1． *Case study of ATM*

Consider an automated teller machine (ATM). The user puts a card into a slot and enters a four-digit personal identification number (PIN). If the PIN is incorrect, the card is ejected. Otherwise, the user may perform the following operations on up to four different bank accounts:

(i) Deposit any amount. A receipt is printed showing the date, amount deposited, and account number.

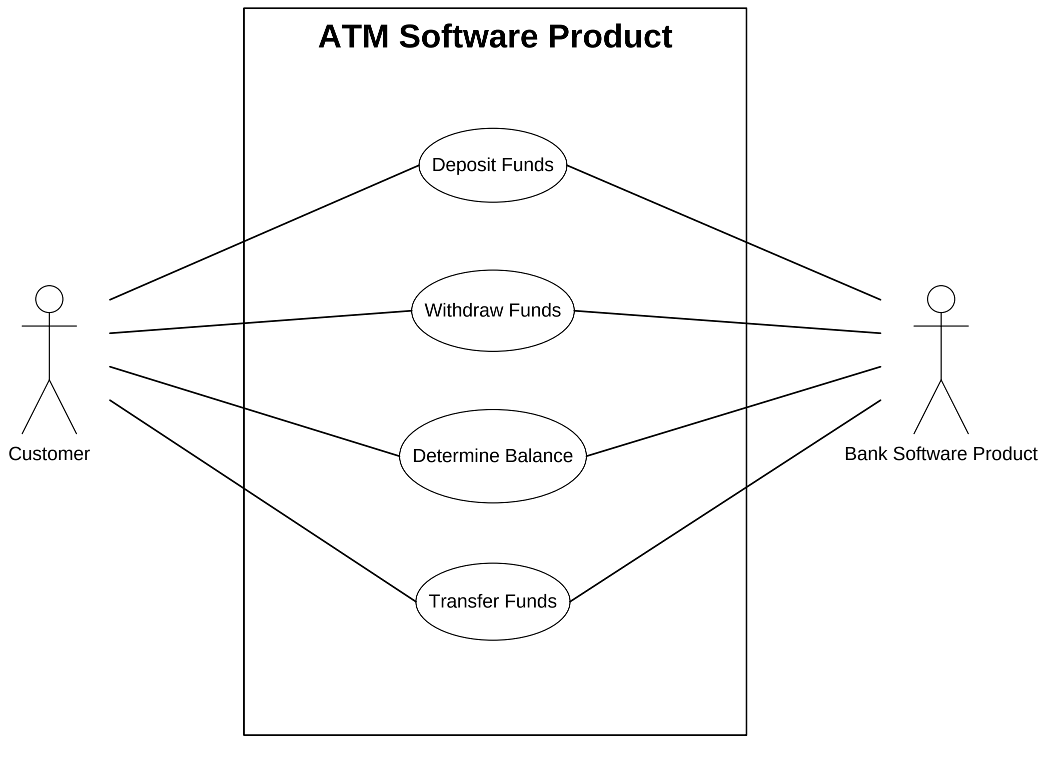
(ii) Withdraw up to $200 in units of $20 (the account may not be overdrawn). In addition to the money, the user is given a receipt showing the date, amount withdrawn, account number, and account balance after the withdrawal.

(iii) Determine the account balance. This is displayed on the screen.

(iv) Transfer funds between two accounts. Again, the account from which the funds are transferred must not be overdrawn. The user is given a receipt showing the date, amount transferred, and the two account numbers.

(v) Quit. The card is ejected.

Analysis:



The use-case diagram for the ATM

Candidate entity classes are determined using noun extraction.

Description of software product in a single paragraph: A software product is to be constructed for an ATM. After a customer's card has been successfully verified, the customer may deposit and withdraw money from an account, inquire about the balance of an account, and transfer funds between two separate accounts.

