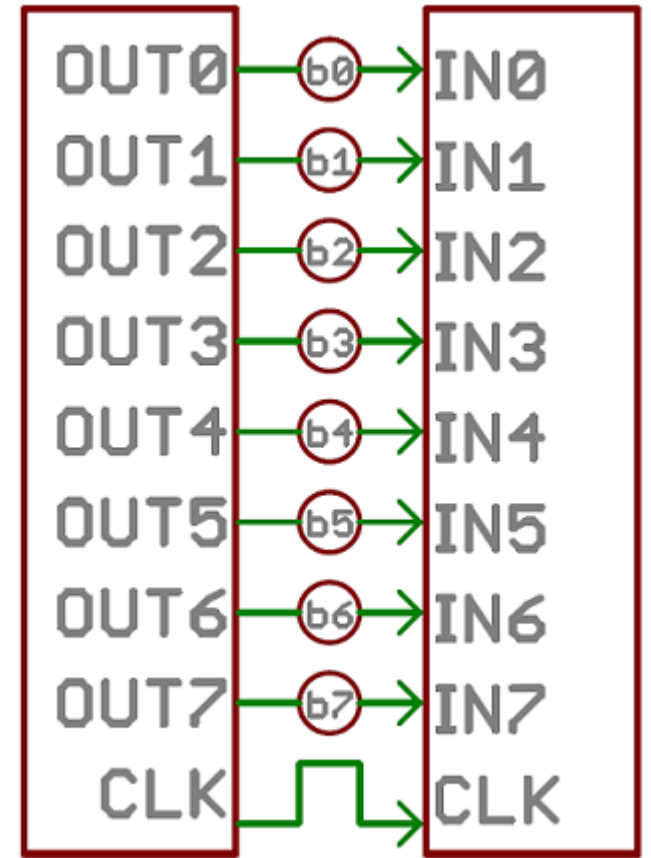
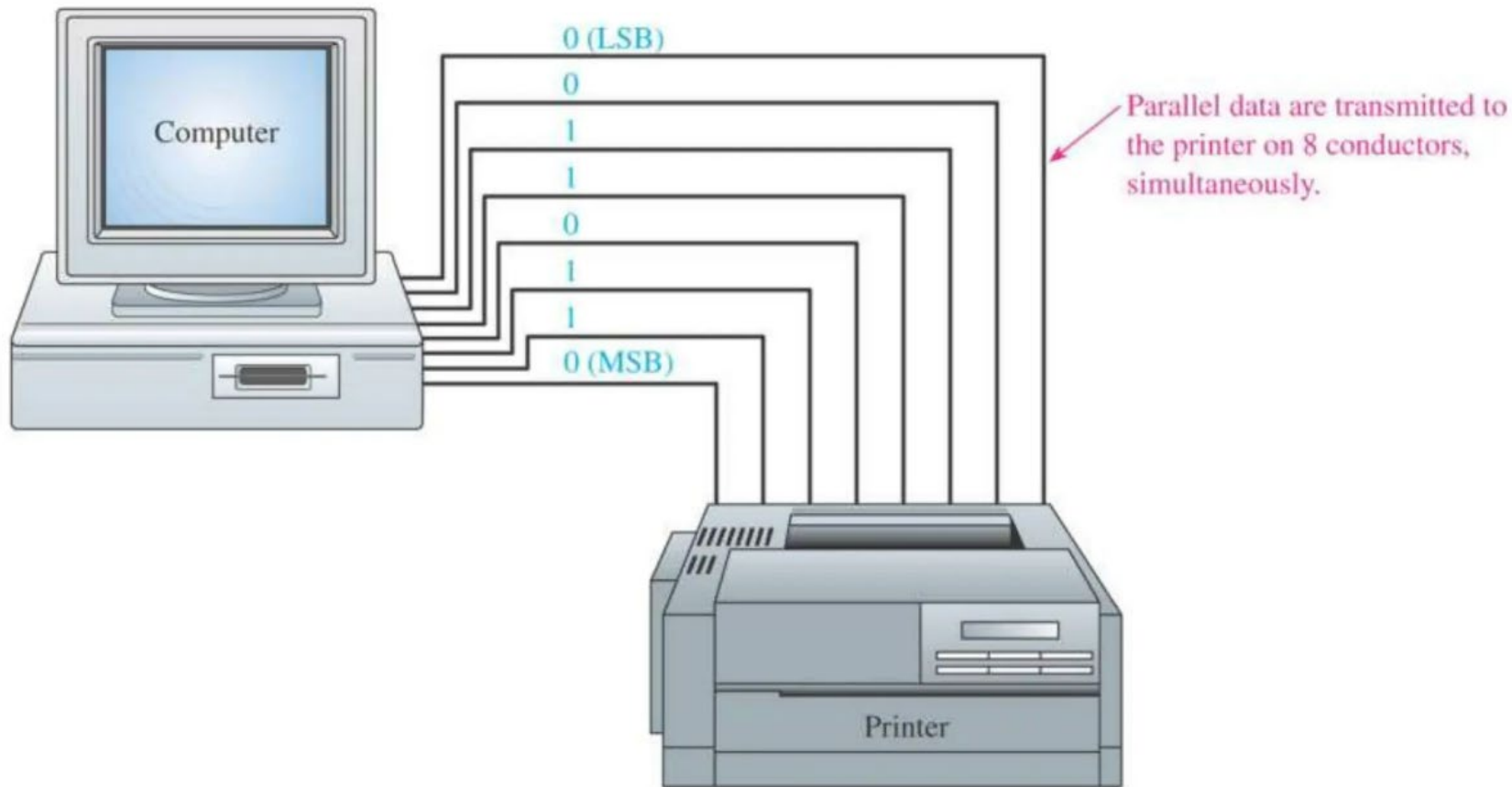


