Lab 12
Recursion and Its Applications

Section 1: Guess program outputs.

1. What is the output of the following program?

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

int function(int num);

int main()
{
  int x = 10;
  cout << function(x) << endl;
  return 0;
}

int function(int num)
{
  if(num <= 0)
    return 0;
  else
    return function(num - 1) + num;
}
```

2. What is the output of the following program?

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

void function(int num);

int main()
{
    int x = 10;
    function(x);
    return 0;
}

void function(int num)
{
    if(num > 0)
    {
        for(int x = 0; x < num; x++)
            cout << '*' ;
        cout << endl;
        function(num - 1);
    }
}
```

3. What is the output of the following program?

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

void function(string str, int pos);

int main(int argc, char* argv[])
{
    string names = "Adam and Eve";
    function(names, 0);
    return 0;
}

void function(string str, int pos)
{
    if(pos < str.length())
    {
        function(str, pos+1);
        cout << str[pos];
    }
}
```

Section 2: Review Questions and Exercises

1. Which repetition approach is less efficient; a loop or a recursive function? Why?

2. When should you choose a recursive algorithm over an iterative algorithm?

Section 3: Programming Challenges

1. Iterative Factorial and Recursive Factorial
Write both iterative version using a loop and recursive version using a recursion of the factorial function. Demonstrate the use of the function in a program that prints the factorial of a number entered by the user.

2. Recursive Conversion
Convert the following function to one that uses recursion.

```
void sign(int n)
{
  while (n > 0)
  {
    cout << n << " ";
    n--;
  }
}
```

Demonstrate the function with a driver program.