Programming Fundamentals
(Lab 2019)

Lab Manual

Computer Science for Session 2019 (Fall-2019)

Programing Fundamentals

This course is a comprehensive introductory course that is intended for students who have no background in computer programming. The aim of this course is to provide students with a firm foundation of "Basics of Programing Fundamentals" and to make them able to design C++ code of algorithms. The aim is to provide foundation of programing and to polish the skills of understanding computational problems in algorithmic way. The programming language used in this programming course is C++.

Instructor: Ms. Sahar Waqar
Graduate Assistant: Mr. Muhammad Nazam Maqbool, Mr. Usman Ghani

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Programing Fundamentals

(Lab 3)

Target: input (**cin**, **get**, **ignore**, **putback**, **peek**), **getline**, Input failure and **clear**, output (**setprecision**, **fixed**, **showPoint**, **scientific**, **setw**, **setfill:left/right**) Formatting, Debugging

i)   Guidelines/Instructions:
- Create meaningful variable names. Add comments for readability. Indent each line of your code.
- Plagiarism/Cheating is highly discouraged by assigning 0 to both who tried and one who shared his/her code.
- Lab work must be evaluated during lab timing and homework is for submission.
- Contact your teacher and GAs during their office hours (mentioned at end of lab.)

ii)   Reading Material:
- **Consult Chapter No 3 of book "C++: Programming from Problem Analysis to Program Design by D.S Malik (latest edition)" for better understanding of given problems.**
- Structure, data type and variables in C++:
  (https://www.studytonight.com/cpp/datatypes-and-modifiers-in-cpp.php)
- Learn C++:
   (https://www.tutorialspoint.com/cplusplus/cpp_data_types.htm)
- C++ programming examples:
  (https://teachingmyselfcode.wordpress.com/coding-in-c/inputoutput/get-ignore-putback-and-peek/)

Data Type of a	Valid Input for a
char	One printable character except the blank
int	An integer, possibly preceded by a **+** or **−** sign
double	A decimal number, possibly preceded by a + or − sign. If the actual data input is an integer, the input is converted to a decimal number with the zero decimal part.

iii)   Tasks to be completed in lab:

Instructor: Ms. Sahar Waqar
Graduate Assistant: Mr. Muhammad Nazam Maqbool, Mr. Usman Ghani

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Example program 1:

```
//*****************************************************************
```
Insertion and Extraction operator
```
//*****************************************************************
1    #include<iostream>
2    using namespace std;
3    int main(){
4        double payRate;
5        cin>>payRate;
6        cout<<payRate;
7    }
```

Suppose you have the following variable declarations:

```
int a, b;
double z;
char ch;
```

The following statements show how the extraction operator >> works.

	Statement	Input	Value Stored in Memory
1	cin >> ch;	A	ch = 'A'
2	cin >> ch;	AB	ch = 'A', 'B' is held for later input
3	cin >> a;	48	a = 48
4	cin >> a;	46.35	a = 46, .35 is held for later input
5	cin >> z;	74.35	z = 74.35
6	cin >> z;	39	z = 39.0
7	cin >> z >> a;	65.78 38	z = 65.78, a = 38

Example Program 2:
```
*****************************************************************
```
Use Pre-defined function pow(x,y), and sqrt(x,y) to solve the following problem. If the radius of the sphere is r, then the volume of the sphere is $(\frac{4}{5} * Pi * r^3)$ and (x_1, y_1) are the coordinates of two points in the X-Y plane, then the distance between these points is. $sqrt((x_2 - x_1)^2 + (y_2 - y_1)^2)$

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

```
include<iostream>

#include<cmath>

#include<string>
```

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```cpp
using namespace std;

const double PI = 3.1416;

int main()
{
    double sphereRadius;                                    //Line 1
    double sphereVolume;                                    //Line 2
    double point1X, point1Y;                                //Line 3
    double point2X, point2Y;                                //Line 4
    double distance;                                        //Line 5

    string str;                                             //Line 6

    cout << "Line 7: Enter the radius of the sphere: ";     //Line 7
    cin >> sphereRadius;                                    //Line 8
    cout << endl;                                           //Line 9

    sphereVolume = (4 / 3) * PI * pow(sphereRadius, 3);     //Line 10

    cout << "Line 11: The volume of the sphere is: "
         << sphereVolume << endl << endl;                   //Line 11

    cout << "Line 12: Enter the coordinates of two "
         << "points in the X-Y plane: ";                    //Line 12
    cin >> point1X >> point1Y >> point2X >> point2Y;        //Line 13
    cout << endl;                                           //Line 14

    distance = sqrt(pow(point2X - point1X, 2)
                   + pow(point2Y - point1Y, 2));            //Line 15

    cout << "Line 16: The distance between the points "
         << "(" << point1X << ", " << point1Y << ") and "
         << "(" << point2X << ", " << point2Y << ") is: "
         << distance << endl << endl;                       //Line 16

    str = "Programming with C++";                           //Line 17

    cout << "Line 18: The number of characters, "
         << "including blanks, in \"" << str << "\" is: "
         << str.length() << endl;                           //Line 18

    return 0;                                               //Line 19
}
```

Output:

Enter the radius of the sphere: 3

The volume of the sphere is: 84.8232

Enter the coordinates of two points in the X-Y plane: 4 7 9 -5

The distance between the points (4, 7) and (9, -5) is: 13

The number of characters, including blanks, in "Programming with C++" is: 20

Example program 3:

