

**LAB 3 – DOS INTERRUPTS – BASIC KEYBOARD & DISPLAY CONSOLE INTERRUPTS**

**3.1 Introduction to DOS & BIOS Interrupts**

The BIOS is specific to the individual computer system. It contains the default resident hardware dependent drivers for several devices including the console display, keyboard, and the boot disk device. Have you ever wondered how you are able to type characters and view them even when no OS is loaded, like when the computer is booting?

The BIOS operates at a more primitive level than the DOS kernel. In a X86 based systems, there are total of 256 possible interrupts, out of which some interrupts are reserved for DOS, BIOS services, which the programmer can access by loading the function number into appropriate registers and then invoking the interrupt.

In providing the DOS functions, the MS-DOS kernel communicates with the BIOS device drivers through the BIOS functions. DOS then provides something like a wrapper over the primitive BIOS function. By providing the wrapper, DOS makes the functions easier to use and more reliable, but in turn, reduce the flexibility and power of the functions. By using the BIOS interrupts directly, the programmer bypasses the DOS kernel.

In the next two experiments you will using INT 21 H (DOS Interrupts) – Here we use INT 21H to access value of key pressed and display charcters.

**3.2 Keyboard Interrupts**

**Purpose: Input a character from keyboard (STDIN) with Echo**

**Program Segment**

MOV AH, 01h ; AH -01 parameter for INT 21h

INT 21h

You have to run the program using debug/debug32 and the ASCII key you press will be stored in AL register.

**Purpose: Input a character from keyboard (STDIN) without Echo**

**Program Segment**

MOV AH, 08h ; AH -08 parameter for INT 21h

INT 21h

You have to run the program using debug/debug32 and the ASCII key you press will be stored in AL register. The difference is the character will not be visible on the screen when you type it

### Purpose: Input a string from keyboard (STDIN)

#### Program

```
.data
max1    db     32          ; 32 is max no. of chars that a user can type in (max possible – 255)
act1     db     ?          ; actual count of keys that user types will be stored here after int has
                                   ; executed (Note this cannot exceed the value specified in max1 –
                                   ; actual keys you enter will 31 as the 32nd will be Enter key)
inp1     db     32 dup(0)   ; Reserve 32 locations for input string

.code

.startup
        LEA     DX,max1
        MOV     AH,0Ah
        INT     21h
```

After the interrupt, act 1 will contain the number of characters read, and the characters themselves will start at inp1 The characters will be terminated by a carriage return (ASCII code 0Dh), although this will not be included in the count (Note: this will not be included in the ACT1 but you have to count Enter also when you are specifying it in max1)

### Purpose: Output a character to display (STD OUT)

#### Program Segment

```
MOV     DL,'A'
MOV     AH,02h
INT      21h
```

After Interrupt is executed character 'A' will be displayed on the screen.

### Purpose: Output a string on display (STDOUT)

#### Program

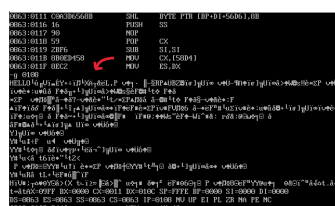
```
.data
str1     db     'HELLO $'   ; all strings must terminate with '$' ASCII value (24h)

.code

.startup
        lea     dx, str1
        mov     ah,09h
        int     21h
```

When interrupt is executed the string "HELLO" will be displayed on screen.

Remove the '\$' sign. What happens?



