SSAD Assignment 3
PDF report
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Design patterns

Creational — Singleton

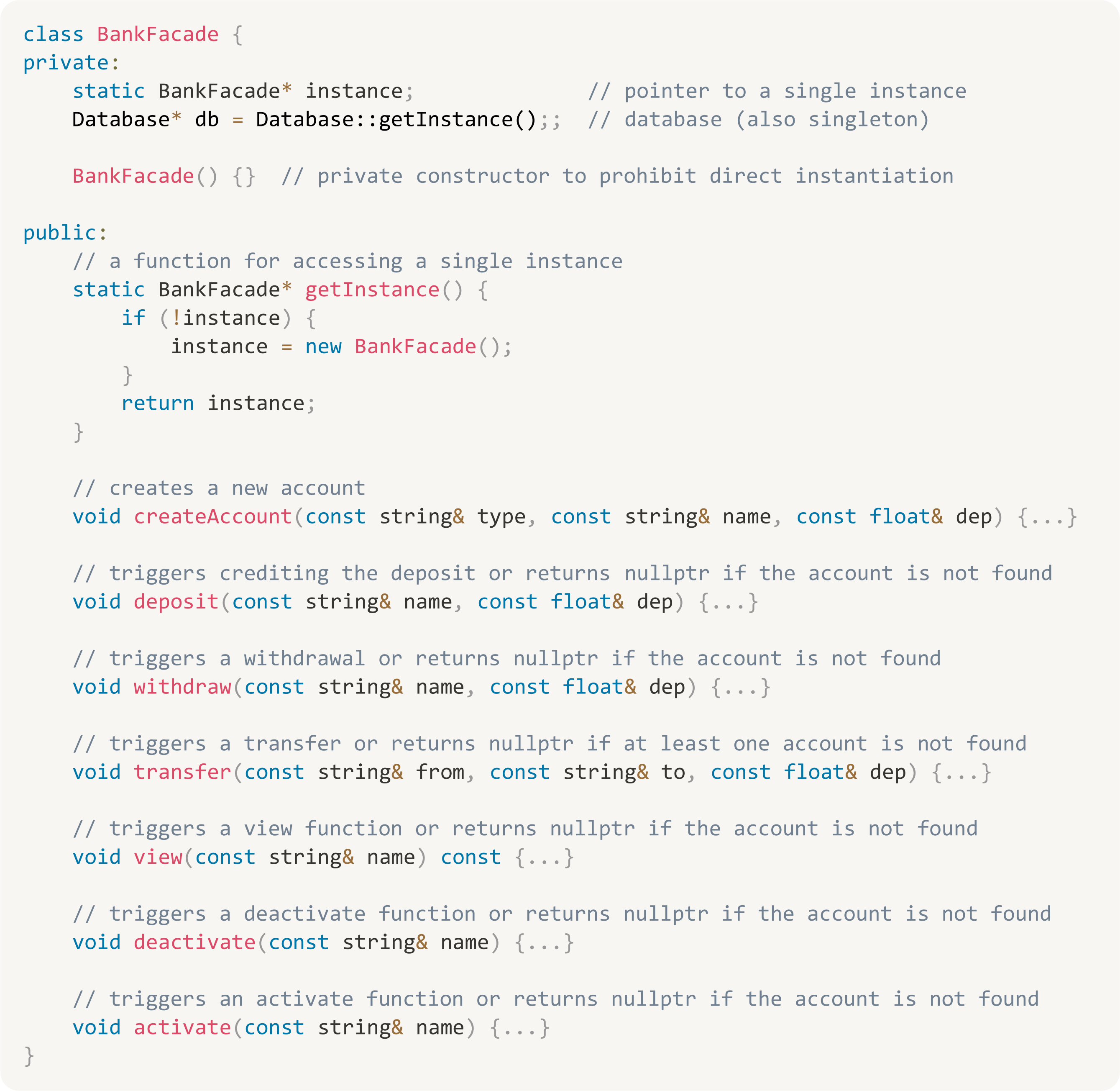
Singleton is used to ensure that a class has only one instance, and provides a global access point to that instance. In the context of the banking system, I wrote the Database class, which I use to store accounts and gain access to them, and the BankFacade class, which I use to manage the banking system. The structure designed through **Singleton** ensures that only one instances of the Database and BankFacade will be created.

```
class Database {
private:
    static Database* instance;     // pointer to a single instance
    map<string, Account> accounts; // map for storing accounts

    Database() {}  // private constructor to prohibit direct instantiation

public:
    // a function for accessing a single instance
    static Database* getInstance() {
        if (!instance) {
            instance = new Database();
        }
        return instance;
    }

    // other functions
};
```

```
class BankFacade {
private:
    static BankFacade* instance;                // pointer to a single instance
    Database* db = Database::getInstance();;  // database (also singleton)

    BankFacade() {}  // private constructor to prohibit direct instantiation

public:
    // a function for accessing a single instance
    static BankFacade* getInstance() {
        if (!instance) {
            instance = new BankFacade();
        }
        return instance;
    }

    // other functions
};
```

