**CHE244**

**Stoll**

**Spring 2020**

**Assignment #6 – Communication in Chemical Instrumentation – 15 points – Due May 15th**

Almost all modern chemical instrumentation relies on electronic communications between some kind of information processor or controller, and the components that do the real work of the instrument (e.g., lamps, detectors, motors). The methods and protocols used for these communications have changed dramatically over the past few decades. Please browse through the following links with reading material on the main communication protocols and approaches used in chemical instrumentation, and then answer the questions below.

[**Overview of Communication Approaches**](https://www.totaltemptech.com/controlling-instruments-with-gpib-ethernet-usb-or-what-is-next/) – START HERE – this is a great high level overview of some of the options and how they related to one another.

**Serial** – The [Wikipedia entry](https://en.wikipedia.org/wiki/Serial_communication) is solid here.

**RS-232** – One of the most used protocols for serial communication. The [Wikipedia entry](https://en.wikipedia.org/wiki/RS-232) is solid here.

**General Purpose Interface Bus (GPIB**) – Some of the older LC instruments in the Stoll Lab still use this communication protocol (look for the fat grey cables). We have a few useful sources here. The history of this approach dates to the early days of Hewlett Packard, and [this piece](https://www.hp9845.net/9845/tutorials/hpib/) tells that story. The [Wikipedia entry](https://en.wikipedia.org/wiki/IEEE-488) is also useful. Finally, Contec has a useful guide [here](https://www.contec.com/support/basic-knowledge/daq-control/gpib-communication/).

**Controller Area Network (CAN**) – All of the modern LC instruments in the Stoll Lab use this approach for communication between modules. Here the [Wikipedia entry](https://en.wikipedia.org/wiki/CAN_bus) is useful, and there is a [good explanation](https://www.ni.com/en-us/innovations/white-papers/06/controller-area-network--can--overview.html#section--206487379) at the National Instruments website as well.

**Ethernet** – Here the [Wikipedia entry](https://en.wikipedia.org/wiki/Ethernet) gives the level of detail we need at the moment.

**Questions**:

1. Explain how serial communication is functionally different from the GPIB approach.
2. What are some of the advantages of GPIB over other options that allow it to persist in the instrumentation industry even though it is a pretty old technology?
3. What are some of the disadvantages of GPIB relative to newer technologies such as CAN and Ethernet?
4. What are the approximate maximum data transfer rates of the following approaches?
   1. Serial
   2. GPIB
   3. Ethernet
5. Even though it is technically possible to do instrument control and data acquisition over WiFi for instruments including chromatography and spectroscopy, we see very little of this actually happening in industry laboratories. Why do you think this is the case?