The screenshot shows a DOS assembly program being executed. The output on the screen is 'HELLO' followed by a carriage return and a dollar sign. The assembly code is as follows:

```
0000:0011 00000000  SHL     BYTE PTR [DI+0000],00
0000:0012 00000000  ROR     SI
0000:0013 00000000  POP     CX
0000:0014 00000000  POP     SI
0000:0015 00000000  MOV     CX,00000001
0000:0016 00000000  MOV     EDI,00000000
0000:0017 00000000  MOV     EDI,00000000
0000:0018 00000000  MOV     EDI,00000000
0000:0019 00000000  MOV     EDI,00000000
0000:001A 00000000  MOV     EDI,00000000
0000:001B 00000000  MOV     EDI,00000000
0000:001C 00000000  MOV     EDI,00000000
0000:001D 00000000  MOV     EDI,00000000
0000:001E 00000000  MOV     EDI,00000000
0000:001F 00000000  MOV     EDI,00000000
0000:0020 00000000  MOV     EDI,00000000
0000:0021 00000000  MOV     EDI,00000000
0000:0022 00000000  MOV     EDI,00000000
0000:0023 00000000  MOV     EDI,00000000
0000:0024 00000000  MOV     EDI,00000000
0000:0025 00000000  MOV     EDI,00000000
0000:0026 00000000  MOV     EDI,00000000
0000:0027 00000000  MOV     EDI,00000000
0000:0028 00000000  MOV     EDI,00000000
0000:0029 00000000  MOV     EDI,00000000
0000:002A 00000000  MOV     EDI,00000000
0000:002B 00000000  MOV     EDI,00000000
0000:002C 00000000  MOV     EDI,00000000
0000:002D 00000000  MOV     EDI,00000000
0000:002E 00000000  MOV     EDI,00000000
0000:002F 00000000  MOV     EDI,00000000
0000:0030 00000000  MOV     EDI,00000000
0000:0031 00000000  MOV     EDI,00000000
0000:0032 00000000  MOV     EDI,00000000
0000:0033 00000000  MOV     EDI,00000000
0000:0034 00000000  MOV     EDI,00000000
0000:0035 00000000  MOV     EDI,00000000
0000:0036 00000000  MOV     EDI,00000000
0000:0037 00000000  MOV     EDI,00000000
0000:0038 00000000  MOV     EDI,00000000
0000:0039 00000000  MOV     EDI,00000000
0000:003A 00000000  MOV     EDI,00000000
0000:003B 00000000  MOV     EDI,00000000
0000:003C 00000000  MOV     EDI,00000000
0000:003D 00000000  MOV     EDI,00000000
0000:003E 00000000  MOV     EDI,00000000
0000:003F 00000000  MOV     EDI,00000000
0000:0040 00000000  MOV     EDI,00000000
0000:0041 00000000  MOV     EDI,00000000
0000:0042 00000000  MOV     EDI,00000000
0000:0043 00000000  MOV     EDI,00000000
0000:0044 00000000  MOV     EDI,00000000
0000:0045 00000000  MOV     EDI,00000000
0000:0046 00000000  MOV     EDI,00000000
0000:0047 00000000  MOV     EDI,00000000
0000:0048 00000000  MOV     EDI,00000000
0000:0049 00000000  MOV     EDI,00000000
0000:004A 00000000  MOV     EDI,00000000
0000:004B 00000000  MOV     EDI,00000000
0000:004C 00000000  MOV     EDI,00000000
0000:004D 00000000  MOV     EDI,00000000
0000:004E 00000000  MOV     EDI,00000000
0000:004F 00000000  MOV     EDI,00000000
0000:0050 00000000  MOV     EDI,00000000
0000:0051 00000000  MOV     EDI,00000000
0000:0052 00000000  MOV     EDI,00000000
0000:0053 00000000  MOV     EDI,00000000
0000:0054 00000000  MOV     EDI,00000000
0000:0055 00000000  MOV     EDI,00000000
0000:0056 00000000  MOV     EDI,00000000
0000:0057 00000000  MOV     EDI,00000000
0000:0058 00000000  MOV     EDI,00000000
0000:0059 00000000  MOV     EDI,00000000
0000:005A 00000000  MOV     EDI,00000000
0000:005B 00000000  MOV     EDI,00000000
0000:005C 00000000  MOV     EDI,00000000
0000:005D 00000000  MOV     EDI,00000000
0000:005E 00000000  MOV     EDI,00000000
0000:005F 00000000  MOV     EDI,00000000
0000:0060 00000000  MOV     EDI,00000000
0000:0061 00000000  MOV     EDI,00000000
0000:0062 00000000  MOV     EDI,00000000
0000:0063 00000000  MOV     EDI,00000000
0000:0064 00000000  MOV     EDI,00000000
0000:0065 00000000  MOV     EDI,00000000
