# Analysis of Recursive Algorithm for Financial Forecasting

## 1. Time Complexity of Recursive Approach

In the financial forecasting tool, a recursive algorithm is used to predict the future value of an investment based on past growth rates. The recursive formula used is:

FV(n) = FV(n-1) \* (1 + rate)

Where FV(n) is the future value after n years.

- Time Complexity: O(n)

- Each recursive call performs a constant-time operation and makes one recursive call.

- Space Complexity: O(n)

- Due to the function call stack, each year adds a new stack frame.

## 2. Optimization of Recursive Algorithm

Recursive algorithms are elegant and easy to implement, but they may lead to excessive memory usage or stack overflow in deep recursions.

Optimizations include:

- Using an iterative version to eliminate stack overhead. Time and space complexity become O(n) and O(1), respectively.

- Using the formula-based approach with Math.pow():

FV = principal \* Math.pow(1 + rate, years)

- This approach is the most efficient with O(1) time and space complexity.

## 3. Conclusion

While the recursive method is a good learning exercise, for production-grade financial forecasting tools, an iterative or formula-based approach is preferred for performance and reliability.