School of Science, Computing and Engineering Technologies
Swinburne University of Technology
SWE30003 Software Architectures and Design
Tutorial Weeks 7-8
(OO Design Exercise II)

Please carefully read the (incomplete) specification of an automated teller machine (ATM) given on the following page.

For the purpose of this tutorial, you can assume that all hardware devices mentioned in the specification have a suitable API that can be used from the software to be developed. For questions 1 to 6 you can also assume that the ATM software will be "stand-alone", that is, it does not need to communicate with any external servers (or similar).

Form groups to three to four students and discuss the following questions (note the difference in the following process concerning the identification and allocation of responsibilities, compared to that in the last tutorial exercise):

1. Identify the objects and classes that are needed in an object-oriented solution.

2. Identify all responsibilities that the ATM's software system needs to perform.

3. Assign each responsibility to one of the identified classes. Please attempt to distribute the responsibilities as evenly as possible throughout the system.

4. For each class, identify possible collaborations that are needed to perform its responsibilities.

5. Document all identified classes, including their responsibilities and collaborations, using Class-Responsibility-Collaboration (CRC) cards. Please also include a brief description of the purpose of each class (that could be written on the back of each card).

6. **Where applicable, identify further relationships between classes and organize the corresponding classes into class hierarchies. Also, highlight the application of any known design patterns in your design.**

7. **How would you go about ensuring that any transactions that change the balance of accounts are reflected across <u>all</u> of the bank's ATMs? Discuss the implications of your solution approach and provide a rationale of why the approach was chosen.**

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8. Any questions from weekly submissions?

An automated teller machine (ATM) is a machine through which bank customers can perform a number of common financial transactions. An ATM machine generally consists of a display screen, a bankcard reader, numeric and special input keys, a money dispenser slot, a deposit slot and a receipt printer.

When the ATM machine is idle, a greeting message is displayed. The keys as well as the deposit slot will remain inactive until a bankcard has been entered into the bankcard reader.

When a bankcard is inserted into the bankcard reader, the reader attempts to read this card. If the card cannot be read, the user is informed that the card is unreadable and the card is ejected.

If the card is readable, the user is asked to enter a personal identification number (PIN). The user is given feedback as to the number of digits entered at the numeric keypad, but not the specific digits entered. If the PIN is entered correctly, the user is shown the main menu (described below). If the PIN is entered incorrectly, the user is given up to two additional chances to enter the PIN correctly. Failure to do so on the third attempt causes the ATM machine to retain the bankcard and giving the user instructions how to retrieve the bankcard. This is only possible by going to dedicated branches of the corresponding financial institution.

The main menu of the ATM machine contains a list of transactions that the user can perform. These transactions are:

- *Deposit funds into an account,*
- *Withdraw funds from an account,*
- *Transfer fund from one account into another account, and*
- *Query the balance of an account.*

The user can select any of these transactions and specify all the relevant information. Once a transaction has been completed, the system returns to the main menu.

At any time after reaching the main menu and before completing any of the transactions, the user may press the cancel key. The transaction being specified (if there is one) is terminated, the user's card is returned, a summary of all transactions (if there were any) is printed, and the machine again becomes idle.