```
//********************************************************************
```
Use of Pre-defined Function ignore
```
//********************************************************************
```

```cpp
1   #include<iostream>
2   using namespace std;
3   int main(){
4   int a,b ;
5   cin>>a;
6   cin.ignore(10, '\n');
7   cin>>b;
8   cout<<endl<<b;
9   cout<<endl<<a;
10
11  }
```

```
C:\Users\Muhammad Usman Ghani\Documents\payrate.exe

1 2 3 4 5 6
12

12
1
-------------------------------
Process exited after 8.16 seconds with return value 0
Press any key to continue . . .
```

Example program 4:

```
//********************************************************************
```
Use of Pre-defined functions peek, Putback and get
```
//********************************************************************
```

```cpp
#include <iostream>
using namespace std;
int main()
{
    char ch;
    cout << "Line 1: Enter a string: ";      //Line 1
    cin.get(ch);                     //Line 2
    cout << endl;                    //Line 3

    cout << "Line 4: After first cin.get(ch); "
        << "ch = " << ch << endl;        //Line 4
    cin.get(ch);                     //Line 5

    cout << "Line 6: After second cin.get(ch); "
        << "ch = " << ch << endl;        //Line 6
    cin.putback(ch);                 //Line 7
    cin.get(ch);                     //Line 8

    cout << "Line 9: After putback and then "
        << "cin.get(ch); ch = " << ch << endl;  //Line 9
    ch = cin.peek();                 //Line 10

    cout << "Line 11: After cin.peek(); ch = "
        << ch << endl;               //Line 11
    cin.get(ch);                     //Line 12

    cout << "Line 13: After cin.get(ch); ch = "<< ch << endl;        //Line 13

    return 0;
}
```

Output:

Sample Run: In this sample run, the user input is shaded.

Line 1: Enter a string: abcd

Line 4: After first cin.get(ch); ch = a

Line 6: After second cin.get(ch); ch = b

Line 9: After putback and then cin.get(ch); ch = b

Line 11: After cin.peek(); ch = c

Line 13: After cin.get(ch); ch = c

//***
Example 5 Output Formatting
//***

//Step 18: Output results

```cpp
#include <iostream>
#include <iomanip>
#include <string>
using namespace std;
int main()
{
//Step 1
    string movieName;
    double adultTicketPrice;
    double childTicketPrice;
    int noOfAdultTicketsSold;
    int noOfChildTicketsSold;
    double percentDonation;
    double grossAmount;
    double amountDonated;
    double netSaleAmount;

    cout << fixed << showpoint << setprecision(2);   //Step2

    cout << "Enter the movie name: ";               //Step 3
    getline(cin, movieName);                        //Step 4
    cout << endl;

    cout << "Enter the price of an adult ticket: ";   //Step 5
    cin >> adultTicketPrice;                          //Step 6
    cout << endl;

    cout << "Enter the price of a child ticket: ";    //Step 7
    cin >> childTicketPrice;                          //Step 8
    cout << endl;
```

```cpp
    cout << "Enter the number of adult tickets "<< "sold: ";     //Step 9
    cin >> noOfAdultTicketsSold;                  //Step 10
    cout << endl;

    cout << "Enter the number of child tickets "
        << "sold: ";                          //Step 11
    cin >> noOfChildTicketsSold;               //Step 12
    cout << endl;

    cout << "Enter the percentage of donation: ";    //Step 13
    cin >> percentDonation;                    //Step 14
    cout << endl << endl;                       //Step 15

    grossAmount = adultTicketPrice * noOfAdultTicketsSold +
    childTicketPrice * noOfChildTicketsSold;             //Step 16
    amountDonated = grossAmount * percentDonation / 100;
    netSaleAmount = grossAmount - amountDonated;         //Step 17

    cout << "-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*"
        << "-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*" << endl;

    cout << setfill('.') << left << setw(35) << "Movie Name: "
        << right << " " << movieName << endl;

    cout << left << setw(35) << "Number of Tickets Sold: "
        << setfill(' ') << right << setw(10)
        << noOfAdultTicketsSold + noOfChildTicketsSold
        << endl;

        cout << setfill('.') << left << setw(35)
        << "Gross Amount: "
        << setfill(' ') << right << " $"
        << setw(8) << grossAmount << endl;

        cout << setfill('.') << left << setw(35)
        << "Percentage of Gross Amount Donated: "
        << setfill(' ') << right
        << setw(9) << percentDonation << '%' << endl;

        cout << setfill('.') << left << setw(35)
        << "Amount Donated: "
        << setfill(' ') << right << " $"
        << setw(8) << amountDonated << endl;

        cout << setfill('.') << left << setw(35) << "Net Sale: "
        << setfill(' ') << right << " $"
        << setw(8) << netSaleAmount << endl;
        return 0;
}
```

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Output :

Sample Run: In this sample run, the user input is shaded.

Enter movie name: Journey to Mars

Enter the price of an adult ticket: 4.50

Enter the price of a child ticket: 3.00

Enter number of adult tickets sold: 800

Enter number of child tickets sold: 1850

Enter the percentage of donation: 10