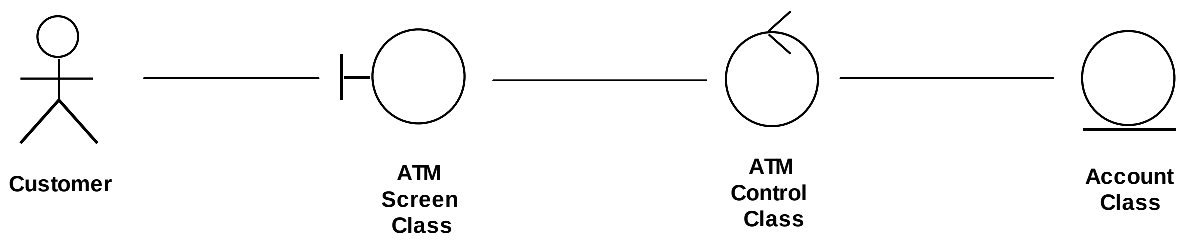
Identify the nouns: A software **product** is to be constructed for an **ATM**. After a **customer**'s **card** has been successfully verified, the **customer** may deposit and withdraw **money** from an **account**, inquire about the **balance** of an **account**, and transfer **funds** between two separate **accounts**.

With regard to the nouns in the previous paragraph, **ATM, card,** and **customer** do not change while the product is operating; in object-oriented terminology, they do not have an internal state. Also, **product**, **funds** and **money** are abstract nouns. Finally, **balance** is a property of **account**. Thus, the sole candidate entity class is **Account Class**.

The **Account Class** can be seen as a boundary class representing the interface between the ATM and the Bank Information System. However, to keep the problem simple, and since the details of how the system is to be distributed are postponed to the design workflow, the **Account Class** is considered an entity class.

The <u>boundary class</u> is **ATM Screen Class**.

The <u>control class</u> is **ATM Control Class**.



Class diagram showing the classes that realize all four of the use cases of the ATM software product.

1. <u>Use case Deposit Funds:</u>

1. The customer inserts his or her card into the ATM and then enters his or her PIN.

2. The ATM verifies that the PIN is correct.

3. The menu appears on the screen.

4. The customer chooses to deposit funds.

5. The customer selects an account.

6. The customer enters the amount to be deposited.

   The ATM opens its deposit slot. The customer puts the envelope containing the deposit into the slot. The ATM takes the envelope and closes the slot.

7. The circulation system sends a message to update the customer’s account balance once the contents of the envelope have been checked.

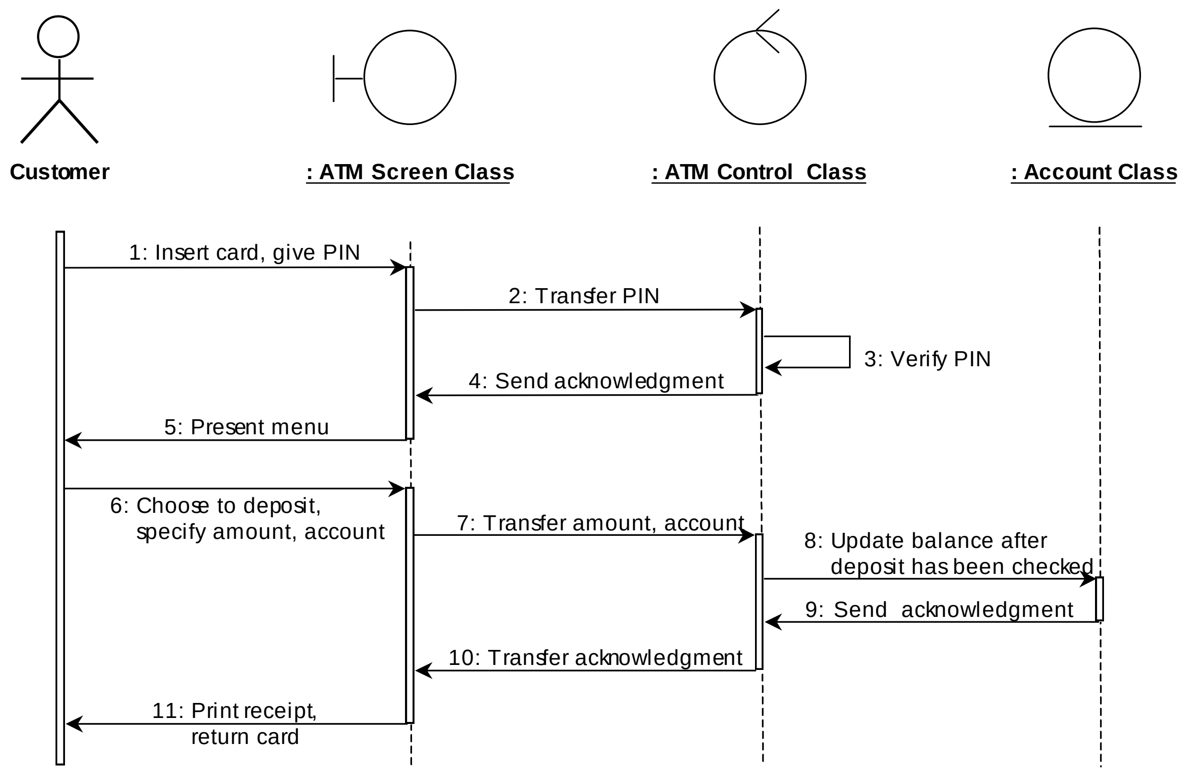
8. The ATM prints a receipt showing the date, the amount of the deposit, the account number, and the balance before deposit.

