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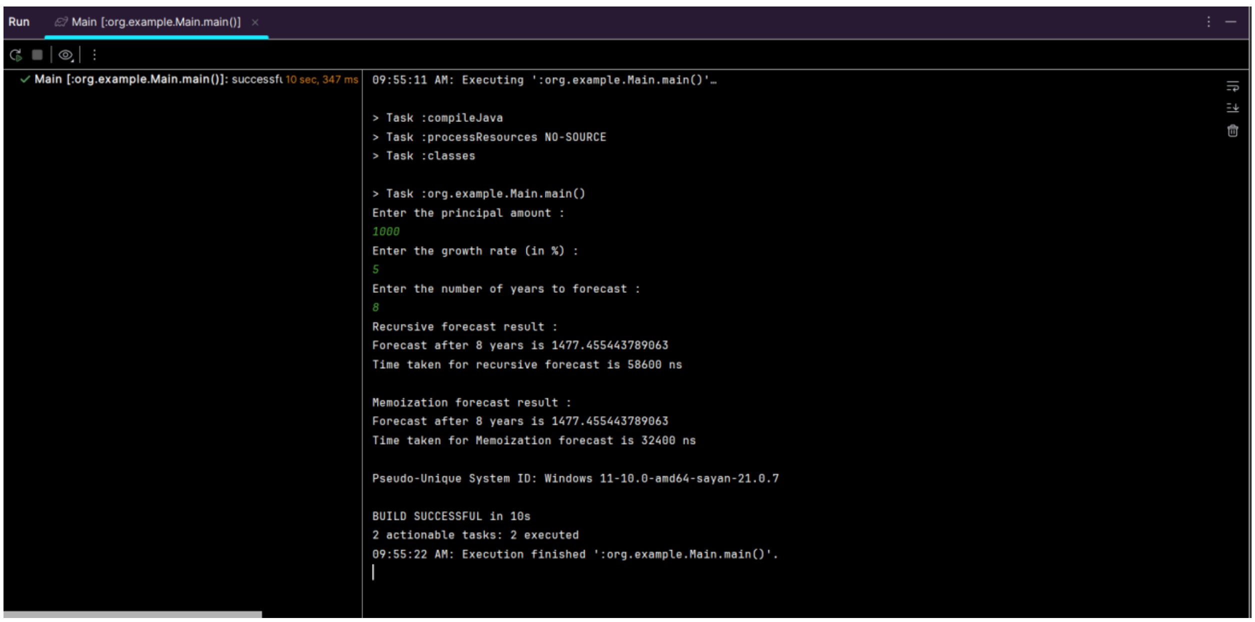
Exercise 7: Financial Forecasting:

Output Screenshots :-



1. Understand Recursive Algorithms

What is recursion ?

Recursion is a technique used in programming where a function calls itself to solve it efficiently by breaking it down into smaller subproblems.

Why is recursion useful in forecasting ?

In forecasting, the future values depend on the past values. Recursion thus help in forecasting future data on past growth patterns.

2. Setup

We define a method to forecast future values based on past data. The essential inputs are:

- Initial amount
- Growth rate (as a percentage)
- Number of years to forecast

3. **Implementation of Recursive Algorithm**

The entire code implementation files are attached in the folder.

I have used this recursive formula :

futureValue(year) = futureValue(year - 1) * (1 + growthRate)

4. **Analysis**

Time Complexity (Unoptimized Recursive Version):

- **O(n)**: One recursive call per year, but no repeated subproblems.
- Still inefficient in practice due to repeated function calls and stack overhead.

Time Complexity (Memoized Version):

- **O(n)**: Same number of logical operations, but faster due to cached results.
- Reduces redundant computation significantly.

How to Optimize:

- We used **memoization**: Stored already-computed year values in a map or array.
- We used **iteration** (loop) instead of recursion for large datasets to avoid stack overflow.
- We can use **dynamic programming** when dealing with multiple interdependent variables.