**Exercise 7: Financial Forecasting**

**Scenario:**

You are developing a financial forecasting tool that predicts future values based on past data.

**1. Understand Recursive Algorithms:**

Recursion is a technique where a function calls itself to solve a smaller instance of the same problem until a base condition is met.  
It helps simplify problems that have repetitive patterns, such as calculating compound interest or predicting future values based on past data.

In financial forecasting, recursion can be used to calculate the value of an investment year after year by applying a fixed growth rate repeatedly.

**2. Setup (in code folder)**

**3. Implementation (in code folder)**

**4. Analysis:**

**Time Complexity:**

* The recursive method calculates the future value year by year.
* For each year, the method performs one recursive call, and this happens **n times**, where **n is the number of years**.
* Therefore, the **time complexity is O(n)**, because the total number of operations depends directly on the number of years for which we want to predict the future value.
* In simple terms, the more years you want to calculate for, the more times the function will call itself.

**Optimization:**

1. **Using Iteration Instead of Recursion:**
   * Recursion uses the system’s call stack to remember each function call, which may cause a **stack overflow error** when ‘n’ becomes very large.
   * This problem can be avoided by replacing recursion with a **simple loop (iteration)**.
   * Iterative solutions are more efficient in terms of space because they do not consume stack space and perform the same task in a straight-forward way.
2. **Using Memoization:**
   * In memoization, results of previous calculations are **stored (cached)** and reused whenever needed.
   * However, in this particular financial forecasting problem, **memoization may not provide much benefit** because each year depends directly on the value from the previous year.
   * Still, if there are **repeated subproblems** in a modified version of the problem, memoization can help reduce the number of computations.