Programming Lab 4 F2018

Hacker Rank Contest

Alexandria University
Faculty of Engineering
Computer and Systems Engineering
Department

CS121: Computer Programming 1
Assigned: Friday, October 19th, 2018
Due: Tuesday, October 23rd, 2018

Lab 4
Decisions - If Statements

1 Lab Objectives

- Learning rules of expression evaluation.

- Learning some of the C mathematical functions.

- If-conditions and relational operators.

- Learning bit-wise operations.

2 Problem 1 - Math Experssions

Write a program to evaluate each of the following expressions: (all parameters should be taken as input from the user).

(a) $\frac{3x+2*10^5}{4x+5.2*10^4}$

(b) $5(\frac{x+y+3}{27+z})^2$

(c) $\frac{a+\frac{b}{c}}{d+\frac{e}{f+g}}$

(d) $(sin(x+y))^2$

3 Problem 2 - Simple Calculator

In this problem, you are required to write a program for a simple calculator that performs only 5 mathematical operations (+, -, /, *, %). Your program should ask the user to 3 inputs:

- First number;

- Operator $(+,-,/,*,\%)$;

- Second number.

Your program then should rewrite the expression back on the screen along with its result. You must check for the following errors:

- When the user enters a symbol that does not represent a valid operator $(+,-,/,*,\%)$.

- When the user tries to divide by zero.

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Example 1:
Enter the first number: 7
Enter the operation: +
Enter the second number: 4
The output should be: "7 + 4 = 11".

Example 2:
Enter the first number: 7
Enter the operation: &
Enter the second number: 4
The output should be: "ERROR: Unsupported Operator!".

Example 3:
Enter the first number: 7
Enter the operation: /
Enter the second number: 0
The output should be: "ERROR: Division by zero is not allowed!".

4   Problem 3 - Leap Year

A year with 366 days is called a leap year. A year is considered a leap year if it is divisible by 4 (for example, the year 1980), except it is not a leap year if it is divisible by 100 (for example, the year 1900); however, it is a leap year if it is divisible by 400 (for example, the year 2000). Write a program that asks the user for a year and computes whether that year is a leap year or not.

5   Problem 4 - Gregorian Calendar

The Gregorian calendar has twelve months (January through December). Given an input number from the user, you should print the corresponding month name. If the input number doesn't represent a valid month, a proper error message should be displayed. In this problem you are **required** to use "Switch Statment".

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6 Bitwise Operations

6.1 Problem 5 - Fast Multiplication

When mulipling by power of two, shif operator can be faster than reqular multiplication. Given two number x and y. Return $z = x * 2^y$ using shift operator. It's guaranteed that z will fit in integer.

6.2 Problem 6 - Saving Memory

Given two numbers $0 \leq$ x, y ≤ 15 you are required to store them in the most efficient way. x and y need only 4 bits so using int(32 bit), short(16 bit), char(8 bit) will be a wast of memory. It may sound that the wast is small but when you have to store 10^6 such variable then you will start to worry about memory usage. The trick is to use char to save x and y. So you should store x in higher 4 bits and y in lower 4 bits of char. Scan x and y as integers from the user and check that $0 \leq$ x, y ≤ 15. Compress x and y in char z and print z as integer.
Example: 1
int x = 7;// 0111
int y = 3;//0011
char z;
do some work here
printf("%d", z);// output 115(01110011)

Example: 2
int x = 15;// 1111
int y = 3;//0011
char z;
do some work here
printf("%d", z);// output -13(11110011)

6.3 Problem 7 - Swapping variables (Bonus)

Swapping two integers is a trivial task using a third one.
Can you swap A, B using xor without another variable?

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7 Notes

- You are required to bring the C programs to the lab on your laptop or on a flash memory.

- Cheating will be severely penalized (for both parties). So, it is better to deliver nothing than deliver a copy!

- You are encouraged to ask any questions on Piazza, or in person.

Good Luck isA :)