9. The menu reappears on the screen.

10. The customer chooses to quit. The ATM returns the card.

A scenario of the Deposit Funds use case of the ATM software product.

The sequence diagram for the above scenario is as follows:



Customer
: ATM Screen Class
: ATM Control Class
: Account Class
1: Insert card, give PIN
2: Transfer PIN
3: Verify PIN
4: Send acknowledgment
5: Present menu
6: Choose to deposit, specify amount, account
7: Transfer amount, account
8: Update balance after deposit has been checked
9: Send acknowledgment
10: Transfer acknowledgment
11: Print receipt, return card

2. Use case Withdraw Funds:

1. The customer inserts the card into the ATM and then enters his or her PIN.

2. The ATM verifies that the PIN is correct.

3. The menu appears on the screen.

4. The customer chooses to withdraw funds.

5. The customer selects an account.

6. The customer enters the amount to be withdrawn (up to $200 in units of $20).

7. The ATM determines that the customer has adequate funds in his or her account.

   The ATM gives the money to the customer.

8. The software product sends a message to update the customer’s account balance to reflect the withdrawal.

9. The ATM prints a receipt showing the date, the amount of the withdrawal, the account number, and the balance after the withdrawal.

10. The menu reappears on the screen.

11. The customer chooses to quit. The ATM returns the card.

a scenario of the Withdraw Funds use case of the ATM software product.

Problem: please draw the sequence diagram for the above scenario

3. Use case Determine Balance:

1. The customer inserts the card into the ATM and then enters his or her PIN.

2. The ATM verifies that the PIN is correct. If not, the transaction is terminated and the ATM returns the card.

3. The menu appears on the screen.

4. The customer chooses to determine his or her balance.

5. The customer selects an account.

6. The ATM displays the account balance on the screen.

7. The menu reappears on the screen.

8. The customer chooses to quit. The ATM returns the card.

A scenario of the Determine Balance use case of the ATM software product.

Problem: please draw the sequence diagram for the above scenario

4. Use case Transfer Funds:

1. The customer inserts the card into the ATM and then enters his or her PIN.

2. The ATM verifies that the PIN is correct.

3. The menu appears on the screen.

4. The customer chooses to transfer funds.

5. The customer selects the source account.

6. The customer selects the destination account.

7. The customer enters the amount to be transferred.

8. The ATM determines that the customer has adequate funds in his or her source account.

9. The software product updates the balance in both the source account and the destination account.

10.	The ATM prints a receipt showing the date, the amount transferred, the account numbers, and the balances in both accounts after the transfer.
11.	The menu reappears on screen.
13.	The customer chooses to quit. The ATM returns the card.

Description of the Transfer Funds use case of the ATM software product.

Problem: please draw the sequence diagram for the above scenario