UNIVERSITY OF COPENHAGEN

Ninth exercise class

Class 1 & 5

Introduction to numerical programming and analysis

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Overview

1. Plan for today

2. Hints

Plan for today

What are we doing today?

Today we will be working with Problem set 5, which covers various functions. Functions are the main way python operates.

Hints

Problem 1

You have to create a function that returns the factorial value of the input. This has to be done recursively this means that you need the following:

- Call the function again.
- An catch so the function doesn't call itself in infinite (this has been done for you).

Problem 2

This problem is about sorting a list using bubble sort, bubble sort works by going through a list and swapping values if the first one is greater than the one after. When writing the code try to think of the following:

- Is going through the list once enough? How many times do you have to go through the list and how can you code this using for loops?
- Create a separate function for swapping two values in the list (remember to create an temporary holder), this makes the code easier.

Remember you can test your solution using the given list.

Problem 3

You have to create a function that returns the index of an given value or the index of the value that is less than or equal to the value and the next value being strictly greater. To do this remember:

- The given list is already ordered, so you need to find the first that is equal to or smaller and where the next value is less. This can be done using a for loop where you start from one end (think how this can done)

Problem 4

This problem ask you to find the value where a function crosses the x-axis. This can be done using what you have learned in Math A:

- You know from mathematics that there will be an solution (You can also asume that the function will only cross the x-axis once), then you can solve it by halving the interval until the interval size is less than a tolerance (ϵ), Choose a ϵ that is quite small i recommend $1e-10$.
- Consider how you can code a unknown number of test until the value is less than the tolerance.

Problem 5

For this function you need to get all the prime numbers, since prime numbers are integers only divisible by 1 and themselves, this can be done by eliminating all the values that aren't prime numbers, by starting from the bottom and removing all values that the latest prime number can be multiplied into.

- Start by creating a list of all values using the inbuilt methods *list()* and *range()*.
- Use a loop (think about which one makes the best sense here) to loop over all values until $\sqrt{n}$.