Name_____

EET 2261 Lab #10
Serial Communications Interface

1. Transmitting Data Over the Serial Communications Interface (SCI)

1. Connected to your computer is a cable whose free end has a 9-pin male connector. Attach this connector to your Dragon12's 9-pin female connector.

2. Make sure that the switch box under your desk is set in position A. (This position selects the cable that we're using. Position B selects the other cable, which ends in a female connector.)

3. In a web browser or other program, open the file named **Lab10SerialTransmit.txt** from the course website or http://nreeder.com/eet2261/mod10.htm.

4. Read through the program, including the comments. Notice that in addition to configuring SCI1 in the initialization code, the program has a Transmit subroutine that uses polling to transmit a single character, and a main loop that calls this subroutine several times.

5. Create a CodeWarrior project named **Lab10SerialTrasmit,** choosing **HCS12 Serial Monitor** on the New Project Wizard's first page.

6. Open your project's main.asm file and replace its contents with the code from **Lab10SerialTransmit.txt**.

7. Before running the program, follow these steps to start and configure Windows HyperTerminal on your personal computer:
   - In the Windows Start menu, click **All Programs > Accessories > Communications > HyperTerminal**.
   - In the Connection Description dialog box, type **HCS12** for the Name, and click **OK**.
   - In the Connect To dialog box, select **COM1**, since that's the port on our computer that is connected to the cable that we're using.
   - In the COM1 Properties dialog box, select **9600** for Bits per Seconds, **8** for Data bits, **None** for Parity, **1** for Stop bits, and **None** for Flow control. Then click **OK**.
   - You should now see a blank HyperTerminal window with a blinking cursor.

8. Back in CodeWarrior, run your program and then switch back to the HyperTerminal window. It should quickly fill up with copies of the word **Hi!**. This text is being sent from the HCS12 chip to your personal computer.

9. Show me your working program. _____

10. Modify your program so that it sends an ASCII Line Feed character after the word **Hi!**. Run your program, and in HyperTerminal's window you should see copies of the word **Hi!** arranged in a staircase pattern across the screen.

11. Modify your program so that after sending the Line Feed character, it also sends an ASCII Carriage Return character. Run your program, and in HyperTerminal's window you should see copies the word **Hi!** aligned along the window's left edge.

12. Show me your working program. _____

13. Modify your program so that it works as above, but sends either **Hi!** or **Bye!,** depending on the position of the Dragon12's leftmost DIP switch:
    - If the switch is set LOW, your program behaves as above.
    - If the switch is set HIGH, your program sends **Bye!** instead of **Hi!**.
    - The program should respond accordingly if the user changes the switch's position while the program is running.

14. Show me your working program. _____

2. Receiving Data Over the SCI

1. In a web browser or other program, open the file named **Lab10SerialReceive.txt** from the course website or http://nreeder.com/eet2261/mod10.htm.

2. Read through the program, including the comments.

3. Create a CodeWarrior project named **Lab10SerialReceive,** choosing **HCS12 Serial Monitor** on the New Project Wizard's first page.

4. Open your project's main.asm file and replace its contents with the code from **Lab10SerialReceive.txt**.

5. Before running your program, make sure that :
    - The serial cable still connects your Dragon12 board to your personal computer.
    - Windows HyperTerminal is running and is configured as it was in the first part of this lab.

6. Back in CodeWarrior, run your program. Then switch back to HyperTerminal and click in the HyperTerminal window where you see a blinking cursor.

7. Press a key on your computer's keyboard. When you do, the Dragon12's LEDs should display the ASCII code for the key you pressed. (But notice that nothing gets displayed in the HyperTerminal window when you press a key. You'll change this in the next program.)

8. Show me your working program. _____

Now that you know how to transmit data over the SCI and receive data over the SCI, let's write some programs that do both.

3. Transmitting and Receiving Data Over the SCI

1. Create a CodeWarrior project named **Lab10Echo,** choosing **HCS12 Serial Monitor** on the New Project Wizard's first page.

2. Combining pieces of the previous two programs, write a program that receives data over the HCS12's SCI1, displays the data on the Dragon12's LEDs, and transmits the data back over the SCI1.

3. Before running your program, make sure that Windows HyperTerminal is running. Back in CodeWarrior, run your program. Then switch back to the HyperTerminal window.

4. Press a key on your computer's keyboard. When you do, the Dragon12's LEDs should display the ASCII code for the key you pressed, **and the character you typed should also be displayed in HyperTerminal's window.** This process of transmitting the received data back to the sender is called an ***echo***.

5. Show me your working program. _____

Next, let's tell the HCS12 to modify the data before sending it back to HyperTerminal.

1. Create a CodeWarrior project named **Lab10UpperCase,** choosing **HCS12 Serial Monitor** on the New Project Wizard's first page.

2. Copy and paste the code from Lab10Echo's main.asm file into this new program's main.asm file. Then modify the code so that letters are always displayed in upper-case in the HyperTerminal window. For example, if the user presses either the **a** key or the **A** key on the computer's keyboard, then **A** is displayed in HyperTerminal. If the user presses a non-alphabetic key (such as **6** or **$**), then the character should be displayed without modification. Hints:
    - Notice in the ASCII table that the only characters we're modifying (lower-case letters) are those with ASCII codes between $61 and $7A.
    - Notice also that to convert the ASCII code for any lower-case letter (such as **a**) to the code for the corresponding upper-case letter (**A**), you just have to add or subtract a constant value.

3. Before running your program, make sure that Windows HyperTerminal is running. Back in CodeWarrior, run your program. Then switch back to the HyperTerminal window.

4. Press a key on your computer's keyboard. When you do, the Dragon12's LEDs should display the ASCII code for the key you pressed, and the character you typed should also be displayed in HyperTerminal's window—**but if the character is a letter, then it should be displayed in upper-case**.

5. Show me your working program. _____

Finally, let's create a counter that the user can control via HyperTerminal.

1. Create a CodeWarrior project named **Lab10Counter,** choosing **HCS12 Serial Monitor** on the New Project Wizard's first page.

2. Write a program (which will be similar in many ways to Lab10SerialTransmit) that counts from 0 to 9 in HyperTerminal's window, and then recycles. In other words, 0 should be displayed on the first line in HyperTerminal's window, and 1 should be displayed on the next line, and so on up to 9, after which it should start again at 0.

3. After running your program to verify that it works, modify it by adding a delay loop to slow the count down to a rate of about three counts per second.

4. After running your program to verify that it works, modify it so that it counts up if the Dragon12's leftmost DIP switch is set HIGH, but counts down if the DIP switch is set LOW. The user should be able to change the count direction by flipping the switch while the program is running.

5. Show me your working program. _____

6. Modify the program so that before it starts counting, it displays a message in the HyperTerminal window asking the user to type the maximum count value. As soon as the user presses a numeric key, the program should start counting, but it should use the typed number instead of 9 as its maximum count value. For example, if the user pressed the **6** key, then when the counter counts up it should recycle to 0 after it reaches 6.

7. Show me your working program. _____

***** In this lab you wrote 4 programs:

- Lab10SerialTransmit
- Lab10Echo
- Lab10UpperCase
- Lab10Counter

Make a copy of the main.asm file for each of these programs and rename them appropriately. Then upload your renamed files for all 4 programs to the Lab 10 dropbox on the course website by the due date. Also turn in your lab sheet at the beginning of class.******