

## ***Homework 4***

*100 Points*

### ***Bit Manipulation***

#### **PROJECT:**

A. 26B\_Hw\_4A.c // see instructions in the source file

B. A variation of Project 3, page 181 // see next page

#### **Grading**

**Part A:**       – 30Points

**Part B:**       – 70Points

1. Error checking (strtok, strtol)                               – 10
2. Use macros with arguments                                     – 10
3. Solve all menu options (bit manipulation)                   – 50

**CIS 26B**  
**Advanced C**  
**Programming Assignments**

A variation of Project 3, page 181

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:

- 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

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 32 bits representing on/off status to standard output.

Note: If the user chooses menu option 9, prompt him 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: **1001** 3 in response to the prompt after he chooses menu item 9. The resulting configuration will be:

11111 1111**10 01**111 /\* Thus 1001 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 fits into the bit string given the starting location. // See more examples on the next pages

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NOTE: This sample output does not contain ALL POSSIBLE situations  
YOUR OUTPUT SHOULD completely test the program!!  
The above two lines and this one should not be part of your output:)

- 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: 1 3

Only one menu selection allowed! Try again!

- 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: 3x

Illegal menu selection! Try again!

- 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: 1

Light settings: 11111 111111 11111

- 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

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- 7) turn off left stage lights
- 8) turn off right stage lights
- 9) enter on/off pattern
- 10) quit the menu

Enter menu choice: 6

Light settings: 11111 000000 11111

- 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: 9

Enter starting light number and on/off pattern: 6 9

Illegal on/off pattern! Try again!

Enter starting light number and on/off pattern: 6

You did not enter a bit pattern! Try again!

Enter starting light number and on/off pattern: 6 10 foo

Too many entries on line! Try again!

Enter starting light number and on/off pattern: 6 101010

Light settings: 11111 010100 11111

- 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: 10