Storage 2 — RDBMS — Project
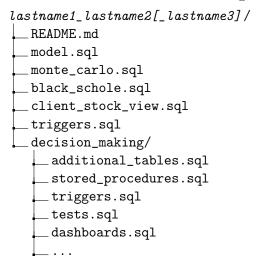
Financial Option pricing & booking dashboard

DEADLINE: Sunday 17th December, 2023

IA-Institut by EPITA & ISG

Friday 24th November, 2023
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Assessment submission procedure

The students will form group of 2 people. In case of odd number of students in the class, one group is allowed to be composed of 3 people OR one student can do the project alone (if and only if he is willing to). *The teacher can forcibly assign an involuntary alone student in a group if needed.* The students will submit on Moodle an archive containing the source code of the project with the following code layout:

```
lastname1_lastname2[_lastname3]/
├── README.md
├── model.sql
├── monte_carlo.sql
├── black_schole.sql
├── client_stock_view.sql
├── triggers.sql
├── decision_making/
    ├── additional_tables.sql
    ├── stored_procedures.sql
    ├── triggers.sql
    ├── tests.sql
    ├── dashboards.sql
    ├── ...
```

The `README.md` file will contain a short explanation of:

- the authors,

- how you structured your submitted assignement,

- what you did in the project,

- what file to execute to get the results corresponding to each step,

- what problems you've encountered,

- how you solved them,

- the known issues,

- what you didn't do (and optionaly what you tried that did not work).

Late assignment policy: the work will have a 1 point penalty per day late. After 3 days late, the assignment's grade will be set to 0 unless proper justification is provided.

Early submission policy: you will be given 0.5 bonus point total if you submit your project 1 day before the deadline, 1 bonus point total if you submit your project 2 days before the deadline.

Introduction

This project aims to simulate a banking system in PostgreSQL that offers its clients the ability to purchase options. The project focuses on relational database modeling, stored procedures for financial computations, and the implementation of triggers. You will use what you did in TD4 as a reference point to implement the routines in this subject. This project also aims to blend financial knowledge with database management skills, challenging you to construct a comprehensive, data-driven decision-making system in a simulated banking environment.

1 Database Modelization (4pts)

Task: Design the Database Schema

Design a relational database schema capable of modeling the following:

- Clients' information including a risk-adversity factor.

- A wallet for each client (limit to one wallet per client).

- Options contained in each wallet.

- Stocks monitored by the bank.

- Historical stock price data.

Deliverables:

- SQL scripts for table creation.

- Entity-Relationship Diagram (ERD) of the database.

2 Monte Carlo Simulation Stored Procedure (3pts)

Task: Implement Monte Carlo Simulation

Develop a PostgreSQL stored procedure for the Monte Carlo simulation to calculate option prices (both put and call) for a given strike price.

- The procedure should return estimated prices for both put and call options.

Deliverables:

- SQL script of the stored procedure.

- Test cases showing the procedure's functionality.

3 Black-Scholes Computation Stored Procedure (3pts)

Task: Implement Black-Scholes Formula

Create a stored procedure to compute option prices (both put and call) for a given strike price, using the Black-Scholes formula.

- The procedure should output prices for both put and call options.

Deliverables:

- SQL script for the stored procedure.

- Test cases to validate its functionality.

4 Creation of a View for Option Prices (3pts)

Task: Develop a Consolidated View

Develop a view to display option prices for each (client, stock) pair, combining both Monte Carlo and Black-Scholes prices. **Deliverables:**

- SQL script to create the view.

- Sample queries using the view.

5 Triggers and Stored Procedure Updates (2pts)

Task: Automate Option Price Updates

Implement triggers to automate the update of option prices upon changes in stock prices or client data.

- Modify stored procedures to be invoked by these triggers.

Deliverables:

- SQL scripts for creating triggers and updating stored procedures.

- Test cases to validate their functionalities.

6 Open reflexion: Decision-Making Process for Options Trading in a Bank System (5pts)

This section of the project focuses on developing a decision-making process for options trading within your simulated banking system. The process will involve evaluating and making decisions on both purchasing new options (calls and puts) and exercising already owned options. You are encouraged to approach this with creativity and originality, considering various financial and risk factors.

Features and Pointers for Implementation

1. **Option Ranking System:**

   - Develop a system to rank options based on their potential value and risk.
   - Consider factors like market volatility, the time value of options, and the client's risk tolerance.

2. **Decision Logic for Buying Options:**

   - Implement logic to decide whether to buy call or put options based on the ranking system.
   - Include considerations for the client's current portfolio, risk adversity factor, and wallet balance.

3. **Decision Logic for Exercising Options:**

   - Create a mechanism to evaluate whether it's beneficial for a client to exercise their owned options.
   - This could involve comparing the current market price of the stock to the strike price of the option and considering the time until expiration.

4. **Client Portfolio Management:**

   - Update the client's wallet and portfolio based on the buy/sell and exercise decisions.

- Ensure that transactions reflect in the client's balance and option holdings.

5. **Bank's Financial Dashboard:**

   - Create a dashboard to estimate the potential gains or losses for the bank, considering all options trading activities.
   - This should reflect the impact of clients' decisions on the bank's financial position.

6. **Client's Financial Dashboard:**

   - Develop a dashboard showing each client's potential gains or losses from their options portfolio.
   - The dashboard should provide insights into the performance of both exercised and currently held options.

7. **Automated Decision-Making Triggers:**

   - Set up triggers in the system that initiate the decision-making process at specific times, such as the end of a trading day.
   - These triggers should be responsive to new data inputs, like changes in stock prices.

Encouragement for Creativity

You are encouraged to explore various strategies and methodologies in the decision-making process. You should consider how different market conditions, stock performances, and individual client profiles could influence the trading decisions. Creative solutions that add depth and realism to the simulated banking environment are highly valued.