ECE 1175 - Homework 2 Solutions

Question 1

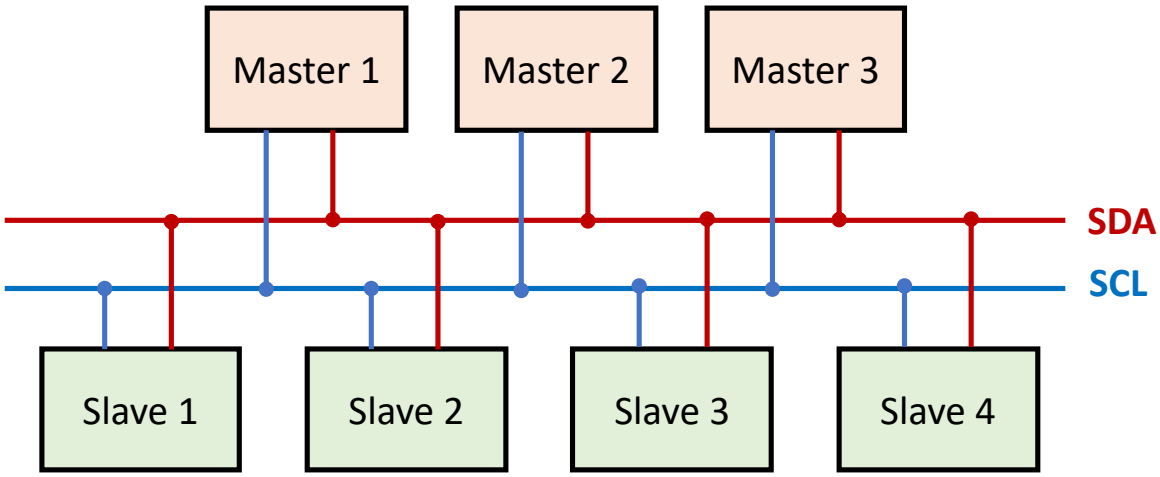
Each program trying to access the shared memory should use the following code to ensure mutual exclusion.

```
// attempt lock, and test if success or not
TestAndSet(){
    oldValue = peek(LOCK);
    poke(LOCK, true);
    return oldValue;
}

// wait until lock is acquired
while(TestAndSet());

// proceed to r/w the locked memory
// ...

// release lock after r/w is finished
poke(LOCK, false)
```

Question 2

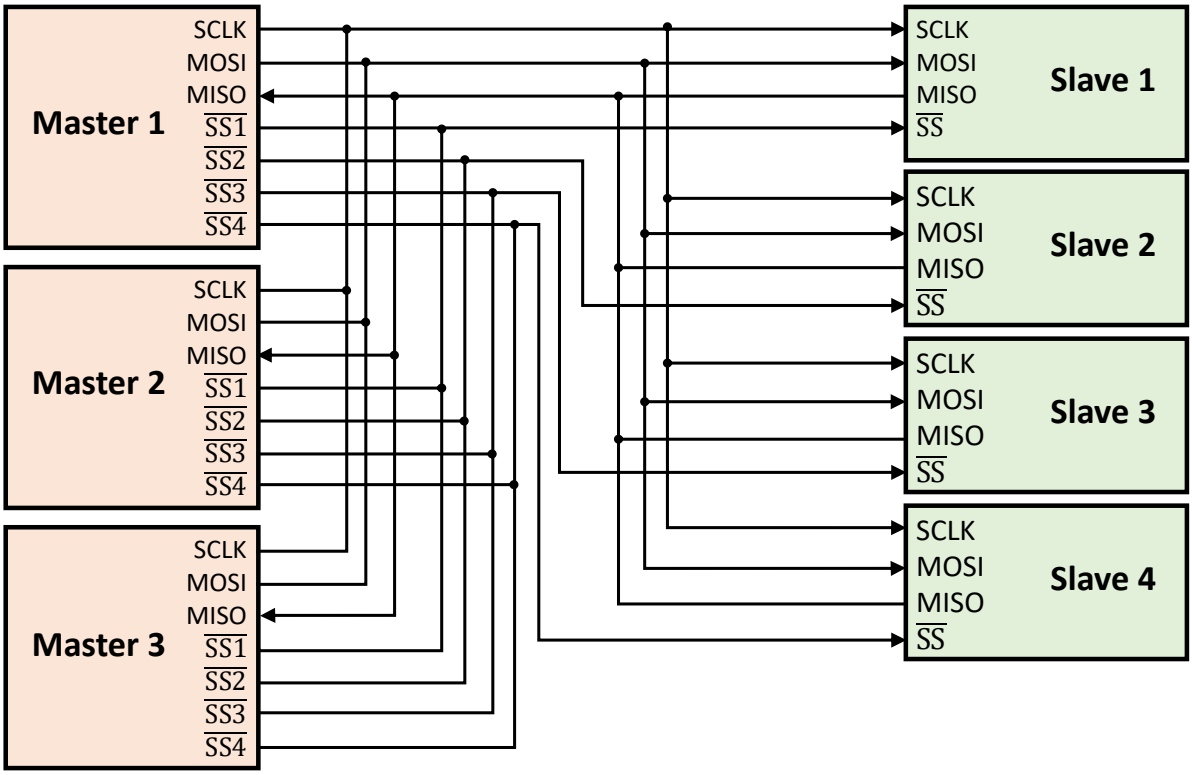
I2C connection

Simply attach all the masters and slaves to the SDA and SCL in parallel. And let the protocol itself to deal with signal collision on lines.



SPI connection

Please refer to the block diagram on page 20 of Practical I/O Interfaces lecture slides. Each master should be connected with all the slaves in the same way.



Question 3

I2C r/w

The duration for each clock cycle should be

$$T_c = \frac{1}{10\ \mathrm{MHz}} = 10^{-7}\ \mathrm{s}$$

The number of clock cycles consumed by each r/w of 1kB data should be (address + w/r + data transfer + ack)

$$N_{\mathrm{r/w}} = (7 + 1 + 1) + 1000 \times (8 + 1) = 9009$$

1k times of r/w lasts

$$T = 1000 \times N_{\mathrm{r/w}} \times T_c = 0.9009\ \mathrm{s}$$

SPI r/w

The number of clock cycles consumed by each r/w of 1kB data should be (instruction + data transfer)

$$N'_{\mathrm{r/w}} = 8 + 1000 \times 8 = 8008$$

1k times of r/w lasts

$$T' = 1000 \times N_{\mathrm{r/w}} \times T_c = 0.8008\ \mathrm{s}$$

Question 4

Assembly code is very architecture-specific. It's OK to use other instruction sets (e.g. MSP430) if you are not familiar with ARM.

```
MOV r0, #0    ; i
MOV r1, #0    ; num1
MOV r2, #0    ; num2
loop:
CMP r0, #5
BGE else          ; branch if i >= 5
ADD r1, r1, #1    ; num1++
BL endif
else:
ADD r2, r2, #1    ; num2++
endif:
ADD r0, r0, #1    ; i++
CMP r0, #10
BLE loop          ; continue if i <= 10
```