**Cognizant Deep Nurture 4.0 - Data structures and Algorithms**

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**Exercise 7: Financial Forecasting – Theoretical**

**1. Understanding Recursive Algorithms**

* Recursion is a programming concept where a method calls itself to solve smaller sub-problems of the original task.
* A recursive function has two essential components:
  + A **base case** to stop recursion when a specific condition is met.
  + A **recursive case** that calls the function with modified inputs.
* It is particularly effective for problems with a repetitive or time-based structure, such as predicting values over a time period.

**2. Role in Financial Forecasting**

* In financial forecasting, recursion is used to simulate compound growth, where each year’s value depends on the previous year's result.
* This approach reflects the formulaic nature of financial predictions by applying the growth rate recursively for the specified duration.

**4. Analysis of the Recursive Algorithm**

* The time complexity of the recursive solution is **O(n)**, where n is the number of years, as it processes each year once.
* While suitable for small input sizes, recursion can become inefficient if it leads to repeated computations or deep call stacks.
* Optimization strategies:
  + **Memoization**: Caches previous results to prevent redundant calculations.
  + **Iteration**: Converts the logic into a loop to reduce memory overhead.
  + **Mathematical formula**: Using Future Value = P × (1 + r)^n is the most optimal solution in production systems.