


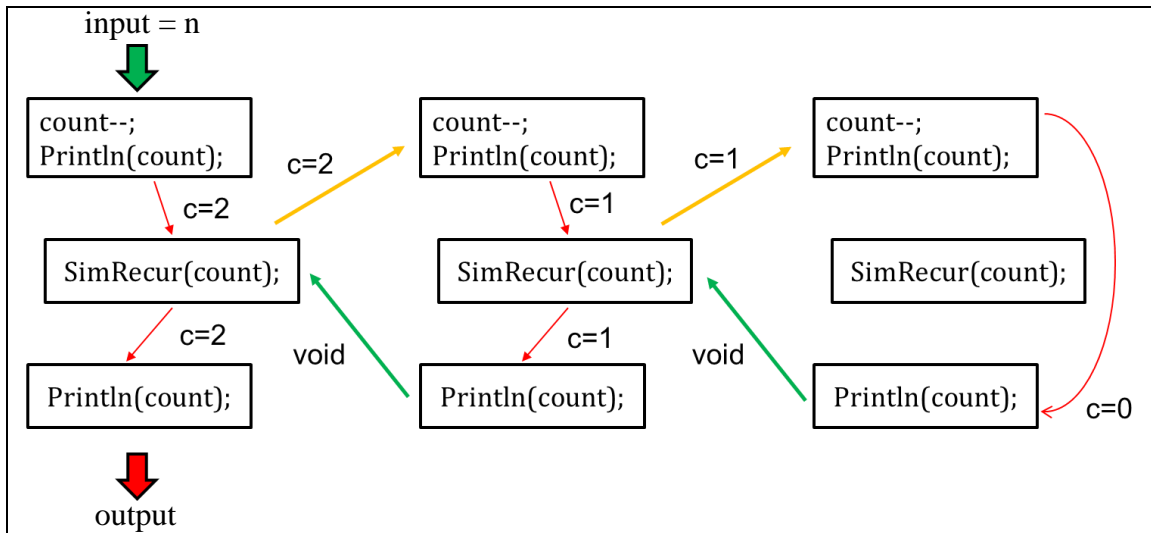
<b>Data Structures and Algorithms Laboratory</b>		
<b>Laboratory 5: Recursion</b>	<b>School of Information Technology</b>	
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<b>Date: 28 Feb 2023</b>	<b>Due date: on LMS</b>	

### Objective

- To understand the step of recursion
- To create the recursive program
- To implement the factorial and the power program

**Exercise 1:** (in-class) Simple recursive program shows how to trace the recursion.

Given the diagram of tracing a countdown algorithm.



Create the recursive program to calculate the result of the given diagram. User have to enter the input to the program.

Expected result:

```

C:\windows\system
Please enter number: 5
The value of the count is 4
The value of the count is 3
The value of the count is 2
The value of the count is 1
The value of the count is 0
Now, the count is "0"
Now, the count is "1"
Now, the count is "2"
Now, the count is "3"
Now, the count is "4"
D:\Java Eclipse Workspace\DSA>Pause
Press any key to continue . . .

```

**Code (Recursion):** Complete the missing parts

```
package DSALab5;

import java.util.Scanner;

public class SimpleRecursion {

    public static void main(String[] args) {

        System.out.print("Please enter number: ");

        Scanner key = new Scanner(System.in);

        int n = key.nextInt();

        SimRecur(n);

    }

    public static void SimRecur(int count) {

        count--;

        System.out.println("The value of count is " + count);

        if(count > 0) {

            SimRecur(count);

        }

        System.out.println("Now, the count is " + count);

    }

}
```

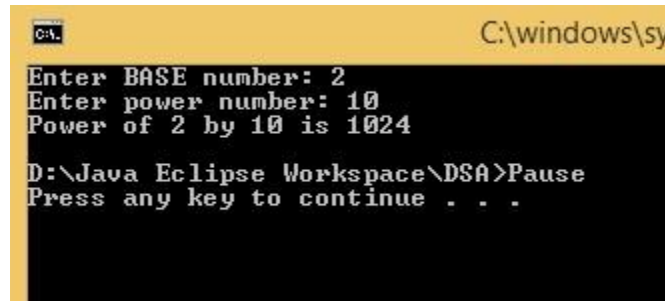
What are the **base case** and return value of the countdown algorithm?

