Recursion

What do you like about Recursion?

How to participate?

Agenda

Item	Time (GMT)
What is Recursion	10
Why use recursion	20
How to write recursive functions (with examples)	15
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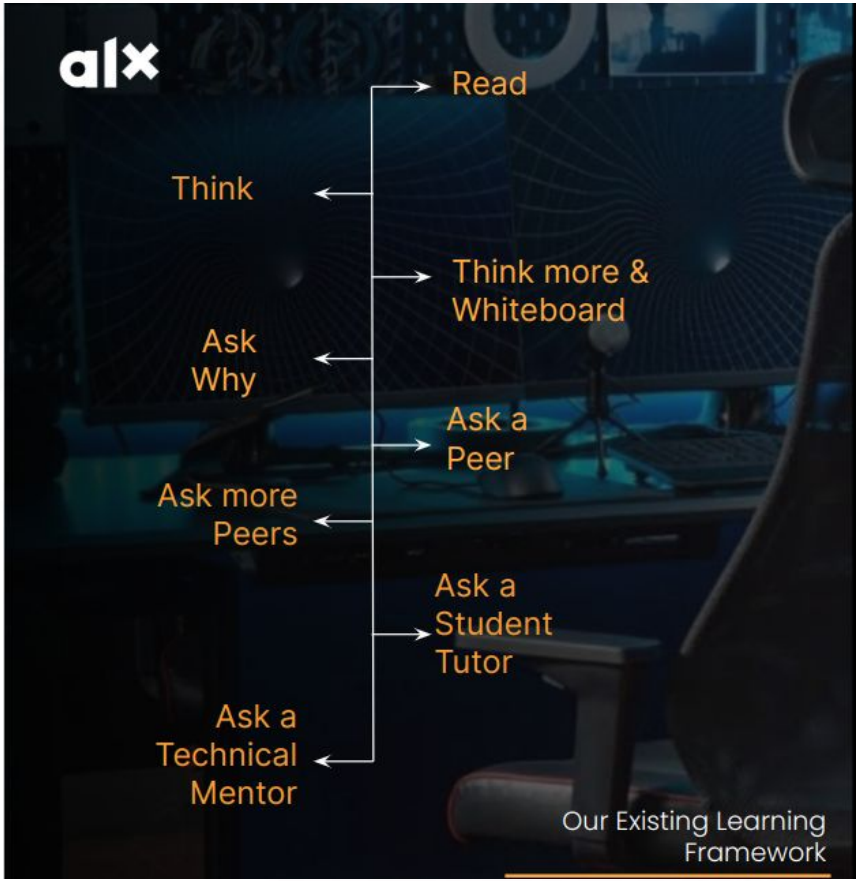
The Framework



What is recursion

- Recursion is a function calling itself.

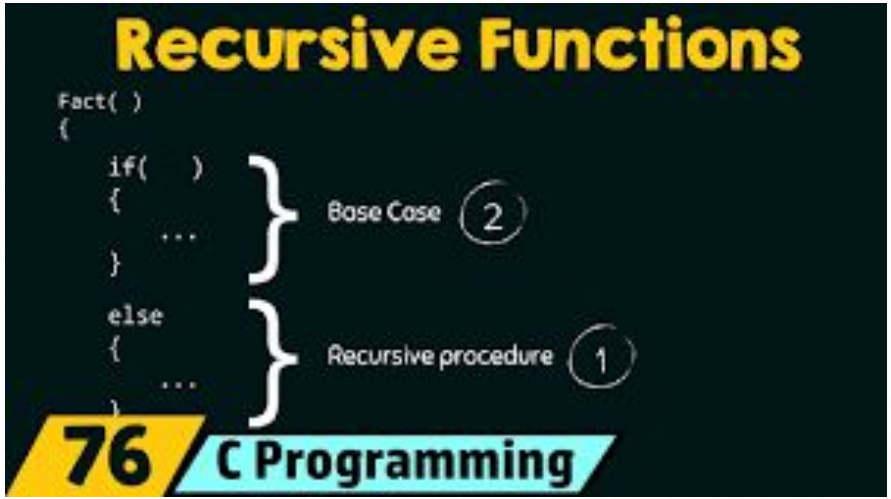
Again What is Recursion

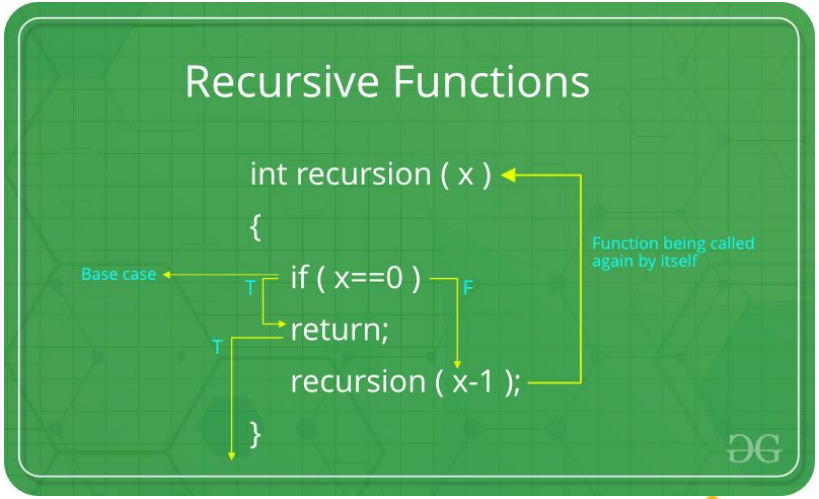
Recursion is the process of defining a problem (or the solution to a problem) in terms of (a simpler version of) itself.