0000:0066 00000000  MOV     EDI,00000000
0000:0067 00000000  MOV     EDI,00000000
0000:0068 00000000  MOV     EDI,00000000
0000:0069 00000000  MOV     EDI,00000000
0000:006A 00000000  MOV     EDI,00000000
0000:006B 00000000  MOV     EDI,00000000
0000:006C 00000000  MOV     EDI,00000000
0000:006D 00000000  MOV     EDI,00000000
0000:006E 00000000  MOV     EDI,00000000
0000:006F 00000000  MOV     EDI,00000000
0000:0070 00000000  MOV     EDI,00000000
0000:0071 00000000  MOV     EDI,00000000
0000:0072 00000000  MOV     EDI,00000000
0000:0073 00000000  MOV     EDI,00000000
0000:0074 00000000  MOV     EDI,00000000
0000:0075 00000000  MOV     EDI,00000000
0000:0076 00000000  MOV     EDI,00000000
0000:0077 00000000  MOV     EDI,00000000
0000:0078 00000000  MOV     EDI,00000000
0000:0079 00000000  MOV     EDI,00000000
0000:007A 00000000  MOV     EDI,00000000
0000:007B 00000000  MOV     EDI,00000000
0000:007C 00000000  MOV     EDI,00000000
0000:007D 00000000  MOV     EDI,00000000
0000:007E 00000000  MOV     EDI,00000000
0000:007F 00000000  MOV     EDI,00000000
0000:0080 00000000  MOV     EDI,00000000
0000:0081 00000000  MOV     EDI,00000000
0000:0082 00000000  MOV     EDI,00000000
0000:0083 00000000  MOV     EDI,00000000
0000:0084 00000000  MOV     EDI,00000000
0000:0085 00000000  MOV     EDI,00000000
0000:0086 00000000  MOV     EDI,00000000
0000:0087 00000000  MOV     EDI,00000000
0000:0088 00000000  MOV     EDI,00000000
0000:0089 00000000  MOV     EDI,00000000
0000:008A 00000000  MOV     EDI,00000000
0000:008B 00000000  MOV     EDI,00000000
0000:008C 00000000  MOV     EDI,00000000
0000:008D 00000000  MOV     EDI,00000000
0000:008E 00000000  MOV     EDI,00000000
0000:008F 00000000  MOV     EDI,00000000
0000:0090 00000000  MOV     EDI,00000000
0000:0091 00000000  MOV     EDI,00000000
0000:0092 00000000  MOV     EDI,00000000
0000:0093 00000000  MOV     EDI,00000000
0000:0094 00000000  MOV     EDI,00000000
0000:0095 00000000  MOV     EDI,00000000
0000:0096 00000000  MOV     EDI,00000000
0000:0097 00000000  MOV     EDI,00000000
0000:0098 00000000  MOV     EDI,00000000
0000:0099 00000000  MOV     EDI,00000000
0000:009A 00000000  MOV     EDI,00000000
0000:009B 00000000  MOV     EDI,00000000
0000:009C 00000000  MOV     EDI,00000000
0000:009D 00000000  MOV     EDI,00000000
0000:009E 00000000  MOV     EDI,00000000
0000:009F 00000000  MOV     EDI,00000000
0000:00A0 00000000  MOV     EDI,00000000
0000:00A1 00000000  MOV     EDI,00000000
0000:00A2 00000000  MOV     EDI,00000000
0000:00A3 00000000  MOV     EDI,00000000
0000:00A4 00000000  MOV     EDI,00000000
0000:00A5 00000000  MOV     EDI,00000000
0000:00A6 00000000  MOV     EDI,00000000
0000:00A7 00000000  MOV     EDI,00000000
0000:00A8 00000000  MOV     EDI,00000000
0000:00A9 00000000  MOV     EDI,00000000
0000:00AA 00000000  MOV     EDI,00000000
0000:00AB 00000000  MOV     EDI,00000000
0000:00AC 00000000  MOV     EDI,00000000
0000:00AD 00000000  MOV     EDI,00000000
0000:00AE 00000000  MOV     EDI,00000000
0000:00AF 00000000  MOV     EDI,00000000
0000:00B0 00000000  MOV     EDI,00000000
0000:00B1 00000000  MOV     EDI,00000000
0000:00B2 00000000  MOV     EDI,00000000
0000:00B3 00000000  MOV     EDI,00000000
0000:00B4 00000000  MOV     EDI,00000000
0000:00B5 00000000  MOV     EDI,00000000
0000:00B6 00000000  MOV     EDI,00000000
0000:00B7 00000000  MOV     EDI,00000000
0000:00B8 00000000  MOV     EDI,00000000
0000:00B9 00000000  MOV     EDI,00000000
0000:00BA 00000000  MOV     EDI,00000000
0000:00BB 00000000  MOV     EDI,00000000
0000:00BC 00000000  MOV     EDI,00000000
0000:00BD 00000000  MOV     EDI,00000000
0000:00BE 00000000  MOV     EDI,00000000
0000:00BF 00000000  MOV     EDI,00000000
