**Exercise 7: Financial Forecasting**

1. **Understand Recursive Algorithms:**
2. Explain the concept of recursion and how it can simplify certain problems.

Answer:

**Introduction**

There are various problem-solving approaches in programming, and one of the most powerful among them is recursion.

**Recursion**

Recursion is a problem-solving technique in which a method or function calls itself to solve smaller instances of the same problem.

**Two parts of recursion**

**Base case**

* The stopping point where the recursion ends.
* Prevents StackOverflowError / Program crash .

**Recursive case**

* The part where the function calls itself on a smaller input instance.

**How it Simplifies Certain Problems**

It divides a complex problem into simpler subproblems of the same type and combines their solutions to form the solution to the original problem.

Ex- Fibonacci, Factorial calculation are some basic applications.

4**. Analysis**

**Note**: I have used Compound Interest (C.I.) to calculate financial forecasting.

a) Discuss the time complexity of your recursive algorithm.

Answer:

For n = no. of years

Time Complexity: O(n)

Space Complexity: O(n), n frames in call stack

b)Explain how to optimize the recursive solution to avoid excessive computation.

Answer:

Recursive solution can be optimised using:

* Dynamic Programming – but there are no overlapping subproblems in my solution.
* **Iterative approach** – I have implemented to optimize calculating Financial Forecasting.

Iterative Approach vs Recursive Approach

1. Iterative Approach has no function calls / no stack growth, minimal overhead.

Recursive Approach has overhead of function calling and stack push and pop. Every recursive call adds a new frame to the call stack.

1. Iterative Approach – Space Complexity – O(1)

The loop runs in place within a single stack frame.

Recursive Approach – Space Complexity – O(n)

If the recursion is too deep - StackOverflowError or stack overflow crash.

1. Both have same Time Complexity of O(n), but as above Iterative is faster due to minimal overhead.

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