

ECGR4101/5101, Fall 2008: Lab 6

Serial I/O with queues

Learning Objectives

You are to write a program that runs on both of your QSK62P boards that transmits and receives serial data.

Laboratory Assignments

In this lab you will be performing serial communications with queuing. This lab will use the on-board UART to communicate between your board and the TA's board. The LED's will be used for signaling and the LCD can be used to display debugging information. This lab must be demonstrated to the TA using her test board to generate the test data.

You will be expected to listen for several different command strings. All valid commands will be transmitted in mixed case. The commands that are valid are Red!, Yellow!, and Green! and toggle the respective red, yellow, and green LEDs. All other strings should be considered invalid and ignored.

1. The program should rely on interrupts.
2. If a string is received it should be checked for validity.
3. If the command string is valid the program should act accordingly, and return an acknowledgement. Invalid strings should be rejected.

Requirements

- Req. 1. The code generated is written in C for the SKP16C62P.
- Req. 2. The code is well commented and easy to follow.
- Req. 3. You do not need to use the LCD, but it may be helpful while you debug your code.
- Req. 4. The serial communications should operate at 4800 baud, odd parity, 8 data bits, one stop bit.
- Req. 5. The student board will be connected via the UART transmit, receive, and ground pins. The transmit pin on the TA's board will be connected to the receive pin on the student board. You should also have a ground line.
- Req. 6. The student board will use interrupts to wait for a character to be sent from the TA board. Received characters will be put in a receive character queue.
- Req. 7. The student board will not process the queue until either the "!" character is received or the queue is full.
- Req. 8. Processing the queue should not occur in the ISR.
- Req. 9. If "Red!" is received from the TA board, then the Red LED is inverted on the board.
- Req. 10. If "Yellow!" is received from the TA board, then the Yellow LED is inverted on the board.
- Req. 11. If "Green!" is received from the TA board, then the Green LED is inverted on the board.
- Req. 12. If the command received by a student board is valid the program should return an acknowledgement with the characters "Green ON" or "Green OFF", depending on the state of the LED and the color change request.
- Req. 13. If the command received is not valid the program should return the not-acknowledgement string "Bad input".

- Req. 14. Each string sent to the TA board should use a queue and interrupts. Each string should end with a CR and LF.
- Req. 15. The code should be as compact as possible. Lab scores will be based on the size of the compiled object file. Smaller compiled code will result in a better score.

Test Procedure

Note: These procedures do not have to be run in order of 1, 2, 3, 4.

Procedure 1: Reset both boards. From the TA board send “Green!”, “Green!”, “Green!” Verify LEDs and responses to the TA board.

Procedure 2: Reset both boards. From the TA board send “Yellow!”, “Yellow!”, “Yellow!” Verify LEDs and responses to the TA board.

Procedure 3: Reset both boards. From the TA board send “Red!”, “Red!”, “Red!” Verify LEDs and responses to the TA board.

Procedure 4: Reset both boards. From the TA board send “Silly!”, “RedYellow!”, “Yellow”, “YellowGreen!” and a special test string. Verify LED did not change and all responses to the TA board show invalid.

Lab Report

Include in the checkout part of your lab report the lines:

- 1. Test procedure 1 is executed and the LED & messages are correct at all times _____
- 2. Test procedure 2 is executed and the LED & messages are correct at all times _____
- 3. Test procedure 3 is executed and the LED & messages are correct at all times _____
- 4. Test procedure 4 is executed and the LED& messages are correct at all times _____
- 5. Comments written as specified in requirements _____
- 6. Size of code (rank) _____/_____

Include in your lab report observations and procedure like the following:

The general learning objectives of this lab were . . .

The general steps needed to complete this lab were . . .

Some detailed steps to complete this lab were

1. Step one

2. Step two

3.

Code generated or modified to complete this lab...

No need to include all the files for the lab. Just include the modified code.

Some important observations while completing/testing this lab were . . .

Here include the memory report given at the end of the compile process (map file).

*We are **especially** interested in seeing the map file.*

In this lab we learned