0000:00C0 00000000  MOV     EDI,00000000
0000:00C1 00000000  MOV     EDI,00000000
0000:00C2 00000000  MOV     EDI,00000000
0000:00C3 00000000  MOV     EDI,00000000
0000:00C4 00000000  MOV     EDI,00000000
0000:00C5 00000000  MOV     EDI,00000000
0000:00C6 00000000  MOV     EDI,00000000
0000:00C7 00000000  MOV     EDI,00000000
0000:00C8 00000000  MOV     EDI,00000000
0000:00C9 00000000  MOV     EDI,00000000
0000:00CA 00000000  MOV     EDI,00000000
0000:00CB 00000000  MOV     EDI,00000000
0000:00CC 00000000  MOV     EDI,00000000
0000:00CD 00000000  MOV     EDI,00000000
0000:00CE 00000000  MOV     EDI,00000000
0000:00CF 00000000  MOV     EDI,00000000
0000:00D0 00000000  MOV     EDI,00000000
0000:00D1 00000000  MOV     EDI,00000000
0000:00D2 00000000  MOV     EDI,00000000
0000:00D3 00000000  MOV     EDI,00000000
0000:00D4 00000000  MOV     EDI,00000000
0000:00D5 00000000  MOV     EDI,00000000
0000:00D6 00000000  MOV     EDI,00000000
0000:00D7 00000000  MOV     EDI,00000000
0000:00D8 00000000  MOV     EDI,00000000
0000:00D9 00000000  MOV     EDI,00000000
0000:00DA 00000000  MOV     EDI,00000000
0000:00DB 00000000  MOV     EDI,00000000
0000:00DC 00000000  MOV     EDI,00000000
0000:00DD 00000000  MOV     EDI,00000000
0000:00DE 00000000  MOV     EDI,00000000
0000:00DF 00000000  MOV     EDI,00000000
0000:00E0 00000000  MOV     EDI,00000000
0000:00E1 00000000  MOV     EDI,00000000
0000:00E2 00000000  MOV     EDI,00000000
0000:00E3 00000000  MOV     EDI,00000000
0000:00E4 00000000  MOV     EDI,00000000
0000:00E5 00000000  MOV     EDI,00000000
0000:00E6 00000000  MOV     EDI,00000000
0000:00E7 00000000  MOV     EDI,00000000
0000:00E8 00000000  MOV     EDI,00000000
0000:00E9 00000000  MOV     EDI,00000000
0000:00EA 00000000  MOV     EDI,00000000
0000:00EB 00000000  MOV     EDI,00000000
0000:00EC 00000000  MOV     EDI,00000000
0000:00ED 00000000  MOV     EDI,00000000
0000:00EE 00000000  MOV     EDI,00000000
0000:00EF 00000000  MOV     EDI,00000000
0000:00F0 00000000  MOV     EDI,00000000
0000:00F1 00000000  MOV     EDI,00000000
0000:00F2 00000000  MOV     EDI,00000000
0000:00F3 00000000  MOV     EDI,00000000
0000:00F4 00000000  MOV     EDI,00000000
0000:00F5 00000000  MOV     EDI,00000000
0000:00F6 00000000  MOV     EDI,00000000
0000:00F7 00000000  MOV     EDI,00000000
0000:00F8 00000000  MOV     EDI,00000000
0000:00F9 00000000  MOV     EDI,00000000
0000:00FA 00000000  MOV     EDI,00000000
0000:00FB 00000000  MOV     EDI,00000000
0000:00FC 00000000  MOV     EDI,00000000
0000:00FD 00000000  MOV     EDI,00000000
0000:00FE 00000000  MOV     EDI,00000000
0000:00FF 00000000  MOV     EDI,00000000
```

**Task1:** Write an ALP that will take in a string of maximum 20 characters from user and display it on the next line on the screen (ASCII equivalent for newline is 0Dh (enter) followed by 0Ah (next line))

**Task2:** Write an ALP that does the following

- (1) Display the string "Enter User Name" and goes to the next line
- (2) Takes in the user entered string compares with user name value already stored in memory
- (3) If there is no match it should exit.
- (4) If there is a match it should display the string "Enter Password" and goes to next line
- (5) Takes in password entered by the user and compares with password already stored in memory
- (6) If there is no match it should exit'
- (7) If there is a match it should display "Hello *Username*"

Note:

While the username is being entered it can be displayed but when password is being entered user pressed key should be displayed instead it should display "\*" for every key pressed.

The user name size is fixed to 10 characters and password to 8 characters.