



Module 11

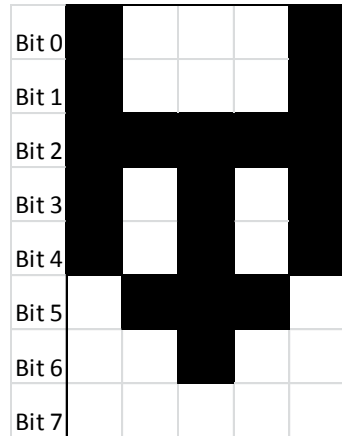
Activity: Liquid Crystal Display



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Question 1

Define a personal image that you would like to display. Make it 7 pixels high and 5 pixels wide. For example, the University of Texas at Austin symbol is a UT.



This image can be defined in the font table as the 5 8-bit numbers
{0x1f, 0x24, 0x7c, 0x24, 0x1f}

Notice bit 0 is on top, and notice bit 7 is clear. See the last two lines of the ASCII table in the **Nokia5110.c** file. Place the 5 8-bit numbers that define your image into the 0x7F line, and test it by outputting
Nokia5110_OutChar(0x7F);

Question 2

Assume the SPI clock is 12 MHz. Assume each character has a blank vertical line to the left and to the right of 8 tall by 5 wide image. In other words to output the above UT symbol the software must output these data
{0x00, 0x1f, 0x24, 0x7c, 0x24, 0x1f, 0x00}

Approximately how long does it take to draw one ASCII character on the LCD?

Question 3

Notice in the Nokia5110.c file there are a set of functions that operate on a RAM buffer called screen. This functions are

Nokia5110_ClearBuffer	Clears the buffer (not the LCD)
Nokia5110_PrintBMP	Draw image into buffer
Nokia5110_ClrPxl	Clear pixel in buffer
Nokia5110_SetPxl	Set pixel in buffer
Nokia5110_DisplayBuffer	Displays buffer on LCD

The way the driver is used is to

- 1) Call **ClearBuffer**
- 2) Call **PrintBMP ClrPxl SetPxl** as needed to form the image
- 3) Call **DisplayBuffer** to update the display

As long as the 1-2-3 sequence occurs faster than 30 times/sec, the display looks continuous to the human eye.

Part a) Develop a function that draws a straight line into this buffer. The x coordinates vary from 0 to 47, and the y coordinates vary from 0 to 63. You may call any of the existing Nokia5110.c functions.

```
Nokia5110_Line(uint8_t x1, uint8_t y1,  
uint8_t x2, uint8_t y2);
```

Part b) Develop a function that draws an unfilled rectangle into this buffer. The x coordinates vary from 0 to 47, and the y coordinates vary from 0 to 63. You may call any of the existing Nokia5110.c functions. The two points are opposite corners of the rectangle.

```
Nokia5110_Rect(uint8_t x1, uint8_t y1,  
uint8_t x2, uint8_t y2);
```

Part c) Develop a function that draws a filled rectangle into this buffer. The x coordinates vary from 0 to 47, and the y coordinates vary from 0 to 63. You may call any of the existing Nokia5110.c functions. The two points are opposite corners of the rectangle.

```
Nokia5110_RectFill(uint8_t x1, uint8_t y1,  
uint8_t x2, uint8_t y2);
```

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