For example, we can define the operation "find your way home" as:

1. If you are at home, stop moving.
2. Take one step toward home.
3. "find your way home".

How do we write recursive functions





Why Recursion Works

In a recursive algorithm, the computer "remembers" every previous state of the problem. This information is "held" by the computer on the "activation stack" or recursion stack.

What is factorial?

fac(0) = 1

fac(1) = 1 * fac(0)

fac(2) = 2 * fac(1) = 2 * 1 = 2

fac(3) = 3 * fac(2) = 3 * 2 = 6

fac(100) = 100 * fac(99)

fac(n) = n * fac(n - 1)

Factorial of a Number

Relation -> F(n) = n * f(n - 1)

Base Case: f(0) = 1

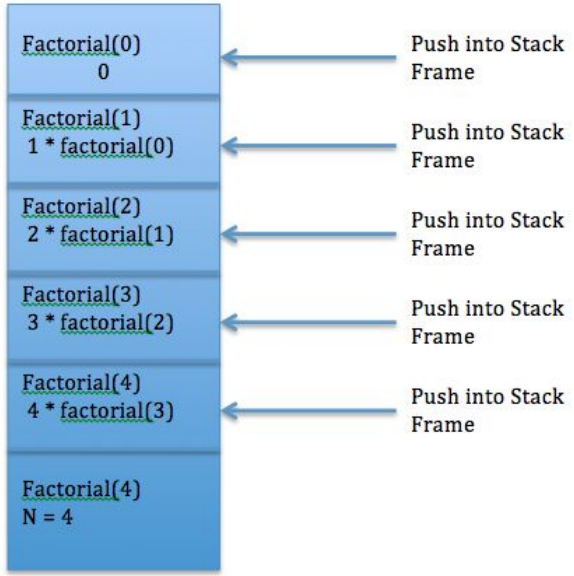
Function factorial(n):

If n == 0:

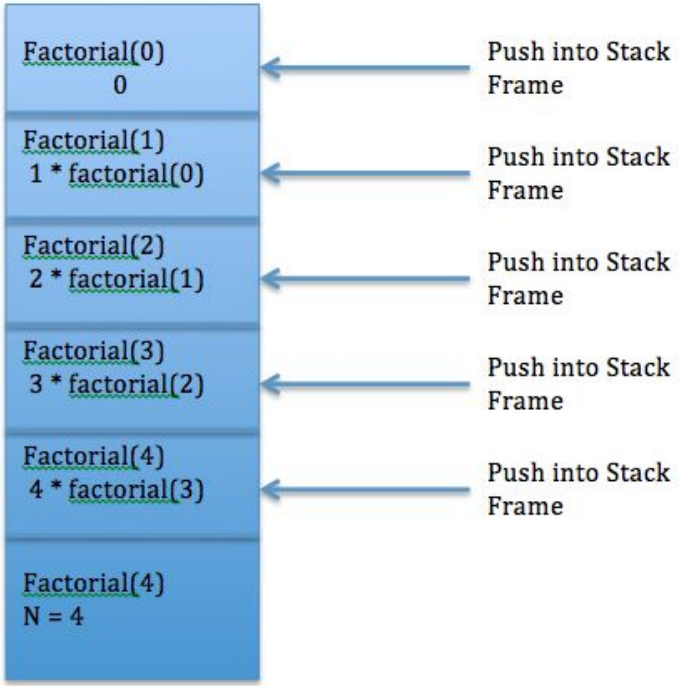
Return 1

Calc = n * factorial(n - 1)

Return calc



Recursion stack



Why do we use Recursion

- Recursion provides a clean and simple way to write code. Some problems are inherently recursive like tree traversals, Fibonacci, etc.

Every recursive code can be written Iteratively

Recursion Visualization

https://recursion.vercel.app/

Fibonacci Sequence

$$f(n) = f(n - 1) + f(n - 2)$$

Disadvantage of Recursion

- Recursive functions are generally slower than non-recursive function.
- It may require a lot of memory space to hold intermediate results on the system stacks.
- Hard to analyze or understand the code.
- It is not more efficient in terms of space and time complexity.

Summary

- There are two types of cases in recursion i.e. recursive case and a base case.
- The base case is used to terminate the recursive function when the case turns out to be true.
- Each recursive call makes a new copy of that method in the stack memory.
- Infinite recursion may lead to running out of stack memory.
- Examples of Recursive algorithms: Merge Sort, Quick Sort, Tower of Hanoi, Fibonacci Series, Factorial Problem, etc.

Resources used

- https://www.geeksforgeeks.org/introduction-to-recursion-data-structure-and-algorithm-tutorials/
- https://www.cs.utah.edu/~germain/PPS/Topics/recursion.html
- https://www.collegenote.net/curriculum/data-structures-and-algorithms/41/454/

Q/A

See you on Next Sessions