Exercise 7: Financial Forecasting

1. Understand Recursive Algorithms

Recursion is a method in programming where a function calls itself to solve smaller versions of a problem. It is particularly useful for problems that can be broken down into similar sub-problems. In financial forecasting, recursion can simplify the process of calculating future values over multiple time periods.

1. Setup

The goal is to calculate the future value of an investment based on its present value, an annual growth rate, and the number of years. We’ll create a recursive function that applies the growth rate year after year.

1. Implementation

public class FinancialForecast {  
  
 public static double calculateFutureValue(double presentValue, double growthRate, int years) {  
 if (years == 0) {  
 return presentValue;  
 } else {  
 return calculateFutureValue(presentValue \* (1 + growthRate), growthRate, years - 1);  
 }  
 }  
  
 public static double calculateFutureValueIterative(double presentValue, double growthRate, int years) {  
 double futureValue = presentValue;  
 for (int i = 0; i < years; i++) {  
 futureValue \*= (1 + growthRate);  
 }  
 return futureValue;  
 }  
  
 public static void main(String[] args) {  
 double presentValue = 10000; // Initial investment  
 double growthRate = 0.05; // 5% growth rate  
 int years = 10; // Forecast for 10 years  
  
 double futureValueRecursive = calculateFutureValue(presentValue, growthRate, years);  
 System.out.printf("Future Value after %d years (Recursive): %.2f%n", years, futureValueRecursive);  
  
 double futureValueIterative = calculateFutureValueIterative(presentValue, growthRate, years);  
 System.out.printf("Future Value after %d years (Iterative): %.2f%n", years, futureValueIterative);  
 }  
}

1. Analysis

Time Complexity: - Recursive method: O(n), where n is the number of years. Each recursive call processes one year. - Iterative method: O(n), but generally faster and more efficient because it avoids the overhead of recursive calls.

Optimization: - Although recursion simplifies the logic, it can lead to high memory usage for large n due to multiple function calls. - The iterative solution is more optimal for practical use cases, especially when forecasting over many years.

In conclusion, recursion provides a clear and straightforward way to model repeated financial growth, while iteration offers better performance for large-scale forecasting.