# P524: Survey of Instrumentation and Laboratory Techniques

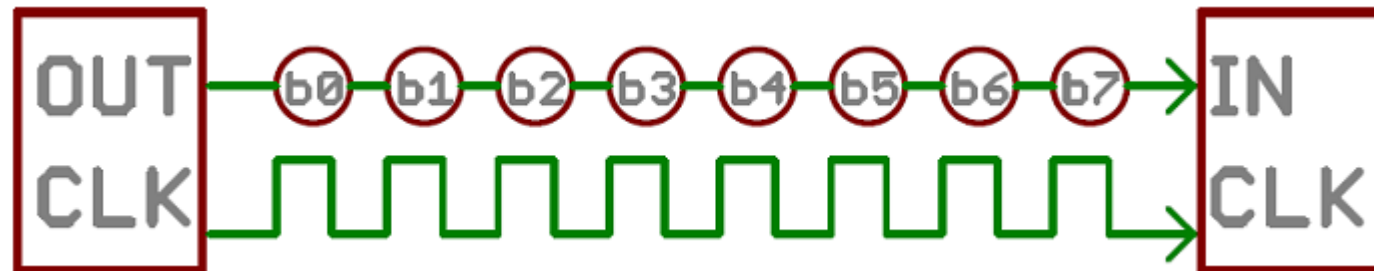
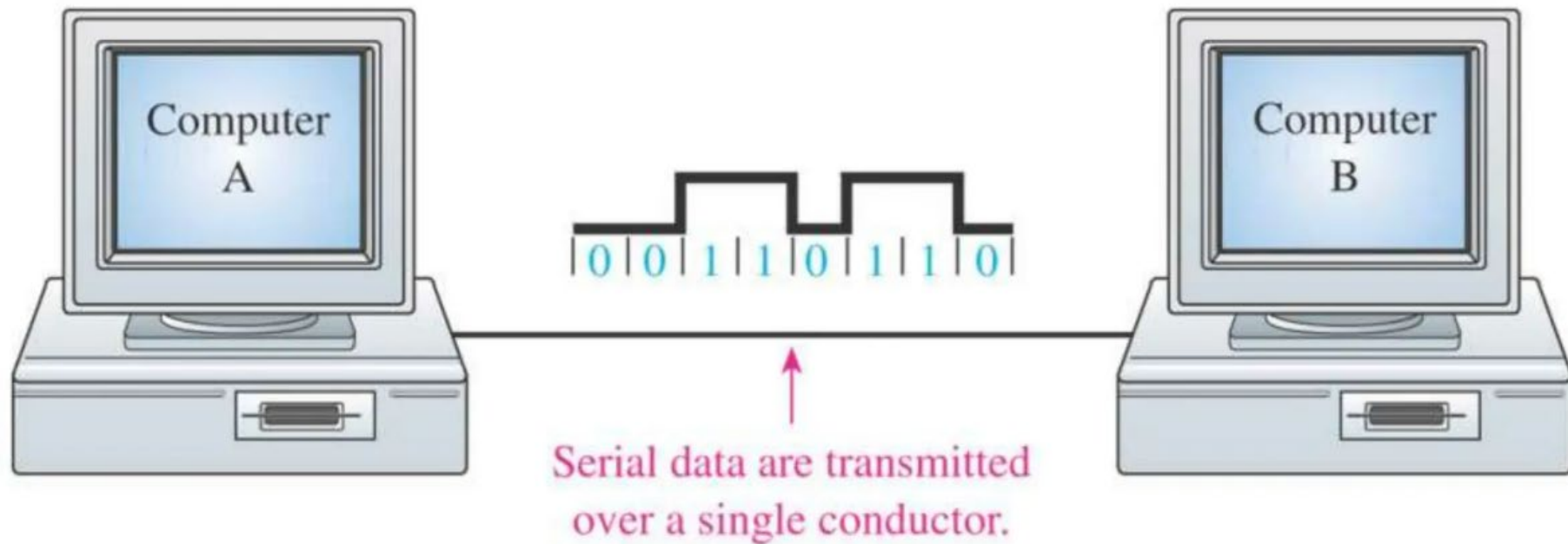
## Week 7: Serial Communications, Oscilloscope

