Programming Fundamentals

Programming Day - Week 05

Introduction

Welcome to your favorite day of the week which is programming day 🎉. This week, we shall work together to learn and implement new programming concepts.

Skills to Learn:

- Distinguish between Local and Global Variables
- Categorize the code into meaningful functions to make the code more modular, readable, structured, and reusable.

Let's do some coding.

Skill: Distinguish between Local and Global Variables

Introduction

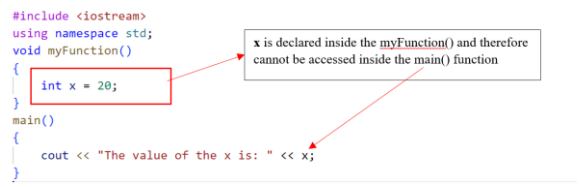
So far, we have learned about various kinds of variables depending on datatypes such as int, float, char, etc. However, in a broader sense, the variables can be categorized into two major categories.

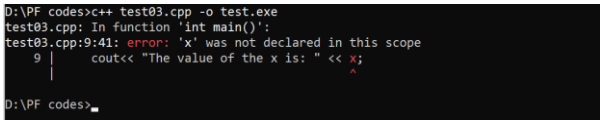
1. Local Variables
2. Global Variables

Local Variables

Local variables can be accessed inside the functions where they have been declared. These variables can only be accessed inside that function.

Consider the following example:





Here is the other scenario for you to consider:

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```
#include <iostream>
using namespace std;
void myFunction()
{
    cout << "The value of the x is: " << x;
}
main()
{
    int x = 20;
}
```

x is declared inside the main() and therefore cannot be accessed inside the myFunction() function

```
D:\PF codes>c++ test03.cpp -o test.exe
test03.cpp: In function 'void myFunction()':
test03.cpp:5:42: error: 'x' was not declared in this scope
    5 |     cout << "The value of the x is: " << x;
      |                                          ^

D:\PF codes>
```

The above-mentioned examples define that the variables declared inside the body of a function cannot be accessed inside the body of other functions.
Such variables are called **Local Variables**.

Global Variables

Global variables can be accessed anywhere in the program and are not limited to a function only. For example:

Consider the following example:

```
#include <iostream>
using namespace std;
int x = 10;
void myFunction()
{
    cout << "The value of the x is: " << x;
}
main()
{

}
```

x is not declared inside the body of a function rather it is declared outside the body of all functions .

Therefore, it can be accessed anywhere in the program.

```
D:\PF codes>c++ test03.cpp -o test.exe

D:\PF codes>test.exe

D:\PF codes>
```

Can you tell why there is no output?

Here is the other scenario for you to consider:

```
#include <iostream>
using namespace std;
int x = 10;
void myFunction()
{

}
main()
{
    cout << "The value of the x is: " << x;
}
```

x is not declared inside the body of a function rather it is declared outside the body of all functions .

Therefore, it can be accessed anywhere in the program.

```
D:\PF codes>c++ test03.cpp -o test.exe

D:\PF codes>test.exe
The value of the x is: 10
D:\PF codes>
```

The above-mentioned examples show that variables declared outside the bodies of functions can be accessed anywhere in the program and therefore are often referred to as **Global Variables**.

Question!

Can you guess the output of the below-mentioned code snippets?

Task 01(CA): Write the below-mentioned program to verify whether your prediction is true or false.

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```cpp
#include <iostream>
using namespace std;

int x = 10;
void myFunction()
{
    int x = 20;
}
main()
{
    cout << "The value of the x is: " << x;
}
```

```cpp
#include <iostream>
using namespace std;

int x = 10;
void myFunction()
{
    cout << "The value of the x is: " << x;
    int x = 20;
}
main()
{
    myFunction();
    int x =30;
    cout << "The value of the x is: " << x;
    myFunction();
}
```

```cpp
#include<iostream>
using namespace std;

int value1 = 10;
int value2 = 20;

int sum (){
  value1 = 40;
  return value1 + value2;
}

main(){

   int x = value1;
   value1 = 100;
   x = 20;
   value2 = sum();
   cout<<value1<<"  "<<value2;

}
```

Conclusion

Variables	Description
Local Variables	This type of variable can only be **accessed only** inside the function(s) where they have been declared.
Global Variables	This type of variable can be **accessed anywhere** in the program.

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Congratulations !! You just have learned another skill.

