UML and the Object Paradigm: Applied Exercises

**Exercise 1:** (Use-Case for a simplified banking system): Customers (i.e. account-holders) can perform any action on their accounts such as: withdrawal, deposit, transfer-money. From inside the bank, we assume the existence of account-managers that follow these operations.

- Construct a first use-case diagram for that description?

In fact, customers can be golden and in-house (those working-at-the-bank) ones. Golden customers can withdraw with a credit, while in-house ones can deposit with interest. Besides, golden customers can have saving accounts, where they can move from current account to that saving account as well as increasing their interest.

- Extend the previous use-case diagram to cope with additional infos?

With the presence of ATM, the withdrawal can be direct (at the office) or via ATM. Using the ATM, a customer should enter his card, enter-pin, enter-amount and then get-money and card back.

- What change in the use-case model?

**Exercise 2:** (Use-Case for a simplified Library system): Students as well as Researchers being first persons, could subscribe to the library, and then can borrow, consult and return-back books from the library. For each for these functions there is a specialized staff at the library.

- Conceive a first use-case diagram for that?

Indeed, the process of borrowing books is not the same as borrowing thesis’s or proceedings. Besides, Researchers are eligible to a so-called long-term borrowing (more than 3 months). For both, if the date of return is not respected, the penalty have to be paid.

- Adapt the previous use-case diagram in consequence?

From the library internal view, the staff has to categorize books depending on field and them. With this classification, books have to sorted on subjects.

- What changes will be required?

**Exercise 3:** (Sequence diagram for CreditCard): Card holders can be at any organization (Trains, Hotels, Airlines, …). The card system there send a message of confirmation of card-validity of the credit-card branch. Once everything Ok, the credit-card institution contact your bank; the bank look for your account balance if sufficient no problem; if not a penalty have to paid plus the amount.

- Conceive a sequence diagram for that description?
Exercise 4: *(Sequence diagram for Banking)*: The students send a message to the library desk to ask for availability of a given book. If available, they can borrow it, by presenting their Library-Card. Three days before the expiration of the return data, they get a warning message from the library return system. If they do not return it they pay a penalty.

- Conceive a sequence diagram for it?

Exercise 5: *(State-Chart diagram for books)*: propose a state-chart diagram for management book states (i.e. available, borrowed, to-be-returned, etc.)

Exercise 6: *(State-Chart diagram for Vending-Machine)*: propose a state-chart diagram capturing the state-transition in a vending machine (i.e. waiting, inserting, choose-good, get-good, get-changes).

Exercise 7: *(State-Chart diagram for ATM)*: propose a state-chart diagram capturing the state-transition in an ATM (i.e. waiting, inserting-card, reading-card, card-ok, enter-pin, pin-ok, Pin-NOK, select-amount, amount-OK, Amount-NOK, Get-Money, Eject-Card).

**Case study 2 (Staff management application)**

Within any (private or public) organization, the management of the staff and their payment is crucial. Let us take this Universe of Discourse (UoD) as a possible staff description at the University. Depending on their different activities, we find three categories of employees: Lecturers (and researchers), administrators and technical and security staff. For sake of simplicity, we abstract away from differences in such categories, and we only deal with their common characteristics.

According to the `states' through which can pass each employee, the staff management system may be informally described as follows:

- Each person, verifying some conditions like the age, the required degree (or necessary formation), etc, can apply for a job at the University. The minimal information to be provided in this case include: the name, the surname, the birthdate, the diploma, the address, his/her familiar situation, and so forth. If (s)he is accepted as a new employee (i.e. if there are sufficiently budget corresponding to the inquired function, and a competent committee estimates this recruitment positively), (s)he becomes an employee (as probationer) at the University. In this case some further information are systematically added like the function, a reference number (uniquely identifying each employee), the department name in which (s)he is appointed as well as the recruitment date.

- After some period that goes from nine months to two years, and only if the employee have had in this (probation) period no caution, (s)he is appointed as a
titular. In this case, further information will be added like the number of rungs (initialized by 1), (administrative) responsibilities if any, etc. Also, we note that each titular employee may progress (with one unit) in the rung after each period that goes from one to three years, and receives an additional salary in function of this rung.

- Each employee, on probation or titular, can go on a leave. Two kinds of leaves are possible: regular leaves, granted to all employees with a fixed period and date (generally, at the beginning of July for 45 days); exceptional leaves such as sick leaves necessitate in addition to the period and the date, the matter of such a leave.

- After some professional misconducts, the employee may be subject to disciplinary measures that go from a warning or a salary diminution to a complete dismissal.

- Each employee may leave temporary or completely the University when necessary. Partial leaves are, for instance, scientific leaves to another Universities (for researchers) or improvement leaves (for administrators and lecturers). Complete leaves include resignation and pensioned off.

- At the end of each month, all employees receive their salaries. To this aim, besides the aforementioned information that should characterize an employee --- particularly his/her function and eventually the number of rungs--- other specific information are needed such as: the basic salary, the allowance, etc. Moreover, the number of absence days has to be communicated at the end of each month. To receive a salary, an invoice containing, in addition to the mentioned information, the take-home pay is to be sent to each employee.

Propose progressively an OO conceptual model of this application. ?