UNIVERSITY OF WESTMINSTER

INFORMATICS INSTITUTE OF TECHNOLOGY

Tutorial 5: Methods & Recursion

Aim:

- Get familiar with Java methods and recursion
- Consolidate learning from week 4, 5 and 6.
- Get feedback.

Note: Use the material from the lecture if you need. If you find any problem or have a question, ask your tutor. If you do not have enough time during the session, it is recommended that you finish the exercises at home. Challenges are optional, although recommended.

Section 01: Main Questions

Q1: Hello With Methods

Write a program that calls a method to print "Hello world".

Create a new project, and add the following method after your main method:

```
private static void hello(){
      System.out.println("Hello world!");
}
```

Add a call to your new method hello in your main:

```
public static void main(String[] args) {
      hello(); }
```

You code should look like this:

```
public class Tutorial4_Ex3 {
      public static void main(String[] args) {
      hello();
      }

private static void hello(){
      System.out.println("This is my first method!");
      }
}
```

Q2: Calculator

Write a program for a calculator that first displays the following menu:

```
**********
   MENU
**********
1.- Addition
2.- Subtraction
0.- Quit Please select an option:
```

Then, when the user selects 1, the program should call a **method** to perform an addition by asking the user to introduce two double numbers. When the user selects 2, the program should call a **method** to perform a subtraction, by asking the user to introduce two double numbers. After performing the operation, the program should ask the user to **select an option again**. When the user selects 0, the program should end.

Note: Since option 1 and 2 both need to read two double numbers, you can also do that in a separate method (to avoid repetition) by returning an array with the 2 double values.

Q3: Printing Numbers

Write a program in Java that prints the numbers 1 to 100 without using a loop. Call the method from the main. You can use parameters if you need.

Q4: Exponents using Recursion.

Write a program that computes exponents. The program should ask the user to input a number (int) and an exponent (int) and return the result. **You cannot use a loop, you have to use recursion (a method that calls itself)**.

Example:

$2^4 = 2 * 2 * 2 * 2 = 16.$

$6^3 = 6 * 6 * 6 = 216.$

Section 02: Challenging Questions

Q5: Double recursion.

Let t(n) be a sequence defined for all non–negative integers by the following recursive definition:

t(0) = 1 t(1) = 3 t(n) = t(n-2) + t(n-1), for n≥2
Write a program in Java that finds out the value of t(4) using recursion.

Acknowledgement: This exercise was taken from Mathematics in Computing (4COSC002W).

Q6: Code verification

What does this display?

```
public static void main(String[] args) {
            int aValue = 3;
            multiply(aValue, 2);
        }
private static void multiply(int sum1, int sum2){
sum1=sum1*sum2;
        System.out.println(sum2+" "+sum1);
}
```

a. Rewrite it so the method returns the final value to the main program and then displays it.

b. Can you make it return a double ex: return (double) sum1;

Q7: Pass power of 2 of a number

Write a method which will take in a number and give back two times the number given. Write the main body of the program to call the function, and when a value is returned the main body should display it.

Q8: Find factorial using Recursion

Write a program that will take a number and return the result of multiplying all the numbers together from 1 to the number given. (factorial). Write the main body of the program to call the function, and when a value is returned the main body should display it.

Q9. Code verification II

```
//swaps parameter names around in function call public
static void main(String[] args) {
    int a = 2;
    int b = 5;
    int c = 4;
    mixup(a, b, 3);
 }
private static void mixup(int b, int c, int a ) {
        a = b + c - a;
        System.out.println(a + " " + c);
}
```

Q10. Code verification III

What does this display

```
public class Main { // demonstrate scope and functions
static int aValue = 5;
    public static void main(String[] args) {
    int aValue = 6;
    int bValue = 4;
    process(bValue);
        System.out.println(aValue);
    }
    private static void process(int aValue) { //AA
         aValue = aValue + 4;
        System.out.println(aValue);
    }
}
```

a. How different is the display if line AA above was:

```
private static void process(int cValue) { //AA
```

b. Can you turn the procedure into a function that returns an int and then displays it.

c. Can you turn the procedure into a function to return a double?

Q11. Code verification IV

Does this multiply 3*2 or add 3 to 2? Why?

```
public static void main(String[] args) {
        double Num1 = 3.0;
        int Num2 = 2;
        double total;
        total = processA( Num1, Num2);
        System.out.println(total);
        }
private static double processA(double Sum, int Count) {
     double newAnswer = Sum + (double) Count;
     return newAnswer;
        }
private static double processA(int Sum, double Count) {
     double newAnswer = (double) Sum * Count;
     return newAnswer;
        }
```

How would you make them both return back an 'int'?

Q12. palindrome

A nonnegative integer is called a palindrome if it reads forward and backward in the same way. For example, the numbers 5, 121, 3443, and 123454321 are palindromes. Write a method that takes as input a nonnegative integer and returns true if the number is a palindrome; otherwise, it returns false. Also write a program to test your method.

Section 03 : HackerRank Challenges

HackerRank: Interview questions. Solve the following tasks in HackerRank:

1. Java method overriding