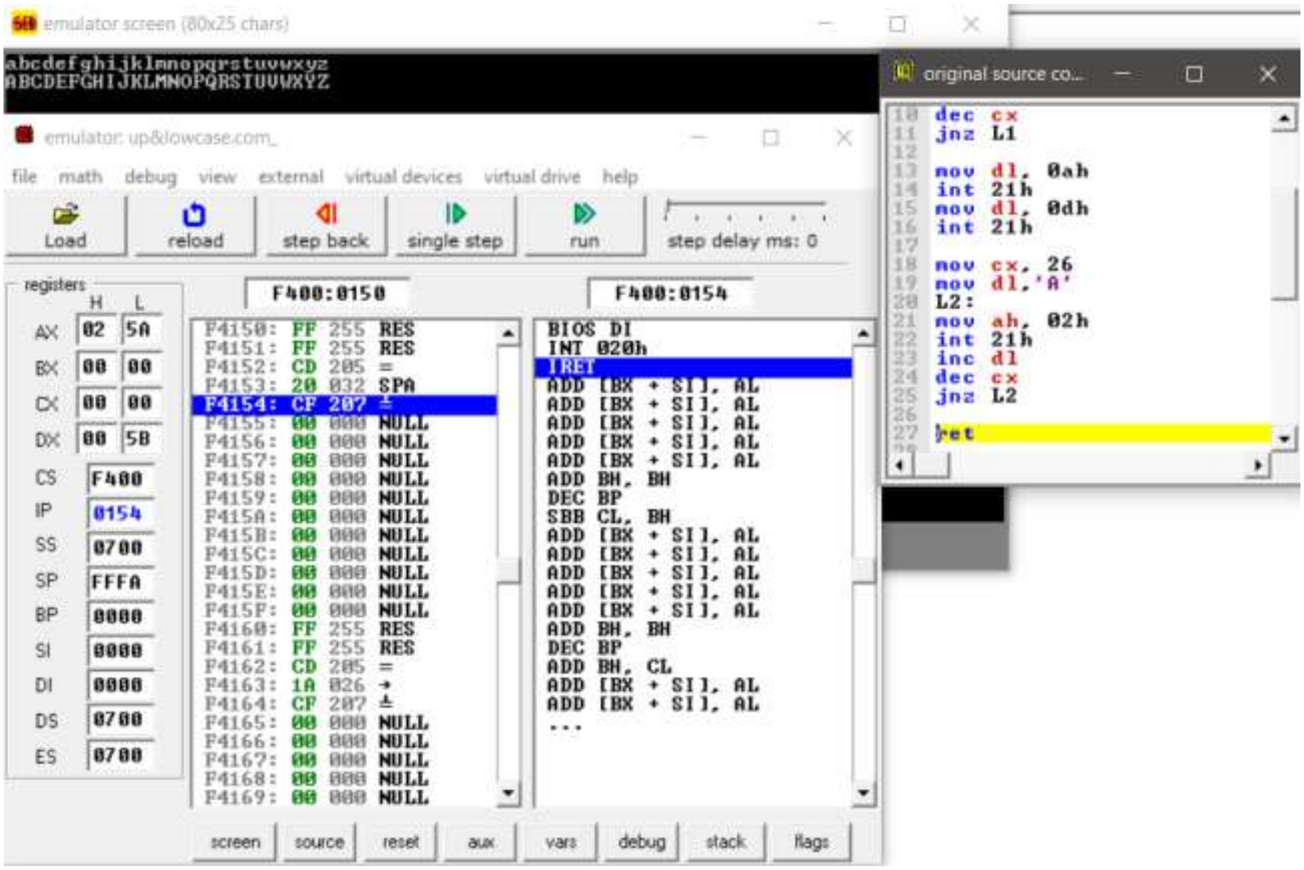
   2) Call INT 21 H.