10/6/2026

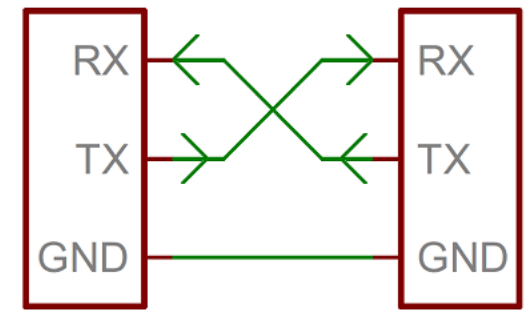
# Parallel communication between a computer and a printer



# Serial communication between computers



# Asynchronous serial protocol



Hardware wiring:

E.g.: Ultimate GPS, Bluetooth, serial LCD

- Baud Rate (bits-per-second): Baud rates can be just about any value within reason. The only requirement is that both devices operate at the same rate. **9600 bps, or 960 bytes per second** for non-critical applications. Other "standard" baud are 1200, 2400, 4800, 19200, 38400, 57600, and 115200.
- Framing the data: Each block (usually a byte) of data transmitted is sent in a packet of frame of bits:

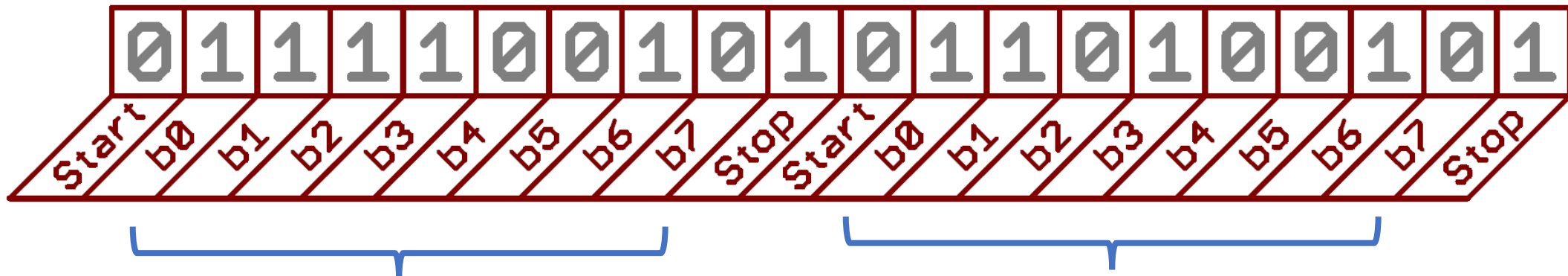


- Synchronization bits: The start and stop bits mark the beginning and end of a packet.
- Parity bit: sum 5-9 bits of data byte: even/odd for error checking

# 9600 8N1 Protocol: 9600 baud, 8 data bits, no parity, and 1 stop bit

one of the most commonly used serial protocols.