Structural — Façade

Façade provides a simplified interface to a complex class system, library, or framework. In the context of the banking system, I used **Façade** to create a simplified interface for performing banking operations (creating accounts, depositing, withdrawing, transferring, viewing, activating, deactivating). The presence of the **Façade** simplifies the interaction with the system for users.



```cpp
class BankFacade {
private:
    static BankFacade* instance;               // pointer to a single instance
    Database* db = Database::getInstance();;  // database (also singleton)

    BankFacade() {}  // private constructor to prohibit direct instantiation

public:
    // a function for accessing a single instance
    static BankFacade* getInstance() {
        if (!instance) {
            instance = new BankFacade();
        }
        return instance;
    }

    // creates a new account
    void createAccount(const string& type, const string& name, const float& dep) {...}

    // triggers crediting the deposit or returns nullptr if the account is not found
    void deposit(const string& name, const float& dep) {...}

    // triggers a withdrawal or returns nullptr if the account is not found
    void withdraw(const string& name, const float& dep) {...}

    // triggers a transfer or returns nullptr if at least one account is not found
    void transfer(const string& from, const string& to, const float& dep) {...}

    // triggers a view function or returns nullptr if the account is not found
    void view(const string& name) const {...}

    // triggers a deactivate function or returns nullptr if the account is not found
    void deactivate(const string& name) {...}

    // triggers an activate function or returns nullptr if the account is not found
    void activate(const string& name) {...}
}
```

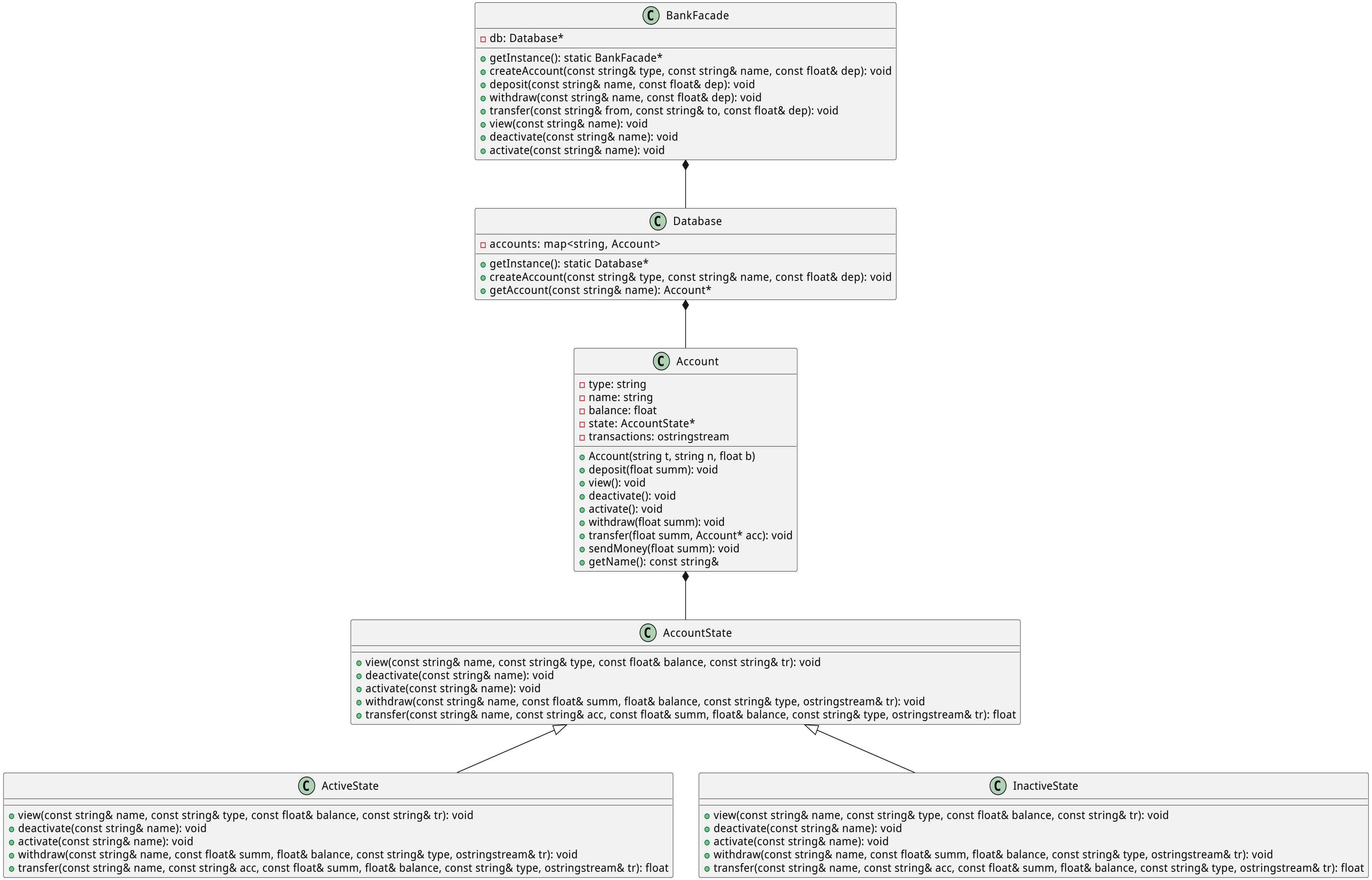
Thus, BankFacade implements two design patterns: **Singleton** and **Facade**. **Singleton** ensures that there is only one instance of the BankFacade class in the application. **Facade** provides a simplified interface to a complex class system, in this case to the Database and Account classes that manage bank accounts.