Task 02(CP):

Create a function that takes the length, width, height (in meters) and output unit in which you want to see the answer and returns the volume of a pyramid in the correct unit.

Notes:

- The units used are limited to: millimeters, centimeters, meters and kilometers.
- Ensure you return the answer and add the correct unit in the format cubic <unit>.

Test Cases:

- pyramidVolume(4, 6, 20, "centimeters") → "160000000.000 cubic centimeters"
- pyramidVolume(1843, 1823, 923, "kilometers") → "1.034 cubic kilometers"
- pyramidVolume(18, 412, 93, "millimeters") → "229896000000000.000 cubic millimeters"

```
Enter the length of the pyramid (in meters): 4
Enter the width of the pyramid (in meters): 6
Enter the height of the pyramid (in meters): 20
Enter the desired output unit (millimeters, centimeters, meters, kilometers): meters
The volume of the pyramid is: 160.000000 cubic meters
```

Task 03(CP):

You've been hired by an Automobile company to write a program to help the tax collector calculate vehicle taxes. Vehicle taxes are based on two pieces of information; the price of the vehicle and the vehicle type code.

$$\text{Tax Amount} = \text{Item Price} * \frac{\text{TaxRate}}{100}$$

The formula of calculating the final price of an item is:
Final Price = Item Price + Tax Amount
Tax rates are in the table below

Vehicle Type	Vehicle Code	Tax Rate

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Motorcycle	M	6%
Electric	E	8%
Sedan	S	10%
Van	V	12%
Truck	T	15%

After the tax has been calculated, the program should display the following on the screen;
The final price on a vehicle of type xxx after adding the tax is $xxx.
with xxx replaced by the vehicle type and $xxx with the final price.

Your job is to write a function
float taxCalculator(char type, float price);
and then write the main function for taking the input from the user and then displaying the final output.

```
G:\Semesters\Programming Fundamentals (Fall 2023)\Week 5\PD Tasks>Task3.exe
Enter the vehicle type code (M, E, S, V, T): E
Enter the price of the vehicle: $300
The final price of a vehicle of type E after adding the tax is $324.00.
```

Task 04(CP):

A firm gets a request for creating a project for which a certain number of hours are needed. The firm has a certain number of days. During 10% of the days, the workers are being trained and cannot work on the project. A normal working day is 8 hours long. The project is important for the firm and every worker must work on it with overtime of 2 hours per day.
Final answer in hours must be rounded down to the nearest integer (for example, 6.98 hours are rounded to 6 hours).
Write a program that calculates whether the firm can finish the project on time and how many hours more are needed or left.
You have to make a function **projectTimeCalculation** that takes needed hours, days that the firm has and number of workers as input and then returns the string as answer.
Input Data

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The input data is read from the console and contains exactly three lines:

- On the first line are the needed hours – an integer in the range of [0 … 200 000].
- On the second line are the days that the firm has – an integer in the range of [0 … 20 000].
- On the third line are the number of all workers – an integer in the range of [0 … 200].

Output Data

Print one line on the console:

- If the time is enough:
  - "Yes!{the hours left} hours left.".
- If the time is NOT enough:
  - "Not enough time!{additional hours} hours needed.".

Input	Output	Input	Output
90 7 3	Yes!99 hours left.	99 3 1	Not enough time!72 hours needed.

```
G:\Semesters\Programming Fundamentals (Fall 2023)\Week 5\PD Tasks>Task4.exe
Enter the needed hours: 99
Enter the days that the firm has: 3
Enter the number of all workers: 1
Not enough time! 72 hours needed.

G:\Semesters\Programming Fundamentals (Fall 2023)\Week 5\PD Tasks>Task4.exe
Enter the needed hours: 90
Enter the days that the firm has: 7
Enter the number of all workers: 3
Yes!99 hours left.
```

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Skill: Categorize the code into meaningful functions to make the code more modular, readable, structured, and reusable

Task05 (Business Project):

Develop the First version of your individual business application. You have to input 3 entities data, perform some calculation on it and then display the result in tabular form. You have to make the menu based system.

Task06 (Game Project):

Develop the First version of your individual Game Project. You have to make 3 types of enemies (horizontal movement, vertical movement, diagonal movement). Also you have to make a player that will move using arrow keys. Also limit the player and enemies in the maze using getCharAtxy function as discussed in the class.

Good Luck and Best Wishes !!

Happy Coding ahead :)

Skill: Categorize the code into meaningful functions to make the code more modular, readable, structured, and reusable