

ECE 3210 LABORATORY 7

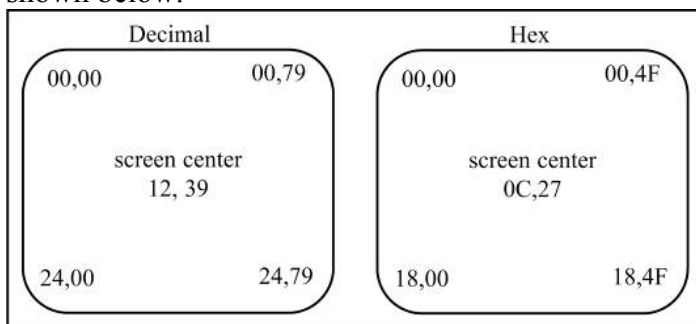
VIDEO PROGRAMMING WITH BIOS INT 10H IN TEXT MODE

OBJECTIVE

To learn about INT 10H to access the video display

BACKGROUND

INT 10H are stored in the BIOS ROM of the IBM PC type computers, and they are used to control the screen video. The monitor screen in normal text mode is composed of 25 rows and 80 columns. There are several types of monitors including: MDA, MCGA, CGA, EGA and VGA. In all these modes the text screen is 80X25 characters long. The text locations are numbered from 0 to 24 for the rows and 0 to 79 for the columns as shown below.



Three Levels of Access (Irvin textbook)

When an application program needs to write characters on the screen in text mode, it can choose among three types of output:

1. **MS-DOS-level access:** Any computer running or emulating MS-DOS can use INT 21h to write text to the video display. Output is quite slow, and you cannot control the text color.
2. **BIOS-level access:** (*The focus of this lab*) Characters are output using INT 10h function, known as BIOS services. They execute more quickly than INT 21h and let you specify the text color.
3. **Direct video memory access:** Characters are moved directly to video RAM (Screen buffer), so execution is instantaneous.

There are two basic video modes on Intel-based systems, ***text mode and graphics mode***. A program can run in one mode or the other, but not both at the same time:

- **In text mode** (*The focus of this lab*) programs write ASCII characters to the screen. The built-in character generator in the BIOS generates a bit-mapped image for each character. A program cannot draw arbitrary lines and shapes in text mode. ***When a computer is booted in MS-DOS, the video controller is set to Video Mode 3 (color text, defaults to 80 columns by 25 rows).*** Figure above represents the screen on text mode 80 x 25.

- **In graphics mode**, programs control the appearance of each screen pixel. The operation is somewhat primitive because there are no built-in functions for line and shape drawing. You can use built-in functions to write text to the screen in graphics mode, and you can substitute different fonts for the built-in fonts.

- **In text mode**

- **Text Video Modes recognized by INT 10H**
- **Example:** *INT 10H Function 00H: Change video mode*

AH = 00H

AL = Video Mode: 03H – 80X25 **CGA** text, 07H – 80X25 **Monochrome** text

Mode	Resolution (columns X rows)	Number of Colors
0	40 × 25	16
1	40 × 25	16
2	80 × 25	16
3	80 × 25	16
7 ^a	80 × 25	2
14h	132 × 25	16

^aMonochrome monitor.

- **Video Text Pages:** Text mode video memory is divided into multiple separate video pages, each with the ability to hold a full screen of text. Programs can display one page while writing text to other hidden pages, and they can rapidly flip back and forward between pages. In the days of high-performance MS-DOS applications, it was often necessary to keep several text screens in memory at the same time. The default video page is **Page 0**.
- **Attributes:** each screen character is assigned an attribute byte that controls both the color of the character (called the foreground) and the screen color behind the character (called the background). Each position on the video display holds a single character, along with its own attribute (color). The attribute is stored in a separate byte, following the character in memory.
- **Blinking:** Characters on the video display can blink. The video controller does this by reversing the foreground and background colors of a character at a predetermined rate. By default, when a PC boots into MS-DOS mode, blinking is enabled. It is possible to turn blinking off using a video BIOS function. Also, blinking is off by default when you open up an MS-DOS emulation window under MS-Windows.

Monochrome display attributes

Blinking	Background			Intensity	Foreground		
D7	D6	D5	D4	D3	D2	D1	D0

D7 Non-blinking= 0

Blinking = 1

D3 Normal intensity = 0

Highlighted intensity = 1

D6 D5 D4 and D2 D1 D0 White = 0 0 0

Black = 1 1 1

CGA display attributes

Blinking	Background			Intensity	Foreground		
	R	G	B		R	G	B
D7	D6	D5	D4	D3	D2	D1	D0

D7 Non-blinking= 0

Blinking = 1

D3 Normal intensity = 0

Highlighted intensity = 1

Both blinking and intensity are applied to foreground only.