Behavioral — State

State is used to change the behavior of an object when its internal state changes. In the context of the banking system, I used this to work with two account states: active and inactive. Depending on the status of the active and inactive accounts, they perform different operations and display different messages. Thus, all the operations with an account excluding deposit (because it doesn't depend on the account's state) are performing in the **State** functions.

```
class AccountState {
public:
    virtual void view(string name, string type, float balance, string tr) = 0;
    virtual void deactivate(string name) = 0;
    virtual void activate(string name) = 0;
    virtual void withdraw(string name, float summ, float& balance, string type,
    ostringstream& tr) = 0;
    virtual float transfer(string name, string acc, float summ, float& balance, string
    type, ostringstream& tr) = 0;
};

// implementation for active accounts
class ActiveState : public AccountState {
public:
    void view(string name, string type, float balance, string tr) override {...};
    void deactivate(string name) override {...}
    void activate(string name) override {...}
    void withdraw(string name, float summ, float& balance, string type,
    ostringstream& tr) override {...}
    float transfer(string name, string acc, float summ, float& balance, string
    type, ostringstream& tr) override {...}
};

// implementation for inactive accounts
class InactiveState : public AccountState {
public:
    void view(string name, string type, float balance, string tr) override {...}
    void deactivate(string name) override {...}
    void activate(string name) override {...}
    void withdraw(string name, float summ, float& balance, string type,
    ostringstream& tr) override {...}
    float transfer(string name, string acc, float summ, float& balance, string
    type, ostringstream& tr) override {...}
};

// objects for active and inactive states
ActiveState active;
InactiveState inactive;

class Account {
private:
    const string type;
    const string name;
    float balance;
    AccountState* state = &active;  // initial state is active
    ostringstream transactions;
public:
    // functions
}
```

UML Diagram


C BankFacade
db: Database*
getInstance(): static BankFacade*
createAccount(const string& type, const string& name, const float& dep): void
deposit(const string& name, const float& dep): void
withdraw(const string& name, const float& dep): void
transfer(const string& from, const string& to, const float& dep): void
view(const string& name): void
deactivate(const string& name): void
activate(const string& name): void
C Database
accounts: map<string, Account>
getInstance(): static Database*
createAccount(const string& type, const string& name, const float& dep): void
getAccount(const string& name): Account*
C Account
type: string
name: string
balance: float
state: AccountState*
transactions: ostringstream
Account(string t, string n, float b)
deposit(float summ): void
view(): void
deactivate(): void
activate(): void
withdraw(float summ): void
transfer(float summ, Account* acc): void
sendMoney(float summ): void
getName(): const string&
C AccountState
view(const string& name, const string& type, const float& balance, const string& tr): void
deactivate(const string& name): void
activate(const string& name): void
withdraw(const string& name, const float& summ, float& balance, const string& type, ostringstream& tr): void
transfer(const string& name, const string& acc, const float& summ, float& balance, const string& type, ostringstream& tr): float
C ActiveState
view(const string& name, const string& type, const float& balance, const string& tr): void
deactivate(const string& name): void
activate(const string& name): void
withdraw(const string& name, const float& summ, float& balance, const string& type, ostringstream& tr): void
transfer(const string& name, const string& acc, const float& summ, float& balance, const string& type, ostringstream& tr): float
C InactiveState
view(const string& name, const string& type, const float& balance, const string& tr): void
deactivate(const string& name): void
activate(const string& name): void
withdraw(const string& name, const float& summ, float& balance, const string& type, ostringstream& tr): void
transfer(const string& name, const string& acc, const float& summ, float& balance, const string& type, ostringstream& tr): float
]