

EE 215 Homework 6 Solution

1. Communications definitions. (10 pts)

Use sentences to describe the difference between:

a. serial and parallel?

Serial uses a single wire to transfer data bits one at a time. Parallel uses multiple wires to transmit data on all the wires at the same time.

b. synchronous and asynchronous?

Synchronous (chronos=time) uses a clock for the communication protocol, asynchronous does NOT use a clock for transmitting.

c. bus controller and contention?

A bus controller determines who is allowed to communicate in a communication system. Contention is how many users determine who will control without a single controller that is directing the action.

d. Duplex and half duplex?

Duplex (or full duplex) is communication in both directions at the same time (ex: SPI), and half duplex is communication in one direction at a time on a single medium (one wire or a wireless channel).

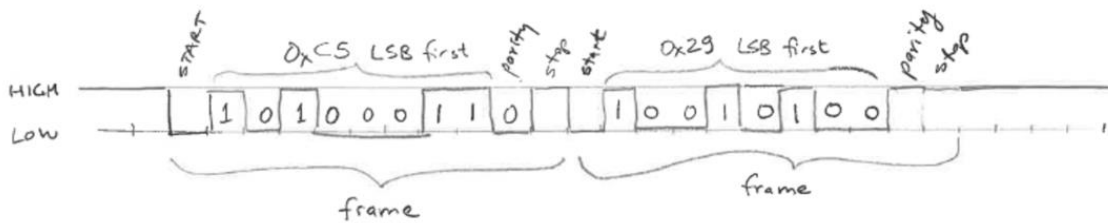
e. Master and slave?

The master device controls communication by providing a clock and other signals. The slave responds to the master signals (and does not need a clock in synchronous systems.)

2. UART (20 pts)

Draw the UART protocol data exchange for the data (0x C5, 0x 29) using 8E1 (8 bits of data, even parity, 1 stop bit). Label the frames. If the baud rate is 300 bps, what is the data rate? Why does the receiver have to sample this data?

the data: C5 = ^{MSB} 1 1 0 0 0 1 0 1 ^{LSB} # of 1 bits = 4 parity bit = 0 ← to make it an even number of bits.
 29 = 0 0 1 0 1 0 0 1 3 1



band rate = 300 bps

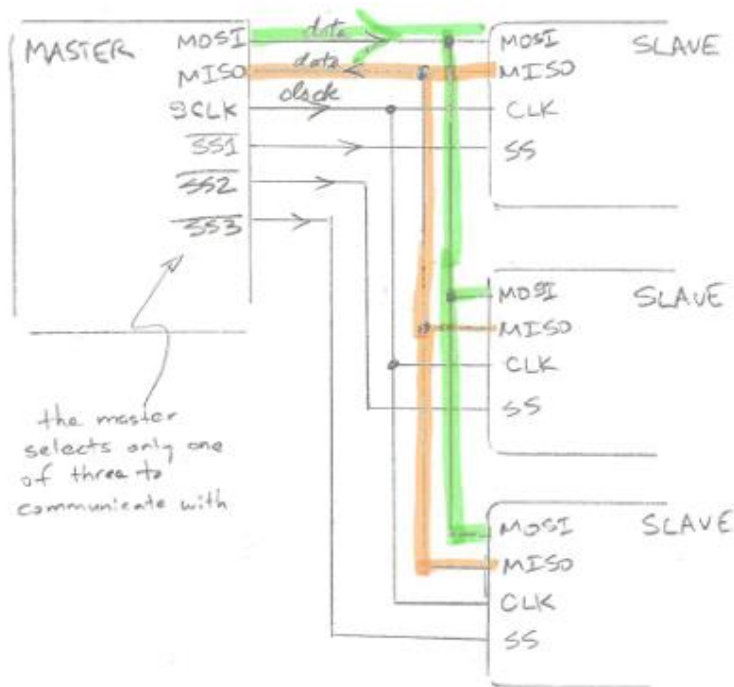
useful data is only 8 of 11 bits, in a frame. = $\frac{8}{11} = 72.7\%$

$300 \left(\frac{8}{11} \right) = \boxed{218 \text{ bps}}$ the data rate < band rate

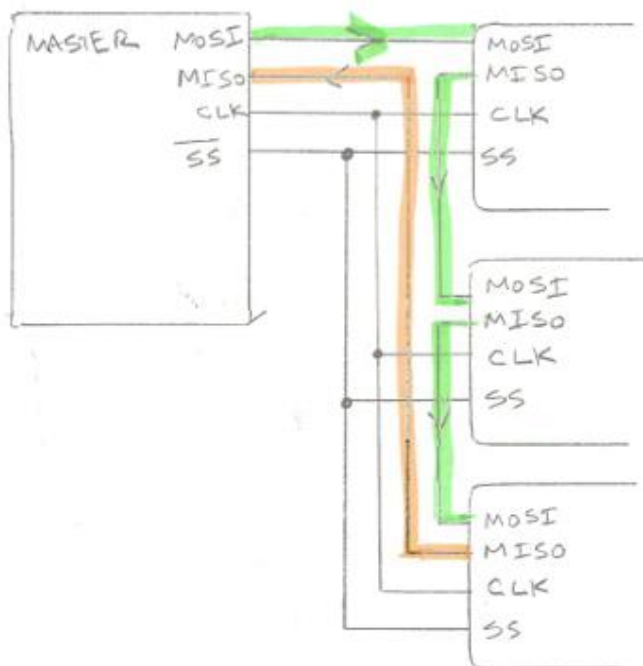
The receiver has no clock to reference the change of the signal.
 The receiver must sample this signal to detect when it starts.

3. SPI (10 pts) Draw the two possible configurations for one master device and 3 slave devices. Label all wire connections with their names.

SPI with 3 slaves : common bus



SPI with 3 slaves, cascade



data flows through
all slaves (cascade)

one ss line at master