Serial communications

Introduction

The first 5 labs in this class will entail either writing text to the screen or reading user input from the keyboard. Normally this is done using a terminal and on the same computer as the program is running on, but for this class we run all of our code on the Uno32 boards. Therefore to communicate with them we use serial communications (run over USB nowadays). To do this we need special software called a serial terminal that handles the low-level details of sending and receiving data.

Software

There is no cross-platform tool that works well for serial communications, so we have different tools depending on your platform:

- Windows - Hercules
- Linux - Cutecom
- Mac OS X - CoolTerm

Read the Tools Installation document on the website for details on how to install these on your platform. The lab computers already have the appropriate tools installed.

Communicating over serial

On Windows using Hercules

Hercules is the best option we have on Windows for the simple serial communications we will be doing. It allows for sending typed and planned text with arbitrary characters, and configuring the COM port and baud rate. The only thing it doesn't do is automatically list all serial ports.

Determining your serial port number

This is done by opening the start menu and searching for "devices", which will yield the "Devices and Printers" menu within the Control Panel. Open this. Under the Unspecified section you should see "FT232R USB UART" and double-click on it. Switching to the "Hardware" tab you will see a line like "USB Serial Port (COM42)",...
this will tell you what COM port the Uno32 is connected over. Remember this number and close all the Properties window and the Devices and Printers window.

**Connecting to the Uno32**

In Hercules, switch to the 2nd tab labeled "Serial". On the right are the configuration options and then the "Open" button. Type in COM## in the "Name" box, where ## is the number you found in the last section, in my case it's 42. Now set the "Baud" option to 115200, this is the speed we will be connecting at. Now, click the "Open" button.

**Sending data**

Transmitting data can be done in two ways. In the first way, you can just click in the textbox under "Received/Sent data" and start typing. This will transmit data as you type it. You will need to set the newlines to use Unix line endings by right-clicking on the text box, selecting "Transmit EOL", and setting this to "LF (Unix)". You will likely have to do this every time on the lab computers, but this setting should stick on your own computer.

The second way to transmit data is to use the "Send" textfields at the bottom of the window. This sends your data all in one go and will be useful for the BattleBoats lab during testing. Note that there are some special rules with sending data this way, which is shown in a tooltip if you hover over the textfield. Basically if you want to send a single $, you have to type it twice. And to send a newline character, use the string "<lf>" to indicate a linefeed.

**On Linux using Cutecom**

Cutecom is a reliable GUI interface to the serial ports on a Linux machine. Screen is available if you'd prefer a command line interface, but we won't discuss that here and the internet will be your resource if you'd like to use it.

**Determining your serial port number**

Available serial ports on a Linux computer are listed as tty devices under the "/dev/" folder. To see which are available on your system open a terminal emulator and run the following command:

```
ls /dev/tty*
```

In the resultant list, you should see some at the end like /dev/ttyUSB0, those will be what you want to connect to. There should be only one, so just use that, otherwise you'll need to experiment to find the right one.
Running Cutecom
Now launch Cutecom. You may need to be root in order to access the serial ports, so if the following directions don't work, try again using `sudo`. To fix this issue, you'll need to search the Internet for help, as it varies between Linux distributions.

Connecting to the Uno32
In Cutecom type the type in the full path to the serial port in the "Device" field, so in my case "/dev/ttyUSB0". Set the "Baud rate" to 115200 and click "Open device".

Sending data
Sending data can be done by typing into the "Input" textfield at the bottom and hitting Enter. You will need to set the drop-down menu that says "No line end" to "LF line end" for the newline character to actually be transmit. This setting should be remembered, however, so you should only need to do it once.