Texas Instruments Robotics System Learning Kit
Module 11
Quiz: Interfacing Graphical Displays
Quiz: Liquid Crystal Display

The SPI status register is located at 
**EUSCI_A3->STATW** (bit 0 is **UCBUSY**)

The SPI flag register is located at 
**EUSCI_A3->IFG** (bit 0 is **RXIFG**, and bit 1 is **TXIFG**)

The 8-bit output data register is located at 
**EUSCI_A3->TXBUF**

The 8-bit input data register is located at 
**EUSCI_A3->RXBUF**

Q1 Busy-wait synchronization
Assume an output peripheral device is interfaced to UCA3 on the MSP432. The MSP432 is the master. Use busy-wait synchronization on **UCBUSY** to write a function that outputs an 8-bit value to the device.

a) There are two options for busy-wait synchronization. 1) Wait for **UCBUSY** to be 0, then output. 2) Output, then wait for **UCBUSY** to be 0. Given a complex system with many tasks to perform, which option is more efficient?

b) Write the function that has the following prototype is

```c
void SPI_OutByte(uint8_t data);
```

c) Write the function that outputs 100 bytes to the device. The function should have the following prototype is

```c
void SPI_OutBuffer(uint8_t buf[100]);
```

Q2 Busy-wait synchronization
Assume an input peripheral device is interfaced to UCA3 on the MSP432. The MSP432 is the master. Use busy-wait synchronization on **RXIFG** to write a function that inputs an 8-bit value to the device. Write the function that has the following prototype is

```c
uint8_t SPI_InByte(void);
```

Q3 Speed of SPI
Assume the SPI clock is 12 MHz. In the Nokia5110.c software driver, there is an array that contains one 84 by 48 LCD image (48*84 = 4,032)

```c
#define SCREENW 84
#define SCREENH 48
uint8_t Screen[SCREENW*SCREENH/8];
```

The function **Nokia5110_DisplayBuffer** sends this entire buffer to the LCD. Approximately how long does this function take to execute?

4 Fundamentals of SPI
Consider the MSP432 to Nokia5110 interface from lab.

Assume the SPI clock is 12 MHz. Make a rough sketch of the waveforms creates as one data byte (value=0x12) is transmitted from MSP432 to LCD. RST will be high and DC will be high. Show the remaining 3 signals

- **SCE** = P9.4 STE
- **DC, data/command**
- **DN, SIMO** = P9.7 SIMO
- **SCLK** = P9.5 CLK
- // bit15 **UCCKPH = 1**: data shifts in on first edge, out on following edge
- // bit14 **UCCKPL = 0**: clock is low when inactive