**Exercise 7: Financial Forecasting**

**Scenario:**

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

**Steps:**

1. **Understand Recursive Algorithms:**
   * Explain the concept of recursion and how it can simplify certain problems.
2. **Setup:**
   * Create a method to calculate the future value using a recursive approach.
3. **Implementation:**
   * Implement a recursive algorithm to predict future values based on past growth rates.
4. **Analysis:**
   * Discuss the time complexity of your recursive algorithm.
   * Explain how to optimize the recursive solution to avoid excessive computation.

**Explain the concept of recursion and how it can simplify certain problems.**

**Recursion** is a programming technique where a function **calls itself** to solve a smaller instance of the same problem. It continues calling itself with reduced input until it reaches a **base case**, which is the condition to stop recursion.

Think of a **set of nested boxes** — to find a tiny object, you keep opening the outer box until you reach the smallest one inside. Once you find the object, you start closing the boxes in reverse.

Each box-opening = recursive call  
Finding the smallest box = base case

Example:(Factorial)

5! = 5 × 4 × 3 × 2 × 1

Recursive definition:

factorial(n) = n × factorial(n - 1)

Base case: factorial(1) = 1

**Code:**

import java.util.Scanner;

public class FinancialForecast {

    public static double calculateFutureValueRecursive(double presentValue, double growthRate, int years) {

        if (years == 0) {

            return presentValue;

        }

        return calculateFutureValueRecursive(presentValue, growthRate, years - 1) \* (1 + growthRate);

    }

    public static double calculateFutureValueIterative(double presentValue, double growthRate, int years) {

        for (int i = 0; i < years; i++) {

            presentValue \*= (1 + growthRate);

        }

        return presentValue;

    }

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        System.out.print("Enter Present Value: ");

        double presentValue = scanner.nextDouble();

        System.out.print("Enter Annual Growth Rate (e.g., 0.05 for 5%): ");

        double growthRate = scanner.nextDouble();

        System.out.print("Enter Number of Years: ");

        int years = scanner.nextInt();

        double futureValueRecursive = calculateFutureValueRecursive(presentValue, growthRate, years);

        double futureValueIterative = calculateFutureValueIterative(presentValue, growthRate, years);

        System.out.printf("\n--- Financial Forecast Result ---\n");

        System.out.printf("Using Recursion: Future Value after %d years = %.2f\n", years, futureValueRecursive);

        System.out.printf("Using Iteration: Future Value after %d years = %.2f\n", years, futureValueIterative);

        scanner.close();

    }

}

**Output:**