The base case is 0.  
Return value of the countdown is count--;

**Exercise 2:** (in-class) Given the formulation for computing “Power”.

$$\text{Power}(x,n) = \begin{cases} 1 & \text{if } n = 0 \\ x * \text{power}(x, n-1) & \text{otherwise} \end{cases}$$

Create the recursive program to calculate the result of “Power” as the expected result.



```
C:\windows\sy
Enter BASE number: 2
Enter power number: 10
Power of 2 by 10 is 1024
D:\Java Eclipse Workspace\DSA>Pause
Press any key to continue . . .
```

**Code (Recursion):** Complete the missing parts

```
package DSALab5;

import java.util.Scanner;

public class CH5_AS3 {

    public static void main(String[] args) {

        // TODO Auto-generated method stub

        System.out.print("Enter BASE number: ");

        Scanner key = new Scanner(System.in);

        int x = key.nextInt();

        System.out.print("Enter power number: ");

        int n = key.nextInt();

        System.out.print("Power of " + x + " by " + n + " is " + Power(x,n));

    }

    public static int Power(int x,int n) {

        if(n == 0) {

            return 1;

        }

    }

}
```

```

}

else {

return (x* Power(x,n-1));

}

}

}

```

What are the **base case** and return value of the Power algorithm?

Base case is 0. Return value of the Power is 1.

From the same recursive problem, modify the source code by using the repetition LOOP statement to solve the problem.

**Code (Loop):** Complete the missing parts

```

package DSALab5;

import java.util.Scanner;

public class CH5_AS3 {

public static void main(String[] args) {

// TODO Auto-generated method stub

System.out.print("Enter BASE number: ");

Scanner key = new Scanner(System.in);

int x = key.nextInt();

System.out.print("Enter power number: ");

int n = key.nextInt();

int pow =1;

for(int i = 1; i <=n ;i++) {

```

```
pow *= x;  
  
}  
  
System.out.print("Power of " + x + " by " + n + " is " + pow);  
  
}  
  
}
```

**Exercise 3:** (Homework) Create the recursive program to calculate the result of “Fibonacci” as the expected result.



The screenshot shows a Windows command prompt window with a yellow title bar. The text inside the window is as follows:  
C:\windows\system32\cmd.exe  
Please enter number: 7  
Fibonacci result is 13  
D:\Java Eclipse Workspace\DSA>Pause  
Press any key to continue . . .

Code (Recursion):

```

package DSALab5;

import java.util.Scanner;

public class CH5_AS3 {

    public static void main(String[] args) {

        // TODO Auto-generated method stub

        System.out.print("Please enter number: ");

        Scanner key = new Scanner(System.in);

        int x = key.nextInt();

        System.out.print("Fibonacci result is " + Fabonacci(x));

    }

    public static int Fabonacci(int n) {

        if(n == 0) {

            return 0;

        }

        else if(n == 1) {

            return 1;

        }

        else {

            return (Fabonacci(n -1)+ Fabonacci(n-2));

        }

    }

}

```

What are the base case and return value of the Fibonacci algorithm?

Base case is 0 and 1. So return is 0 and 1.

From the same recursive problem, modify the source code by using the repetition LOOP statement to solve the problem.

**Code (Loop):**

```
package DSALab5;

import java.util.Scanner;

public class CH5_AS3 {

    public static void main(String[] args) {

        // TODO Auto-generated method stub

        System.out.print("Please enter number: ");

        Scanner key = new Scanner(System.in);

        int x = key.nextInt();

        int Fib = 0;

        int a = 0;

        int b = 1;

        if(x == 0) {

            Fib = 0;

        } else if(x == 1) {

            Fib = 1;

        } else

        {

            for(int i = 1; i < x ; i++) {

                Fib = a + b;
```

```
a = b;  
  
b = Fib;  
  
}  
  
}  
  
System.out.print("Fibonacci result is " + Fib);  
  
}  
  
}
```