

CPT 111 – Principles of Programming  
Week 10 Programming Lab  
Functions II

Learning Outcomes:

- Understanding local and global variables
- Describe functions with parameters – passing by reference
- Demonstrate Overloading functions

- 
1. What is the difference between a static local variable and a global variable?
  2. What is the output of the following program?

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

void myFunc(); // Function prototype

int main()
{
    int var = 100;
    cout << var << endl;
    myFunc();
    cout << var << endl;
    return 0;
}

// Definition of function myFunc
void myFunc()
{
    int var = 50;
    cout << var << endl;
}
```

3. What is the output of the following program? Explain your answer.

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

void showVar(); // Function prototype

int main()
{
    for (int count = 0; count < 10; count++)
        showVar();
    return 0;
}

void showVar() // Definition of function showVar
{
    static int var = 10;
    cout << var << "\t";
    var++;
}
```

4. Modify Question 3 such that variable `var` is not declared as static variable. What is the output? Explain your answer.

```
void showVar() // Definition of function showVar
{
    int var = 10;
    cout << var << "\\t";
    var++;
}
```

5. What is the output of the following program? Explain your answer.

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

void showVal(int=5, int=10); // Function prototype with default arguments

int main()
{
    showVal(); //Function call
    showVal(9);
    showVal(9, 99);
    return 0;
}

void showVal(int x, int y) // Function definition
{
    cout<< x << "\\t" << y <<endl;
}
```

6. Define the prototype and header for a function called `compute`. The function should have three parameters: an `int`, a `double`, and a `long` (not necessarily in that order). The `int` parameter should have a default argument of 5, and the `long` parameter should have a default argument of 65536. The `double` parameter should not have a default argument.
7. Define the prototype and header for a function called `calculate`. The function should have three parameters: an `int`, a reference to a `double`, and a `long` (not necessarily in that order.) Only the `int` parameter should have a default argument, which is 47.
8. What is the output of the following program?

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

void test(int = 2, int = 4, int = 6);

int main()
{
    test();
    test(6);
    test(3, 9);
    test(1, 5, 7);
    return 0;
}

void test (int first, int second, int third)
{
    first += 3;
    second += 6;
    third += 9;
    cout << first << " " << second << " " << third << endl;
}
```

9. The following program asks the user to enter two numbers. What is the output of the program if the user enters 12 and 14? Explain the effects of using parameters passing by reference.

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

void func1(int &, int &);
void func2(int &, int &, int &);
void func3(int, int, int);

int main()
{
    int x = 0, y = 0, z = 0;
    cout << x << " " << y << " " << z << endl;
    func1(x, y);
    cout << x << " " << y << " " << z << endl;
    func2(x, y, z);
    cout << x << " " << y << " " << z << endl;
    func3(x, y, z);
    cout << x << " " << y << " " << z << endl;
    return 0;
}

void func1(int &a, int &b)
{
    cout << "Enter two numbers: ";
    cin >> a >> b;
}

void func2(int &a, int &b, int &c)
{
    b++;
    c--;
    a = b + c;
}

void func3(int a, int b, int c)
{
    a = b - c;
}
```

10. Days Out - Write a program that calculates the average number of days a company's employees are absent. The program should have the following functions:

- A function called by `main` that asks the user for the number of employees in the company. This value should be returned as an `int`. (The function accepts no arguments.)
- A function called by `main` that accepts one argument: the number of employees in the company. The function should ask the user to enter the number of days each employee missed during the past year. The total of these days should be returned as an `int`.
- A function called by `main` that takes two arguments: the number of employees in the company and the total number of days absent for all employees during the year. The function should return, as a `double`, the average number of days absent. (This function does not perform screen output and does not ask the user for input.)

*Input Validation: Do not accept a number less than 1 for the number of employees. Do not accept a negative number for the days any employee missed.*

11. **Overloaded Hospital** - Write a program that computes and displays the charges for a patient's hospital stay. First, the program should ask if the patient was admitted as an in-patient or an out-patient. If the patient was an in-patient, the following data should be entered:

- The number of days spent in the hospital
- The daily rate
- Hospital medication charges
- Charges for hospital services (lab tests, etc.)

The program should ask for the following data if the patient was an out-patient:

- Charges for hospital services (lab tests, etc.)
- Hospital medication charges

The program should use two overloaded functions to calculate the total charges. One of the functions should accept arguments for the in-patient data, while the other function accepts arguments for out-patient information. Both functions should return the total charges.

*Input Validation: Do not accept negative numbers for any data.*

12. `isPrime` Function - A prime number is a number that is only evenly divisible by itself and 1. For example, the number 5 is prime because it can only be evenly divided by 1 and 5. The number 6, however, is not prime because it can be divided evenly by 1, 2, 3, and 6.

Describe a function name `isPrime`, which takes an integer as an argument and returns `true` if the argument is a prime number, or `false` otherwise. Demonstrate the function in a complete program.