

## Lab 13 – Recursion

### Aim

This lab is intended to give you practice with using recursion

### Resources

Your week 13 lecture notes will be useful

### Tips:

1. This sheet is intended to take less than the full 2 hours. You should use free time to work on your CW3 assignment.
2. This lab is challenging, and will be easier if you stop and think about it!
3. This lab will use NO for or while loops. No loops at all, only recursion!

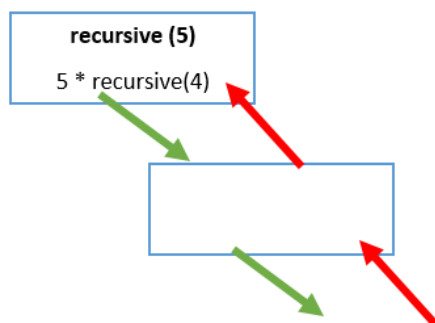
### Recursion - Factorial

Your lecture week 13 notes introduce 2 problems, Fibonacci and Factorial.

- Consider the factorial problem. A suitable set of test cases would look like:

Input Integer	Expected Answer	Your Answer	Pass Test?
0	1		
1	1		
2	2		
3	6		
4	24		
5	120		

- We CAN solve this using loops, but this week, we are going to use **recursion**
- Using the week 13 lecture notes, create a method that will solve this problem.
- What is the process through the program? It can help to draw the process. Starting with an input of 5, how many times does it call the method? Complete the diagram:



### Student Money

Given a class of students, we wish to find out how much money there is in the class. We will not use any loops here, only recursion. We assume that each student has 7 RMB. This leads to the following test cases:

Number Students	Expected Answer	Your Answer	Pass Test?
0	0		
1	7		
2	14		
3	21		
4	28		
5	35		
6	42		
7	49		

- You need to create a recursive method that calls itself, and does **not** use any loops that will solve the test cases above
- First, what are the **base** cases? What are the simplest possible cases
- How can you then solve it recursively? Draw a diagram of the process.

### Student Money – Now with richer students

Given a class of students, we wish to find out how much money there is in the class. We will not use any loops here, only recursion. Here, most students have 7 RMB, but every 3<sup>rd</sup> student has 11 RMB.

- Student 1 has 7 RMB, student 2 has 7 RMB, student 3 has 11 RMB, student 4 has 7 RMB, student 5 has 7 RMB, student 6 has 11 RMB, and so on.
- First, what are your test cases? Fill in the table:

Number Students	Expected Answer	Your Answer	Pass Test?
0			
1			
2			
3			
4			
5			
6			
7			

- Create a method to solve this problem (hint, you may need to use the **mod** of an integer). Test all your test cases to make sure it solves the problem.

### Strings and Recursion

Christmas is coming, and we want to create an overexcited program. This will receive a string, and will recursively check each character. If an “s” is found, then it will replace the “s” with “Santa”.

- For example, the method call:  
`System.out.println(christmasComing("christmasiscoming"));`
- Will produce the output: `chriSantatmaSantaiSantacoming`
- Create some test cases:

	Expected Answer	Your Answer	Pass Test?

- Create a method to solve this!

### Remaining time?

Use the remaining time to continue with your CW3!