Homework 4

Bit Manipulation

100 Points

Projects

`26B_H_4A.c` – Basic Bit Manipulation using macros and functions.

`26B_H_4B.c` – Computer Controlled Lights (details below and on the next pages)

Grading

Program 4A – 30Points
Program 4B – 65 Points

1. Error checking (strtok, strtol) – 10
2. Use macros with arguments – 10
3. Solve all menu options (bit manipulation) – 45

Self-Assessment Report: – 5Points

Write a short report (`26B_H4Report.docx`), briefly explaining your code and containing an assessment of your implementation based on the above grading criteria

Computer Controlled Lights

A theater stage has a set of computer-controlled lights. There are 16 lights. A theater employee is working the lights, and you can assume that the on/off situation of the lights is entirely dependent on an unsigned short variable in your program. Your program which supplies the following menu (or design your own menu):

1) turn on all lights
2) turn on center stage lights (lights 5-10)
3) turn on left stage lights (lights 11-15)
4) turn on right stage lights (lights 0-4)

5) turn off all lights
6) turn off center stage lights
7) turn off left stage lights
8) turn off right stage lights

9) overlay on/off pattern onto light configuration

10) quit the menu

CIS 26B
Advanced C
Programming Assignments

Your program must:

1) Use the bit set/unset formulas as given in class.
2) Seek to reduce redundant code. You will find that some operations are related in this program and can therefore be combined to reduce code volume.
3) Use **`strtok`** to get user tokens. Assume whitespace (tabs or spaces) might surround any user response i.e. to the menu or a prompt which you supply.
4) Use **`strtol`** to convert strings (i.e. user responses to menu choices) to integers.
5) Perform complete user error-checking.
6) Simply re-prompt a user if the user gives no token in response to the menu. Allow a user to use an empty response to the option 9 prompts to bail out i.e. to get back to the main menu. A user should never be forced to give a response to any prompt!!
7) After each menu choice (except the "quit" choice), output the on/off status of the 16 lights to standard output.

Note: If a user chooses menu option 9, prompt the user for a bit pattern and a starting bit from which to superimpose the bit pattern onto the current light configuration. For example, suppose the current light configuration is:

11111 111111 11111

The user enters: 1011 3 in response to the prompt after he chooses menu item 9. The resulting configuration will be:

11111 111110 11111 // Thus 1011 is overlaid starting at bit 3

Menu choice 9 will require a different function than items 1-8. You must make sure that the given pattern is a valid bit string (use strtol() with base 2) and that it fits into the bit string given the starting location.

NOTE: This sample output does not contain all possible situations, but your output should completely test the program!

Examples

1) turn on all lights
2) turn on center stage lights (lights 5-10)
3) turn on left stage lights (lights 11-15)
4) turn on right stage lights (lights 0-4)
5) turn off all lights
6) turn off center stage lights
7) turn off left stage lights
8) turn off right stage lights
9) enter on/off pattern
10) quit the menu

Enter menu choice (0 for Menu): 1 3
Only one menu selection allowed! Try again!
Enter menu choice (0 for Menu): 3x
Illegal menu selection! Try again!
Enter menu choice (0 for Menu): 1
Light settings: 11111 111111 11111

```
Enter menu choice (0 for Menu): 0
        1)  turn on all lights
        2)  turn on center stage lights (lights 5-10)
        3)  turn on left stage lights (lights 11-15)
        4)  turn on right stage lights (lights 0-4)
        5)  turn off all lights
        6)  turn off center stage lights
        7)  turn off left stage lights
        8)  turn off right stage lights
        9)  enter on/off pattern
        10) quit the menu
Enter menu choice (0 for Menu): 6
Light settings:  11111 000000 11111
Enter menu choice (0 for Menu): 9
Enter on/off pattern and starting light number: 9 6
Illegal on/off pattern!  Try again!
Enter on/off pattern and starting light number: 6
You did not enter a bit pattern!  Try again!
Enter on/off pattern and starting light number: 10 foo 6
Too many entries on line!  Try again!
Enter on/off pattern and starting light number: 101010 6
Light settings:  11111 010100 11111
Enter menu choice (0 for Menu): 10
```

Suggestion: Show the menu once, before the loop. To avoid showing the menu each time, give the user the option to show menu upon request:

Enter menu choice (0 for Menu): 10