1. Object-Oriented Analysis (OOA)

- **Main Objects**:
  - **Transaction**: represents a banking transaction (deposit, withdraw, fee, interest)
  - **Account**: basic bank account (account number, balance, owner, transaction history)
  - **SavingAccount**: special type of account, inherits from Account, adds interest rate and withdrawal fee
  - **Customer**: represents a bank customer who owns multiple accounts
- **Functional requirements**:
  - Deposit, withdraw, add interest
  - Record transaction history
  - Compare transactions (operator==)
  - Use operator += to add transactions to accounts

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2. Class Design

- **Inheritance**:
  - SavingAccount inherits from Account to reuse account management code
  - Adds **interest rate** and **withdrawal fee** features
- **Operator Overloading**:
  - operator<<: print account/transaction details
  - operator==: compare two transactions (same amount, type, and date)
  - operator+=: add a transaction to an account, update balance, and log the transaction

Reason: it makes the code cleaner and more natural. For example:

*acc1 += t1;

instead of calling separate methods like deposit() or withdraw()

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3. Code Description

- **Transaction**:
    - Attributes: amount, type, date
    - Methods: display, getters, operator<<, operator==
- **Account**:
    - Attributes: accountnumber, balance, ownername, history
    - Methods: deposit, withdraw, displayinfo, operator+=
- **SavingAccount**:
    - Adds interestRate.
    - Overrides withdraw() (with a 1% fee)
    - Adds addinteresrate() method
- **Customer**:
    - Stores multiple accounts (vector<Account*>)
    - Calculates total balance and displays account info

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4. Test Results

```
--- Test deposit ---

Transaction done: Amount: 200 Type: deposit Date: today

accountNumber: 1001

Balance: 700

ownerName: Alice


--- Test withdraw (success) ---

Transaction done: Amount: 100 Type: withdraw Date: today

accountNumber: 1001
```

```
Balance: 600

ownerName: Alice


--- Test withdraw (fail) ---

Not enough balance to withdraw.

Withdraw failed: not enough balance.

accountNumber: 1001

Balance: 600

ownerName: Alice


--- Test operator += ---

Transaction done: Amount: 300 Type: deposit Date: today

Transaction done: Amount: 200 Type: withdraw Date: today

accountNumber: 1001

Balance: 700

ownerName: Alice


--- Test SavingAccount interest ---

Transaction done: Amount: 50 Type: interest Date: today

accountNumber: 1002

Balance: 1050

ownerName: Alice


--- Test SavingAccount withdraw ---
```

```
Transaction done: Amount: 200 Type: withdraw Date: today

Transaction done: Amount: 2 Type: fee Date: today

accountNumber: 1002

Balance: 848

ownerName: Alice


--- Test Transaction comparison ---

two accounts are similar


--- Customer info ---

Customer: Alice

 | ID: 101

Accounts:

accountNumber: 1001

Balance: 700

ownerName: Alice


accountNumber: 1002

Balance: 848

ownerName: Alice


Total Balance: 1548
```

Explanation of the output

- **Deposit Test:** A deposit of 200 increases the account balance to 700, and the transaction is recorded

- **Successful Withdrawal Test:** Withdrawing 100 reduces the balance to 600, confirming proper deduction and transaction logging
- **Failed Withdrawal Test:** When attempting to withdraw more than the available balance, the system prevents the operation, shows an error message, and keeps the balance unchanged
- **Operator += Test:** The overloaded operator performs both a deposit of 300 and a withdrawal of 200 in sequence, leaving the balance at 700 and recording both transactions
- **SavingAccount Interest Test:** The system adds 50 as interest to the savings account, updating the balance to 1050 and recording the transaction
- **SavingAccount Withdrawal Test:** Withdrawing 200 applies an additional fee of 2, reducing the balance to 848. Both transactions are recorded
- **Transfer Test:** The transfer operation moves 300 from account 1001 to account 1002. Account 1001 shows a “transfer-out” transaction, and account 1002 records a corresponding “transfer-in,” with balances updated accordingly
- **Transaction Comparison Test:** The system compares two accounts and determines that they are similar based on the comparison operator implementation
- **Customer Information:** Finally, the system prints the customer’s details, including all associated accounts, balances, and the total balance across accounts

