CSCE 3600: Systems Programming
Recitation Assignment 2 – More Bits & Bytes
Due: 11:59 PM on Friday, September 17, 2021

PROGRAM DESCRIPTION:

In this recitation assignment, will write a complete C program that accepts as input any two integers from the user and swaps both integers using bitwise operators only without a third variable. Early on in your programming career, you were told that you need to use a third variable in order to swap two variables, but in this assignment, you will accomplish this task without the extra variable. We will use the bitwise XOR ^ operator to swap the integers as the bitwise XOR operator evaluates each bit of the result to 1 if the corresponding bits of the operands are different and 0 otherwise.

Although not required, you may find Chapter 2 on Bits, Bytes, and Data Types in the *System Programming with C and Unix* optional reference textbook by Adam Hoover to be helpful.

For this recitation assignment, complete the following tasks. You may receive guidance from your TA or fellow students.

1. Declare an integer pointer and then request memory using `malloc()` for an array of 2 integers. This means that you should request memory for a size of 2 times the size of an integer and assign it to `int_ptr`. Use `man 3 malloc` for details on this system call.

2. If the `malloc()` system call failed to return memory, print out a meaningful error message and terminate the program.

3. Prompt the user to enter the first integer using `printf` and then read in the user's response using `scanf`, storing the integer in the first element of the integer array allocated in step 1.

4. Prompt the user to enter the second integer using `printf` and then read in the user's response using `scanf`, storing the integer in the second element of the integer array allocated in step 1.

5. Now, print out the original values of both the integers input by the user.

6. This next step is where the swapping is done:

    a. Use the bitwise XOR operator ^ on both the array elements and assign the result to the first element.

    b. Use the bitwise XOR operator ^ on both the array elements and assign the result to the second element.

    c. Use the bitwise XOR operator ^ on both the array elements and assign the result to the first element.

7. Now, print out the swapped values of both the integers input by the user.

8. Finally, release the allocated memory using `free()`.

REQUIREMENTS:

☐ No additional comments are required for this recitation assignment, although you should ensure that your name and EUID is included in your code as comments.

☐ Your program should be named "`rec02.c`", without the quotes.

☐ Your program will be graded based largely on whether it works correctly on the CSE machines (e.g., `cse01`, `cse02`, ..., `cse06`), so you should make sure that your program compiles and runs on one of the CSE machines. If you require any special libraries or compiler options, please be sure to include these directives in a comment in the code and/or Canvas submission.

☐ Although this assignment is to be submitted individually (i.e., each student will submit his/her own source code), you may receive assistance from your TA and even other classmates. Please remember that you are ultimately responsible for learning and comprehending this material as the recitation assignments are given in preparation for the minor assignments, which must be completed individually.

SAMPLE OUTPUT (user input shown in **bold**)**:**

```
$ ./a.out
Enter first         integer: 571
Enter second integer: 18
Original values: 1st =           571 2nd =        18
Swapped    values: 1st =          18 2nd =      571
$ ./a.out
Enter first         integer: -4 Enter
second integer: 288
Original values: 1st =            -4 2nd =       288
Swapped    values: 1st =         288 2nd =       -4
```

SUBMISSION:

☐ You will electronically submit your `rec02.c` program file to the **Recitation 2** dropbox in Canvas by the due date and time.