National University of Computer and Emerging Sciences

Laboratory Manual

for

Programming Fundamentals

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Lab Manual 06

Use of loops, nested loops.

Problem 1:

Using while loop, write a C++ program to print the given star pattern.

```
*
**
***
****
*****
```

Problem 2: Use nested for loop

Write a program that reads in the size of the side of a square then prints a hollow square of that size out of asterisks and blanks. Your program should work for squares of all side sizes between 1 and 20.

Sample Run:

Input: 5

Output:

```
*****
*   *
*   *
*   *
*****
```

Problem 3:

Print the same pattern as in problem 2 using while loop.

Problem 4:

Print the same pattern as in problem1 using for loop.

Problem 5:

Print the following Rectangle ask for two dimensions Length and Width (use nested do-while loop)

Input:
Length: 5

Width: 10

Output:

```
**********
**********
**********
**********
**********
```

Problem 6:

Write a C++ program that takes a number n from user and display multiplication table from 1 to n. Following is the multiplication table of 1 to 10 (when user enters n = 10).

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

Problem 7

Implement the following equation:

$$\sum_{i=0}^{N}\sum_{j=0}^{i}\sum_{k=0}^{j}(ijk)$$

Take value of N from the user.

Problem 8

Write a C++ program to compute **Sin(x)** where

$$\sin(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \ldots\ldots\ldots\ldots \frac{x^n}{n!}$$

Your program should accept two values from the user (the angle x and the value of n) and then should compute and print the value of sin(x).

To make the program, do following tasks.

- Write two functions, i.e. function to calculate factorial and function to calculate power having following prototypes.

  double Factorial (int n); //Factorial function prototype

  double Power(double x, int y); //Power function prototype

- Use these functions in your main function to compute the series.

Problem 9

Write a program that lets the user perform arithmetic operations on fractions. Fractions are of the form a/b, where a and b are integers and b is not equal to 0. Your program must be menu driven, allowing the user to select the operation (+, - *, or /) and input the numerator and denominator of each fraction. Furthermore, your program must run until the user quits and must consist of at least the following functions:
menu: This function informs the user about the program's purpose, explains how to enter data, how to quit and allows the user to select the operation.

addFractions: This function takes as input four integers representing the numerators and

denominators of two fractions, adds the fractions, and returns the numerator and denominator of the result.

subtractFractions: This function takes as input four integers representing the numerators and denominators of two fractions, subtracts the fractions, and returns the numerator and denominator of the result.

multiplyFractions: This function takes as input four integers representing the numerators and denominators of two fractions, multiplies the fractions, and returns the numerator and denominator of the result.

divideFractions: This function takes as input four integers representing the numerators and denominators of two fractions, divides the fractions, and returns the numerator and denominator of the result..)

Here is the illustration of the program:

Welcome to the 10-function Calculator!

Enter

+	**For addition operation**
-	**For subtraction operation**
*	**For multiplication operation**
/	**for division operation**
q	**To quit**

--> +

Enter the first value: 5

Enter the second value (other than zero): 8

Enter the third value: 6

Enter the forth value (other than zero):8

Output:

The numerator of result is 11 and denominator of result is 8

--> /

Enter the first value: 5

Enter the second value (other than zero): 8

Enter the third value: 6

Enter the forth value (other than zero):8

Output: 5 and 6

--> q

(Quit the menu)

Problem 10

The cost to become a member of a fitness center is as follows:

a) The senior citizens (age>50years) discount is 20%.
b) If the membership is bought and paid for 12 or more months, the discount is 10
c) If more than five personal training sessions are bought and paid for, the discount on each session is 15%.

Write a menu-driven program that determines the cost of a new membership. Your program must contain

i. a **function** that displays the program and discounts available
ii. a **function** to get all of the necessary information to determine the membership cost, and
iii. a **function** to determine the membership cost.

Use appropriate parameters to pass information in and out of a function. (Do not use any global variables.)

Problem 11:

Write a program in C++ to find the frequency of each digit in a given integer.

Sample Run:

Find frequency of each digit in a given integer:

Input any number: 122345
The frequency of 0 = 0
The frequency of 1 = 1

```
The frequency of 2 = 2
The frequency of 3 = 1
The frequency of 4 = 1
The frequency of 5 = 1
The frequency of 6 = 0
The frequency of 7 = 0
The frequency of 8 = 0
The frequency of 9 = 0
```

Static Variables inside Functions

Static variables when used inside function are initialized only once, and then they hold there value even through function calls.

These static variables are stored on static storage area, not in stack.

```
void counter()

{

    static int count=0;

    cout << count++;

}



int main()

{

    for(int i=0;i<5;i++)

    {

        counter();

    }

}
```

```
Output

0 1 2 3 4
```

Let's see the same program's output **without using static** variable.

```
void counter()

{

    int count=0;

    cout << count++;

}



int main()

{
```

```
    for(int i=0;i<5;i++)
    {
        counter();
    }
}
```

```
Output

0 0 0 0 0
```

Problem Example:

Create a simple sum function that takes 2 numbers as input and returns the sum of these two numbers. But you have to take the record of how many times Sum function is called for this you have to create static variable ‘count’ in sum function.

Sample Run:

Enter value of a: 5

Enter Value of b: 6

Function is called 1 time

Sum = 11

Press any key to continue or -1 to exist

Enter value of a: 4

Enter Value of b: 6

Function is called 2 time

Sum = 10