Analysis:

Time Complexity:

- Basic Recursive Forecast:

• Each recursive call performs one multiplication and makes one additional recursive call.

• Time complexity is O(n), where n is the number of years.

- Optimized Recursive (Memoized) Forecast:

• Also O(n), but with better performance when the function is reused or when overlapping subproblems occur.

• Avoids repeated calculation by storing already computed values.

Space Complexity:

- Recursive Forecast:

• Requires O(n) stack space for n recursive calls.

• No additional storage beyond the call stack.

- Optimized Version:

• Requires O(n) for both stack and memoization array.

Optimization Techniques:

- Memoization:

• Stores intermediate results to prevent recomputation.

• Especially useful in problems where recursion leads to recalculating the same value multiple times.

- Iterative Conversion:

• Replace recursion with loops to avoid stack overflow in large datasets.

• Use dynamic programming if the problem can be expressed in terms of overlapping subproblems.

Real-World Application:

- This model is useful in predicting investment growth, inflation trends, loan balances, and budgeting.

- Financial models typically use compound interest formulas, and recursion can be an elegant way to simulate them.

Recommendation:

- For small to moderate input sizes, recursive methods are readable and efficient.

- For large forecasting periods (e.g., 30+ years), prefer iterative methods or closed-form mathematical equations.