Lab Assignment #6

Purpose: practice using loop statements.
Collaboration: You should work in a group of two.

Getting started

Change into your cse220 directory
Create a new directory called lab06
Change into the new directory
Implement the two programs below in your lab06 directory

Program “Binary representation of decimal”

This program wants you to display a binary format of a decimal number. You need to get a positive integer from user. If user enters a negative number, you should ask the user to enter a new number. You should keep getting numbers from users till the input is positive. (you should use a ‘while’ loop)

To display a number in binary format, you need to use ‘shift’ operators to shift the input one bit to the left and read the most left bit of input and display it. Technically you should print the bits from left to right one by one. Here is the procedure:

1- Define a mask that isolates the most left bit. This mask should help you to be able to figure out if the most significant bit of the input is ‘1’ or ‘0’.
2- Write a ‘for’ loop that counts from 1 to the number of bits of an integer number. (Hint: you can use the function ‘sizeof()’ to find out the number bytes of an integer number)
3- Inside the ‘for’ loop, you need to use ‘bitwise’ operators to check if the most left bit is ‘0’ or ‘1’, and then print it.
4- Shift your input ‘one bit’ to the left. (Then you program should automatically go to the beginning of the ‘for’ loop.)
5- When you are done with the ‘for’ loop, you can simply ‘return’ from the ‘main()’.

Wrap Up

Show your TA that your modified program works as intended. Test your program with input 15, 202.
Program “Euler’s number”

The Euler’s number $e$ is a mathematical constant approximated at 2.718. The formula for computing it is as follows:

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! + \ldots$$

where $n! = n \times (n-1) \times (n-2) \times \ldots \times 1$, e.g., $4! = 4 \times 3 \times 2 \times 1$

Write a program `euler.c` that approximates the value of $e$ by using the following equation:

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! + \ldots + 1/n!$$

where $n$ is a number entered by the user.

Your program will first compute $e$ as 1, then as $1 + 1/1!$, then as $1 + 1/1! + 1/2!$ and so on. In each step, print the step number and the value of $e$, as follows:

1: 2.000000
2: 2.500000
3: 2.666666
... ...

Hint:
(1) First ask the user for an input integer $n$ ($n$ should be no less than 1);
(2) Your program should consist of two `for` loops: The first loop should have a counting variable $i$ that counts from 1 to $n$. Each value of $i$ corresponds to one step as we just mentioned above. The second loop, which should be inside the body of the first loop, computes $i!$ for a given $i$. For example,

```c
int product = 1;
for (int j = i; j > 0; j--){
    product *= j;
}
```

Wrap Up

Implement the program and test it with different $n$ as input. Show your TA the results.