```
_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*
Movie Name: ....................... Journey to Mars
Number of Tickets Sold: ...........         2650
Gross Amount: ..................... $ 9150.00
Percentage of Gross Amount Donated:      10.00%
Amount Donated: ................... $  915.00
Net Sale: ........................ $ 8235.00
```

//**
Debugging Understanding Logic Error
//**

```cpp
#include <iostream>                                  //Line 1

using namespace std;                                 //Line 2

int main()                                           //Line 3
{                                                    //Line 4
    int fahrenheit;                                  //Line 5
    int celsius;                                     //Line 6

    cout << "Enter temperature in Fahrenheit: ";     //Line 7
    cin >> fahrenheit;                               //Line 8
    cout << endl;                                    //Line 9

    celsius = 5 / 9 * (fahrenheit - 32);             //Line 10

    cout << fahrenheit << " degree F = "
         << celsius << " degree C. " << endl;        //Line 11

    return 0;                                         //Line 12
}                                                    //Line 13
```

Sample Run 1: In this sample run, the user input is shaded.

Enter temperature in Fahrenheit: 32

32 degree F = 0 degree C.

Sample Run 2: In this sample run, the user input is shaded.

Enter temperature in Fahrenheit: 110

110 degree F = 0 degree C.

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Note: Print 5/9 and (fahrenhit-32) separately you will find error

Solution: replace line 10 with "celsius = static_cast<int> (5.0 / 9 * (fahrenheit - 32) + 0.5);**"**

Lab Tasks

1. Write and run a program that will read radius r from the keyboard, and then will calculate the circumference using the formula: $C = 2*pi*r$. Finally display the circumference C up to 3 decimal places.
2. Write and run a program that reads a floating-point number through the keyboard and calculate its square and then displays the result. Result must be displayed up to 5 decimal places.
3. Make variable double pi=3.1416 and show the following output. (help: setw(6)=3.1415 building function.)

```
Formatting the output :
---------------------------
The value of pi : 3.1416
The value of pi 4 decimal place of total width 8    : |  3.1416|
The value of pi 4 decimal place of total width 10   : |    3.1416|
The value of pi 4 decimal place of total width 8    : |--3.1416|
The value of pi 4 decimal place of total width 10   : |----3.1416|
The value of pi in scientific format is : 3.1416e+00
Status in mumber : 0
Status in alphabet : false
```

iv)   **Tasks to be submitted:**
1. As user to input two number and show the output according to the exact format given below

   num1 + num2: 280
   num1 - num2: 200
   num1 * num2: 9600
   num1 / num2:   6
   num1 % num2: 0

2. Ask user to enter number and show the multiplication table (multiple cout statements) in the following format using setw() function.

   ```
   5   *   1   =   5
   5   *   2   =   10
   5   *   3   =   15
   5   *   4   =   20
   5   *   5   =   25
   5   *   6   =   30
   5   *   7   =   35
   5   *   8   =   40
   5   *   9   =   45
   5   *   1   =   50
   ```

3. Run the Program and understand the output and upload the .cpp file with proper comments.

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```cpp
#include<iostream>
using namespace std;
int main()
{
    char char1;
    cout << "Enter string: ";
    cin.get(char1); cout << endl;
    cout << "char1 = " << char1 << endl;
    cin.get(char1); cout << endl;
    cout << "char1 = " << char1 << endl;

    cin.putback(char1);
    cin.get(char1);
    cout << endl;
    cout << "char1 = " << char1 << endl;

    char1 = cin.peek();
    cout << "char1 = " << char1 << endl;

    cin.get(char1);
    cout << endl;
    cout << "char1 = " << char1 << endl;

    return 0;
}
```

4. Paula and Danny want to plant evergreen trees along the back side of their yard. They do not want to have an excessive number of trees. Write a program that prompts the user to input the following:
   a. The length of the yard
   b. The radius of the fully-grown tree
   c. The required space between fully grown tree

   The program outputs the number of trees that can be planted in the yard and the total space that will be occupied by the fully-grown tree.

5. Two cars A and B leave an intersection at the same time. Car A travels west at an average speed of x miles per hour and car B travels south at an average speed of y miles per hour. Write a program that prompts the user to enter the average speed of both the cars and the elapsed time (in hours and minutes) and outputs the (shortest) distance between the cars.

v)   Submission instructions:

- See manual 1 for understanding "How to submit your assignment".
- All rules discussed in lab1 for grading assignments will apply for all labs of this course.

vi)   Office hours and email address for communication:

- See lab manual 1

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