A device transmitting the [ASCII](#) characters 'O' and 'K' would have to create two packets of data:



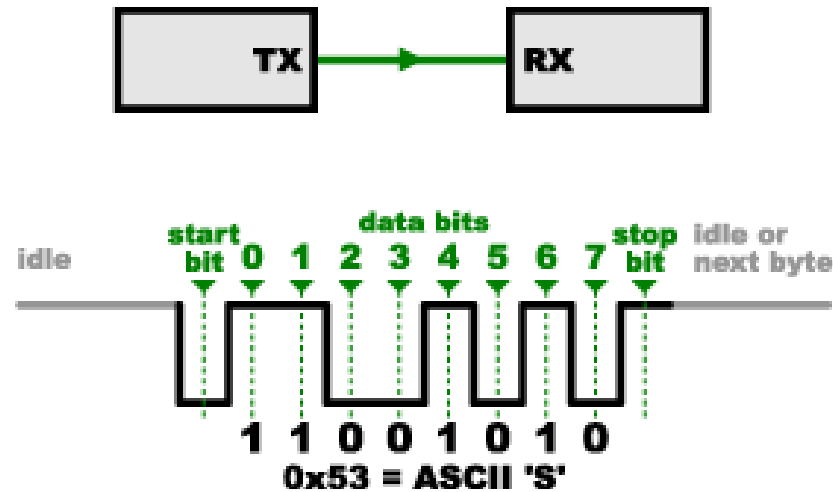
The ASCII value of O (that's uppercase) is 79, which breaks down into an 8-bit binary value of 01001111.

K's binary value is 75, or binary: 01001011.

**Endianness:** Is data sent most-significant bit (msb) to least, or vice-versa? If it's not otherwise stated, you can usually assume that data is transferred **least-significant bit (lsb) first**.

# Asynchronous vs Synchronous serial protocols

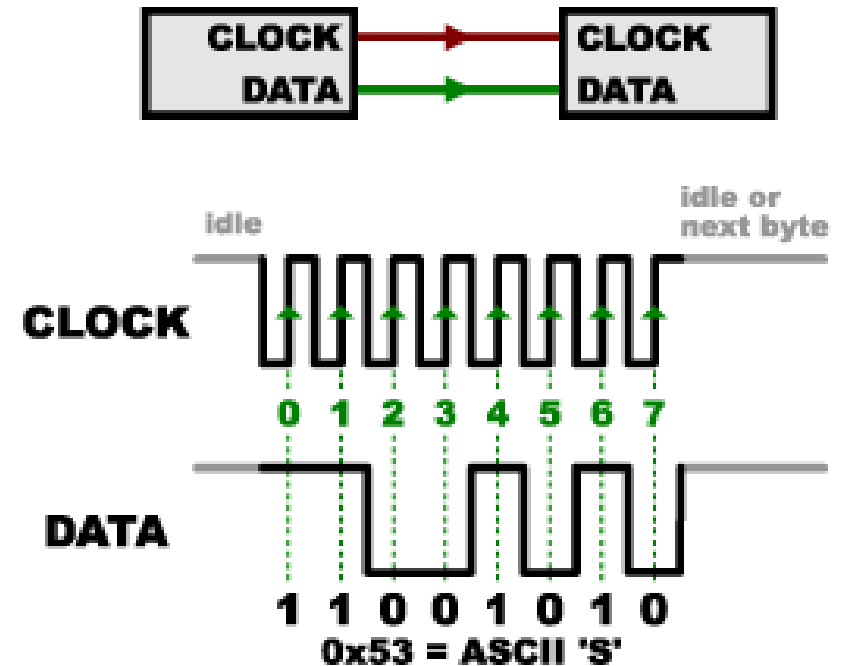
## Asynchronous:



The start bit is always indicated by an idle data line going from 1 to 0, while the stop bit(s) will transition back to the idle state by holding the line at 1.

Complex hardware to strip data bits

## Synchronous:



- Because the clock is sent along with the data, specifying the speed isn't important
- Save the start and stop bits; simple hardware converts to parallel

# In-class assignment and Homework (due 10/13\*)

- 1. Please read all three SparkFun tutorials listed near the start of unit 3 writeup.
- 2. SPI and I2C BME: Wire up and demonstrate 2 BME sensors, one with I2C interface (original), the other with SPI

\* With all troubleshooting, if needed; as a practical matter it should be running by 10/8