IIT Madras

ONLINE DEGREE

Programming in Python
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Recursion: A simple question

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$$L = [11, 12, 16, 2, 3, 4, 0, 5, 6]$$

$$\text{CheckO}(L) \begin{cases} \text{False} \\ \text{True} \checkmark \end{cases}$$

```
CheckO (L):
    if L[0] == 0:
        return True
```

```
CheckO (L):
    if L[0] == 0:
        return True
    else:
        checkO(L[1: n-1])

if len(L) == 0
    return False.
```

Well, we are now going to write a program using recursion. Before writing the program, I will tell you what is the question? You see there is a list L with many elements, so on. There is also 0

somewhere. Assume there is a 0 somewhere. Now, there is this function check 0, which takes a list L and returns 0 if the element 0 is not present, and returns 1, if it is present.

It can be a little confusing, because when 0 is present, it returns 1, when 0 is not present, it returns 0. So, this basically is true or false. So, maybe it will be easy on your minds if I were to use true or false. I say false if 0 is not present, true if 0 is present. In this case, it should return true simply because 0 is present in the list. How do you write a program for this?

So, let me try writing a program for this. How do you do? So, what I do is, I will say, the pseudocode, check 0 will take a list L, of course, you must put a def here, but it is pseudocode I will not put it. It does not matter. Pseudocode is plain English. It need not necessarily be, you cannot adhere to a programming language syntax here. As you know, we have discussed that in detail in computational thinking course.

So, check 0 of L, what would I do? I will say, if the first element is 0, then I will return true. Yes, it is found. Else, I cannot say 0 is not present. Else, I will say check 0 of L not from 0, but 1 to the last element n minus 1. Do not worry, I am using Python syntax here. So, this is just plain English.

All I do is if it is true, if 0 equals 0 return true, else I keep doing this. And if, I should also probably say, if L is empty, if you have gone to the end of the list, if the length is 0, then return false. There is all sorts of very bookkeeping details. You probably will find it confusing. But do not worry, we will write a piece of code to check what is what.

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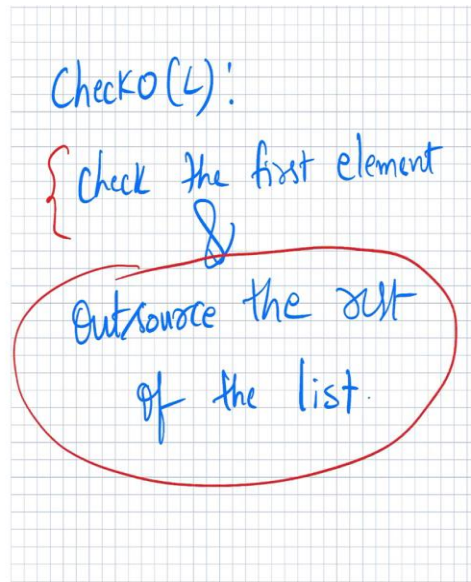
So, just keep in mind that all you are trying to do is if this pseudocode is very heavy on your mind, all you are trying to do is check 0 of a list L in simple English is check the first element and outsource the rest of the list, just like your vessel problem.

The reason why I did not want to write a proper pseudocode here is I want to make this appear very similar to the vessels problem that I told you. So, all that recursion demand is check some one unit of, do just one unit of work, which you do here and then the rest of it gets reduced by one unit. And that you once again repeat it. Clean only one vessel and then leave the rest of it to someone else to do it. So, that is all is idea.

$$Fact(10) = 10 * Fact(9)$$

$$Sum(n) = n + Sum(n-1)$$

$$Sum(5) = 5 + \underline{Sum(4)}$$

Recursion

```
Check0 (L):
    if L[0] == 0:
        return True
    else:
        check0(L[1:n-1])
if len(L) == 0
    return False.
```

For instance, our typical factorial example just to revisit it, which we did the in a couple of weeks before, factorial of a number 10 is simply 10 times the factorial of 1 less than 10. Sum of the first n numbers is n plus sum of the first n minus 1 numbers. Sum of the first five numbers, 1 plus 2 plus 3 plus 4 plus 5 is simply 5 plus sum of 4, which is 4 plus 3 plus 2 plus 1 here.

So, this is recursion. Let us now go ahead and look at this. Not so right. I did not, I am sorry, pardon me, I did not write it properly. So, let me write a small code for this and then show you how this can be coded in Python. So, actually, this is not the exact syntax. I just wanted to tell it

in plain English here. This may not even be completely right. But when we are writing the code, we will fix it.