D6 D5 D4 and D2 D1 D0 Color as defined on the following table

Color Attributes

I	R	G	B	Color
0	0	0	0	Black
0	0	0	1	Blue
0	0	1	0	Green
0	0	1	1	Cyan
0	1	0	0	Red
0	1	0	1	Magenta
0	1	1	0	Brown
0	1	1	1	White
1	0	0	0	Gray
1	0	0	1	Light blue
1	0	1	0	Light green
1	0	1	1	Light cyan
1	1	0	0	Light red
1	1	0	1	Light magenta
1	1	1	0	Yellow
1	1	1	1	High intensity white

Examples-course website:

LAB7EX2.ASM (Monochrome mode)

LAB7EX3.ASM (CGA mode)

LAB7EX4.ASM (0A function write to screen)

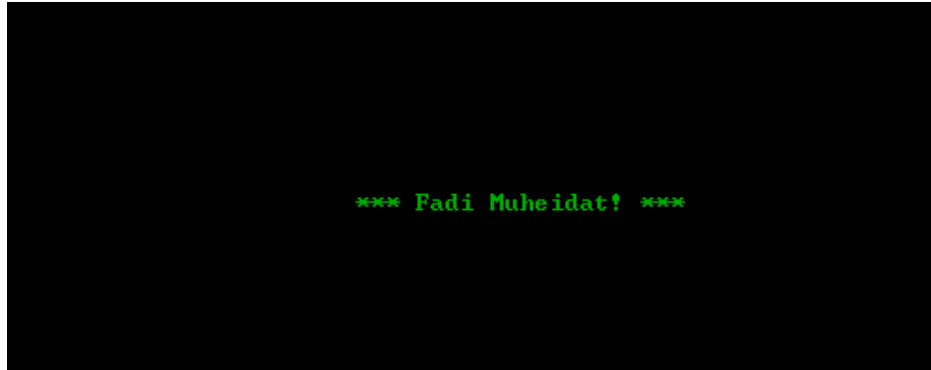
LAB7EX5.ASM (colors)

INT 10h Video Functions: See Appendix

Several functions are performed by INT 10H, therefore the programmer needs to identify which one is being used by storing an appropriate value in register AH. Depending on the function being used, other register may be used to pass information to the interrupt subroutine.

PRELAB

1. Write a code to *display your name* in foreground color GREEN and background BLACK



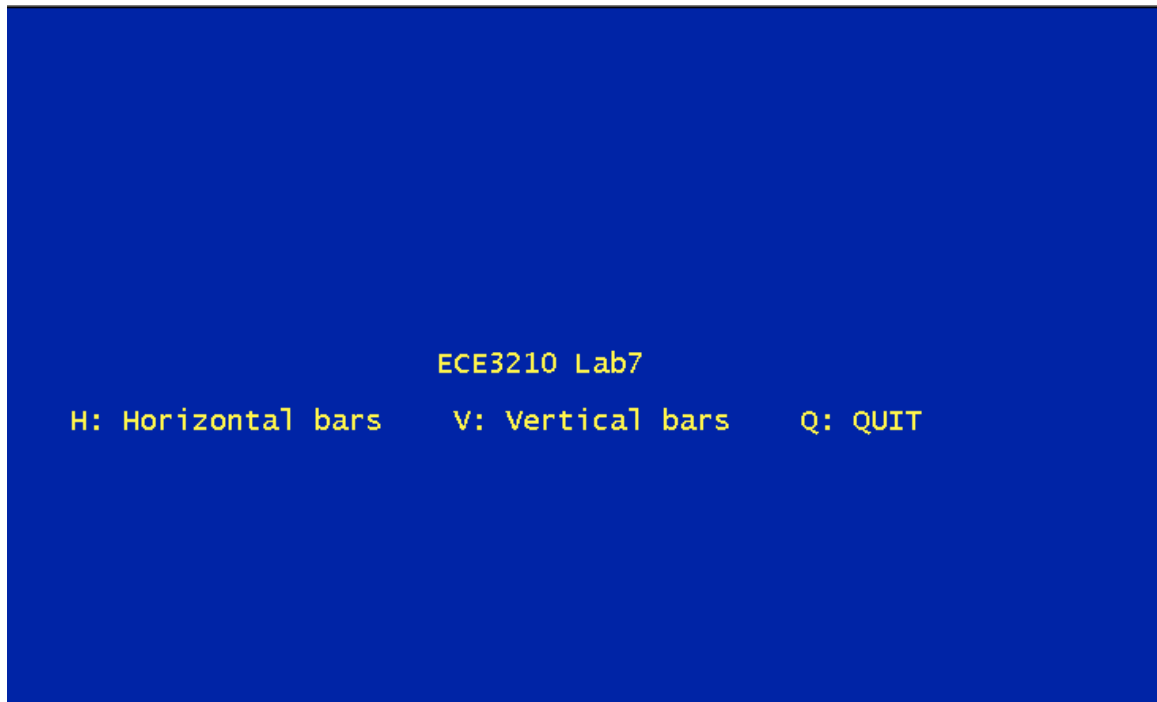
2. Modify the code *Lab7EX3.asm* to write the first 4 letters of your Name



LABORATORY

1. Create the following Menu
2. For each choice generate the chosen pattern. Make sure the patterns have three differently colored bars.

3. Display the new screen until any key '**B**' is pressed on the keyboard then return to the main screen to display the menu of choices again.



Sample run

