# Hands-on Experiment # 10 : Worksheet

Section\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

No more than 3 students per one submission of this worksheet.

Student ID \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student ID \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student ID \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Part A: Getting Familiar with Writing Recursive Methods

1. Consider the following recursive definition.



Find the value of *f(n)* for all values of *n* listed in the table below.

|  |  |
| --- | --- |
| *n* | *f(n)* |
| 0 | 1 |
| 1 | 1 |
| 2 | 1 |
| 3 | 3 |
| 4 | 5 |
| 5 | 9 |
| 6 | 17 |

1. Write a Java method called *computeF(int n)* which returns the value of *f(n)*. Assume that *n* is a non-negative integer. Test your method in a program in which the values of f(n) according to the following table are computed. Complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
| *n* | *f(n)* | *n* | *f(n)* |
| 0 | 1 | 7 | 31 |
| 1 | 1 | 8 | 57 |
| 2 | 1 | 9 | 105 |
| 3 | 3 | 10 | 193 |
| 4 | 5 | 100 | 1.2707161788700277E26 |
| 5 | 9 | 200 | 3.7067466851909835E52 |
| 6 | 17 | 500 | 9.20080768385554E131 |

List all your source code below.

import java.util.Scanner;

public class Recursive {

static double[] num = new double[501];

static int called = 0;

public static void main(String[] *args*) {

Scanner kb = new Scanner(System.in);

int n = kb.nextInt();

System.out.println("f(" + n + ") :" + computeF(n));

System.out.println("Called: " + called + " times");

}

public static double computeF(int *n*) {

called++;

if (n < 3)

return 1;

if (num[n] != 0)

return num[n];

num[n] = computeF(n - 1) + computeF(n - 2) + computeF(n - 3);

return num[n];

}

}

1. (Optional) Based on your code, how many times *computeF()* is called in order to compute *computeF(500)*? You may modify the signature of the method so that you have a way to track the number of times it is called.

The number of times is :

1495

Explain how you obtained the answer. Show all relevant code.

Use called variable to collect round of function called.

import java.util.Scanner;

public class Recursive {

static double[] num = new double[501];

static int called = 0;

public static void main(String[] *args*) {

Scanner kb = new Scanner(System.in);

int n = kb.nextInt();

System.out.println("f(" + n + ") :" + computeF(n));

System.out.println("Called: " + called + " times");

}

public static double computeF(int *n*) {

called++;

if (n < 3)

return 1;

if (num[n] != 0)

return num[n];

num[n] = computeF(n - 1) + computeF(n - 2) + computeF(n - 3);

return num[n];

}

}

## Part B: Thinking Recursively

1. Write a recursive method that checks whether the input *String* is a palindrome (<http://en.wikipedia.org/wiki/Palindrome>). Assume that the input *String* only contains English alphabets. You can design the method signature by yourself.

List your source code here.

import java.util.Scanner;

public class Palindrome {

public static void main(String[] *args*) {

Scanner kb = new Scanner(System.in);

String str = kb.nextLine();

System.out.println(check(str));

}

public static boolean check(String *str*) {

if (str.length() < 2)

return true;

return (str.substring(0, 1).equals(str.substring(str.length() - 1)))

&& check(str.substring(1, str.length() - 1));

}

}

Submit this worksheet (by only one member of the group) via <http://www.myCourseVille.com> (Assignments > Hands-on Experiment # 10) before noon of the day after your lecture.