9. Stop.

Program:

```
  org 100h


 mov cx, 1Ah
 mov dl,'a'
 L1:
    mov ah, 02h
    int 21h
    inc dl
    dec cx
     jnz L1

     mov dl, 0ah
     int 21h
     mov dl, 0dh
     int 21h

     mov cx, 26
     mov dl,'A'
L2:
      mov ah, 02h
      int 21h
      inc dl
      dec cx
      jnz L2

 ret
```

Output:



```
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

```
dec cx
jnz L1

mov dl, 0ah
int 21h
mov dl, 0dh
int 21h

mov cx, 26
mov dl,'A'
L2:
mov ah, 02h
int 21h
inc dl
dec cx
jnz L2

ret
```

registers

	H	L
AX	02	5A
BX	00	00
CX	00	00
DX	00	5B

CS	F400
IP	0154
SS	0700
SP	FFFA
BP	0000
SI	0000
DI	0000
DS	0700
ES	0700

```
F400:0150

F4150: FF 255 RES
F4151: FF 255 RES
F4152: CD 205 =
F4153: 20 032 SPA
F4154: CF 207 ±
F4155: 00 000 NULL
F4156: 00 000 NULL
F4157: 00 000 NULL
F4158: 00 000 NULL
F4159: 00 000 NULL
F415A: 00 000 NULL
F415B: 00 000 NULL
F415C: 00 000 NULL
F415D: 00 000 NULL
F415E: 00 000 NULL
F415F: 00 000 NULL
F4160: FF 255 RES
F4161: FF 255 RES
F4162: CD 205 =
F4163: 1A 026 →
F4164: CF 207 ±
F4165: 00 000 NULL
F4166: 00 000 NULL
F4167: 00 000 NULL
F4168: 00 000 NULL
F4169: 00 000 NULL
```

```
F400:0154

BIOS DI
INT 020h
IRET
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
SBB CL, BH
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
ADD BH, CL
ADD [BX + SI], AL
ADD [BX + SI], AL
...
```

Conclusion: In this practical exercise, we successfully implemented a program to display characters in both uppercase and lowercase.

1. Explain INT 21H.

   Ans. In assembly language programming for DOS and early versions of Windows, `INT 21h` is a software interrupt that provides access to various services offered by the operating system through the DOS API (Application Programming Interface). This interrupt is commonly used for performing file operations, keyboard input/output, screen output, and other system-level tasks.

   Here are some of the commonly used functions provided by `INT 21h`:

   File Operations:
   - `AH = 0x3D`: Open File
   - `AH = 0x3E`: Close File
   - `AH = 0x3F`: Read from File
   - `AH = 0x40`: Write to File
   - `AH = 0x42`: Move File Pointer
   - `AH = 0x4C`: Terminate Program with Return Code

   Screen Output:
   - `AH = 0x02`: Display Character
   - `AH = 0x09`: Display String

Keyboard Input/Output:

- `AH = 0x01`: Read Character from Standard Input
- `AH = 0x06`: Direct Console Output
- `AH = 0x07`: Direct Console Input
- `AH = 0x08`: Read Character with Echo

Miscellaneous:

- `AH = 0x00`: Terminate Program
- `AH = 0x4A`: Resize Memory Block

When using `INT 21h`, the specific function to be performed is specified in the AH register, and additional parameters or data may be passed in other registers or memory locations, depending on the function being called.

For example, to display a character on the screen using `INT 21h`, you would load the ASCII value of the character into the AL register and set AH to `0x02`. Then you would trigger the interrupt using the `INT 21h` instruction.

2. Explain working of increment and decrement instructions.

Ans. Increment Instruction: Syntax: `INC destination.` Function: The increment instruction increases the value of the destination operand by one. The destination operand can be a register or a memory location. After the increment operation, the Zero Flag (ZF) and Sign Flag (SF) in the CPU's flags register are updated based on the result. If the result is zero, the ZF is set; if the result is negative, the SF is set. Example: `INC AX` increases the value in the AX register by one.

Decrement Instruction: Syntax: `DEC destination.`Function: The decrement instruction decreases the value of the destination operand by one. Similar to the increment instruction, the destination operand can be a register or a memory location. After the decrement operation, the Zero Flag (ZF) and Sign Flag (SF) in the CPU's flags register are updated based on the result. If the result is zero, the ZF is set; if the result is negative, the SF is set. Example: `DEC BX` decreases the value in the BX register by one.