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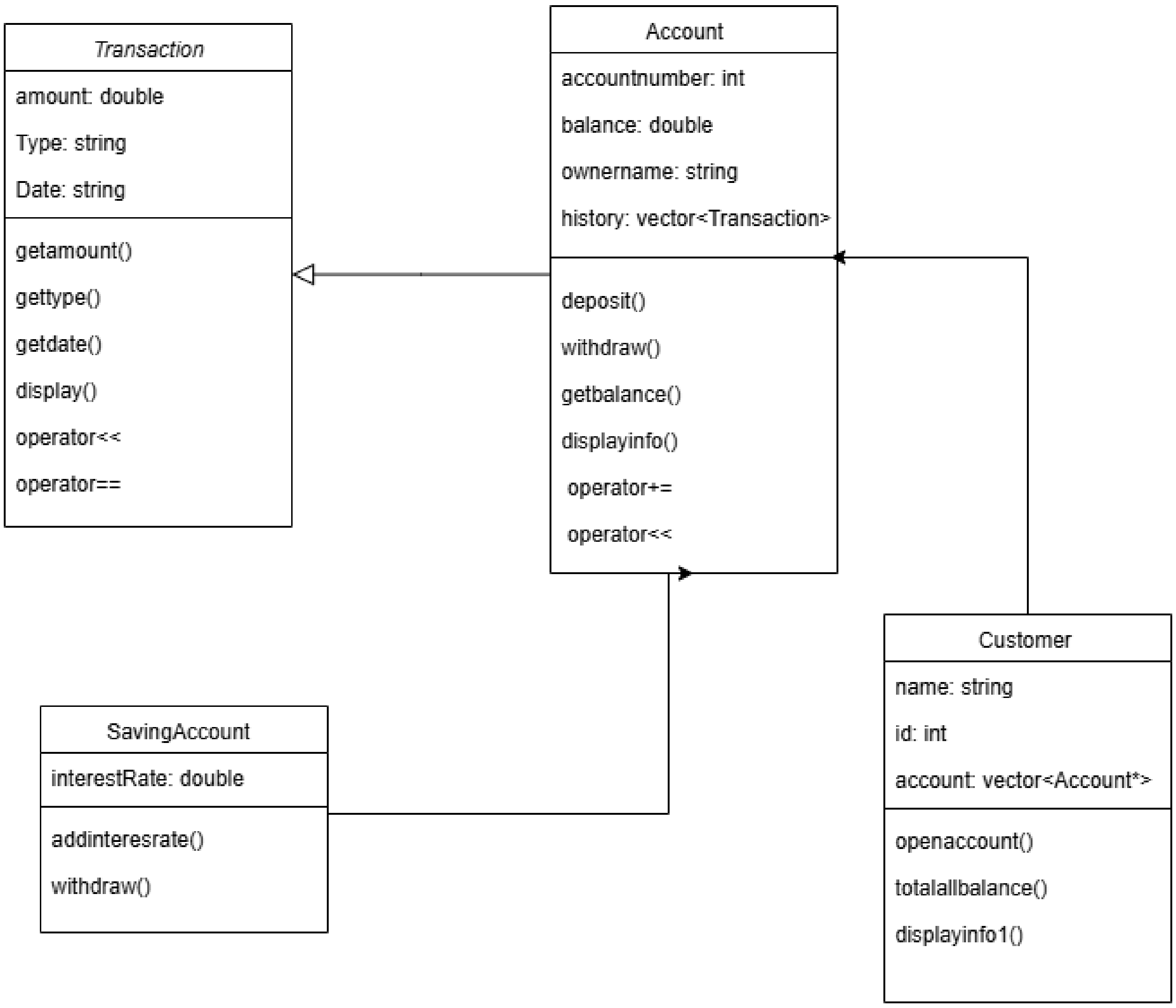
5. UML Diagrams



Class Diagram

- Classes: Transaction, Account, SavingAccount, Customer
- Relationships:
  - SavingAccount **inherits** from Account
  - Account **contains** Transaction (composition)
  - Customer **has** multiple Account objects

(Represented by rectangles with attributes/methods, arrows for inheritance and composition)

Sequence Diagram (for deposit operation)

1. main calls acc1->deposit(200)

2. deposit updates the balance
3. Creates a Transaction object
4. Adds it to history
5. Prints "Transaction done..."

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6. Use of LLM Tools

- Generating initial ideas for object-oriented design and UML diagrams
- Providing examples of C++ code for class structure, operator overloading, and inheritance
- Suggesting documentation structure (OOA analysis, class design, test cases)