1. Data Generation

- **Synthetic Dataset**: A synthetic dataset of prices and volumes was created over 60 time steps (one per minute). The prices follow a random walk starting from around 100, providing a simple yet effective demonstration of how order execution strategies behave in a dynamic market environment.

2. VWAP Calculation

- **Global VWAP Calculation**: The script calculates a global VWAP (Volume-Weighted Average Price) as a benchmark. It does so by summing the product of price and volume across all time steps and dividing the result by the total volume. This VWAP acts as a reference to compare the execution results of the strategy.

3. TWAP Execution Simulation

- **Order Splitting**: The total shares to be bought (100 shares) are evenly split across the 60 time steps.
- **Expected vs. Actual Fill Price**: In each time slice, the expected price is assumed to be the current price, while the actual fill price includes a small random noise to simulate real-world market conditions, where fills might differ slightly from the expected price.

4. Performance Metrics

- **Execution Cost vs. VWAP**: This metric compares the average executed price to the global VWAP. A positive value indicates that the execution cost was higher than the benchmark, and a negative value indicates that the strategy performed better than the benchmark.

- **Slippage**: Measures the difference between the expected and actual fill prices. Slippage helps quantify how much worse or better the fills were compared to anticipated ones.