**Exercise 7: Financial Forecasting**

**Scenario:**

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

**Step 1: Understand Recursive Algorithms**

**Concept of Recursion**

Recursion is a technique where a method calls itself to solve a problem. A recursive function has two main components:

1. **Base Case**: This is the condition under which the recursion stops. Without a base case, the function would call itself indefinitely, leading to a stack overflow.
2. **Recursive Case**: This is the part of the function where the method calls itself with a smaller or simpler input, gradually working towards the base case.

**How Recursion Simplifies Problems**

Recursion simplifies problems that can be broken down into smaller, similar subproblems. It is particularly useful for problems that have a natural hierarchical structure, such as tree traversals, and for algorithms like factorial calculation, Fibonacci sequence, and solving puzzles like the Towers of Hanoi.

**Step 2:** Setup

**Method to Calculate Future Value Using Recursion**

We can create a recursive method to calculate future values based on past growth rates. For simplicity, let’s assume we are calculating future value based on a constant annual growth rate.

**Step 3: Implementation**

Recursive Algorithm to Predict Future Values.

**Step 4:** Analysis

**Time Complexity**

The time complexity of the above recursive algorithm is O(n)where n is the number of years. This is because each recursive call reduces the problem size by one year, leading to a linear number of calls.

**Optimizing the Recursive Solution**

One major drawback of the recursive approach is the repeated calculation of the same values, leading to excessive computation and stack overflow for large inputs. To optimize this, convert the recursive approach to an **iterative** approach.

**Iterative Approach**

An iterative approach can be used to avoid the overhead of recursive calls.

**Comparison and Conclusion**

* The iterative approach is more straightforward and efficient for this particular problem since it avoids the call stack overhead and is easier to understand and implement.

In conclusion, while recursion provides a clear and concise way to solve problems, it may not always be the most efficient. For this financial forecasting tool, the iterative approach is recommended for its simplicity and efficiency.