TO: Prof. Pierre-Emmanuel Gaillardon, Course Instructor
FROM: David Venegas
DATE: February 20th, 2024
SUBJECT: Pre-Lab 04 (UART)

1. **What is the difference between a parallel and serial interface?**

<u>**Parallel:**</u> Transmit blocks of data using multiple wires, with each wire representing the value of a single binary bit. In a parallel system, the transmitter sets the logical state of each wire, and the receiver samples all of the connections at a single instant. Parallel interfaces have a bit-width which represents how many wires are in the connection and indicates how many bits the line sends at one time. Common bit-widths are powers of 2 to simplify bit conversion.

<u>**Serial:**</u> Use a single wire to stream a block of data over time by lining up the bits one after another in succession; to transmit data properly, both the transmitter and receiver must agree on the time duration between data bits, which is the interface's bits/data rate. A serial transmitter produces periodic transitions on the single data line corresponding to the data that it sends; the receiver samples this data line at a particular frequency and appends the sampled value to the end of the received data.

2. **What is the difference between a synchronous and asynchronous interface?**

<u>**Synchronous:**</u> Use a separate "clock" signal to notify the receiver when to sample; the data capture often synchronizes to a transition like a rising or falling edge of the clock. Synchronous systems are often simpler in design, but they do require the extra clock connection.

<u>**Asynchronous:**</u> operate without a physical clock signal. Some asynchronous communications encode a virtual clock within the transitions of the data, while others estimate the time intervals that data should arrive. The lack of a clock signal necessitates more complex asynchronous interconnects, and they also have lower data rates than synchronous connections.

3. **What is one thing that a communication protocol does?**

- Low level or hardware protocols define how bits form the raw data; this primarily involves the sample data rate and whether the interface is asynchronous or has an explicit clock signal.

- Software protocol is a device driver that gives meaning to the binary data flowing into and out of the system; these drivers may be as simple as recognizing certain values as commands, or as complex as defining the organization of variable-length data packets.

4. What does the baud rate of a signal mean?

The transmitter and receiver must operate on a predetermined period between bits. This frequency—known as the Baud Rate—represents the number of bits per second that the sender transmits.

5. What register in the USART would you use to enable the transmitter hardware?

Control register 1 (USART_CR1)

6. Does the transmit (TX) line of the USB-USART cable connect to the transmit (TX) or receive (RX) of the STM32F0?

To communicate, the transmitter of one device must be connected to the receiver of the other. If necessary, refer to the following when connecting the cable to the board:

USB-UART Transmit (TX) →STM32F0 Receive (RX)
USB-UART Receive (RX) →STM32F0 Transmit (TX)