Assignment 9

Please note the following announcements:
There will be **no lecture** on Thursday, **December 23, 2004**.
RWTH Aachen: The lecture on Tuesday, **January 11, 2005**, will be given in lecture hall **AH I**.

This assignment solely deals with UML. In addition to the information presented in the lecture, you find a link to a short description of the notation on our home page. Furthermore, there is a bunch of books in our computer science library about OO modelling with UML.

**Task 9.1 (UML Use Cases)**

Design an information system for a bank company. Consider the following use cases:

- A potential customer wants to open a bank account.
- A customer uses an ATM\(^1\) to withdraw money from his/her account.
- A customer applies for a credit.
- Customer makes a money transfer using the web site of the bank.
- Customer closes an account.

Sketch a use case **diagram** that covers these use cases (compare slides 93/95 of chapter 5). Define sub-use cases where appropriate and describe their relationship (`uses` or `extends`).

In addition, give a detailed textual description of the second use case (customer uses ATM) including a detailed description of the procedure and error situations (e.g. wrong PIN number entered, not enough money in ATM, compare slide 94 of chapter 5).

**Task 9.2 (UML Structure Diagram)**

Sketch a structure diagram for the scenario from exercise **9.1**.

Consider the following object types:

- Accounts are either private accounts or business accounts. Private accounts are for one or multiple persons. A person may have multiple accounts. Business accounts are for a company. Persons and companies have addresses.
- A bank company has branches and ATMs. Branches and ATMs have addresses. An ATM is operated by a branch.
- A bank company has employees. Employees are persons and work in a specific branch.
- Transactions are money transfers\(^2\), cash deposits\(^3\), or cash withdrawals\(^4\). Money transfers can be made via the Internet or in written form at a branch of the bank. Cash withdrawals can be made at an ATM or at a branch of the bank. If they are made at a branch, then some employee is responsible. Cash deposits can only be made at a branch, and an employee is responsible for this transaction.

Define classes for these object types including a few reasonable attributes and operations.

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\(^1\)Automated teller machine, German: Geldautomat
\(^2\)German: Überweisungen
\(^3\)Bareinzahlungen
\(^4\)Barabhebungen
Task 9.3 (UML Sequence Diagram) (2 Points)
Sketch a sequence diagram for the ‘normal’ operation of an ATM (i.e. a customer inserts the card, enters his/her PIN, enters the amount, takes the card, and takes the money). The sequence diagram should show the interaction between the different components of the ATM. The ATM consists of the following components:

- screen
- keyboard
- card reader (Kartenlesegerät)
- money tray
- money output device
- interface to banking server (for modifications of the account data of the customer)

Note: You do not have to consider any user or technical errors for this diagram.

Task 9.4 (UML State Diagram) (2 Points)
Sketch a state diagram for the scenario from exercise 9.3. Consider also two error situations:

- user enters wrong PIN number once or three times
- ATM does not have enough money

The following two Christmas tasks are - of course - not relevant for the written exam. The points offered are additional extra points that can nevertheless be used to reach the 50% criteria for the participation in the written exam.

Task 9.5 (Christmas Task) (3 Points)
We would like to model the nativity of Jesus Christ as a set of use cases. You may take a look at the original texts on e.g. http://www.bible.org/netbible/luk2.htm, http://www.bible.org/netbible/mat1.htm and http://www.bible.org/netbible/mat2.htm.

It is up to your creativity what use cases and actors you may identify and interrelate. Some examples:

- As a result of Augustus’ decree, Mary and Joseph have to go to their hometown Bethlehem to register themselves.
- Mary delivers her child. This implies looking for an appropriate place to do so (maybe the fact that there was no place for her in the inns and that Mary had to lay her child in a manger can be modelled as an exception?).
- The three wise men visit Jesus, worship him and give him gifts of gold, frankincense, and myrrh.
- Think of the angels and the shepherds...

Task 9.6 (Christmas Modeling Experience) (4 Points)
Make the holistic modeling experience! Build up a 3D model of the use case diagram you have developed in exercise 9.5.

The actors could be ‘modeled’ by some (plastic or mush) figures, the use cases themselves could be represented by some appropriate symbol or just by some annotated balloons.

You can create a ‘virtual reality’ model (that can be viewed by us with a VRML browser or similar technologies) or a realistic natural 3D model (what about integrating some chocolate?).

Again, only your creativity is the limit!

Merry Christmas and a Happy 2005!

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5i.e. the traditional Christmas story