
OBJECTIVES

- Understand and Master the Dynamic UML Diagrams:
  - ❖ State Machine Diagram (Statecharts)
  - ❖ Activity Diagram
  - ❖ Sequence Diagram

TEAM EXERCISES

Task / Exercise C0 (Introductory Questions):

Answer the questions briefly, Teams must assigned a student to write their answers:
When to use the following UML diagrams :

- Use Case Diagram
- State Diagram
- Activity Diagram
- Sequence Diagram

TEAM EXERCISES

Task / Exercise C1 (State Machine Diagram):

Context: Refer to "Case 1: Research Project Submission System" from TD 5.
In the Research Project system, a Proposal goes through a complex lifecycle.
Based on the description provided in TD 5, **model the State Machine Diagram for a single Proposal object.**

Requirements:

- Identify the States: (e.g., Draft, Submitted, Under Ethical Review, etc.).
- Identify Transitions & Events: What triggers the move from one state to another? (e.g., submit(), approve(), requestClarification()).
- Guards: Are there conditions?

Specific Behavior:

- The proposal starts in a Draft state.
- Once submitted, it enters Ethical Review.
- The Ethics Committee can request clarifications, returning the proposal to a state where the author must update it, or they can Approve it.
- Only after Ethical Approval does it move to Scientific Review.
- If the Scientific Council endorses it, it moves to Budget Allocation (Final State).
- The proposal can be Rejected at either the Ethical or Scientific stage (Final State).

Task / Exercise C2 (AD, SD):

Teams should split themselves into two sub-teams where each one should work on a case.

Each subteam shall draw the following UML diagrams :

- Activity Diagram
- Sequence Diagram

CASE STUDY 1 : Vending Machine

You are going to build a vending machine to sell snacks (Chocolate bars, sweets and ...). Inside the vending machine, every product has a number assigned to it in the format of two digits. The machine has a small screen to display messages to the customer with a numbers keypad for customers to interact with the vending machine.

For the flow of buying a product :

1. The customer would first select the product by typing the two digits into the numbers keypad and pressing [Enter] key.
2. The price would be shown for the product, for the case when the product is not available, a message “out of stock” would be displayed instead.
3. The customer would insert the coins. The user can hit the Cancel button to return their money instead.
4. The machine counts the money and dispenses the product when the amount inserted is correct or above the displayed price.
5. If there is a change to give the customer, the machine would dispense the correct amount of change.
6. The machine would display a message “thank you“ and later return to its initial state

Implicit requirement : the machine must give back the change or at least politely tell the customer that I will be stealing your change if they agree.

For the Sequence diagram, you may use the following entities:
• **User** • **SelectionPanel** • **MainController** • **ProductController** • **CoinController**

CASE STUDY 2 : ATM (using Carte Dhahabia)

You are building an ATM system that allows users to withdraw cash. The ATM has a small screen to display instructions and messages to users, a numeric keypad for entering PINs and amounts, a card slot for inserting and ejecting ATM cards, a money dispenser for cash, and a receipt printer.

For the Flow of Operations to withdraw money:

Card Insertion:

1. The customer inserts their ATM card into the machine.
2. The machine validates the card and displays a prompt to enter the PIN.

PIN Entry:

3. The customer types the 4-digit PIN using the numeric keypad and presses [Enter].
4. If the PIN is correct, the machine proceeds to the next step. Otherwise, it allows three attempts. After three incorrect attempts, the card is retained, and the transaction is canceled.

Select Transaction Type:

5. The machine displays a menu (e.g., Withdraw Cash, Check Balance, Deposit).
6. The customer selects "Withdraw Cash."

Amount Entry:

7. The customer enters the amount they wish to withdraw and presses [Enter].
8. The machine verifies the amount against the account balance and availability of cash in the ATM and does not exceed the daily limit of 5000DA.
    1. If sufficient funds exist, the transaction proceeds.
    2. If not, the machine displays an error message: "Insufficient Balance" or "Amount Not Available in ATM."
    3. The user may cancel or retry with a different amount.

Cash Dispensing:

9. The ATM dispenses the requested amount.
10. If the cash dispenser encounters a problem, the machine displays an error and rolls back the transaction. The card is returned.

Receipt Printing and Card Return:

11. The machine offers to print a receipt.
12. Once the receipt is printed or skipped, the machine ejects the card.
13. A message "Thank You" is displayed, and the machine returns to its initial state.

For the sequence diagram, use the following entities :
• **User** • **ATM System** • **Cash Dispenser** • **Card Controller** • **Bank** • **Account** • **Printer**

OPTIONAL EXERCISES

Task / Exercise P1 :

Each pair of students in the same team shall draw the use case diagram for one of the following applications:

1. Draw the Activity Diagram for the case when the user signups
2. Draw the Sequence Diagram for the case when the user resets their password.

Task / Exercise P2 :

The login functionality needs to be changed to enforce a 2-Factor authentication by sending an email to the user containing a random passcode. Draw the Sequence diagram for the new login functionality.

Task / Exercise P3 :

You have been asked to develop a system that will help with planning large-scale events and parties such as weddings, graduation celebrations, and birthday parties. Using an activity diagram, model the process context for such a system that shows the activities involved in planning a party (booking a venue, organizing invitations, etc.) and the system elements that might be used at each stage.

Task / Exercise P4:

Draw a use-case diagram and a set of activity diagrams for the process of buying glasses from the viewpoint of the patient. The first step is to see an eye doctor who will give you a prescription. Once you have a prescription, you go to an optical dispensary, where you select

your frames and place the order for your glasses. Once the glasses have been made, you return to the store for a fitting and pay for the glasses

Task / Exercise P5 :

Draw a use-case diagram and a set of activity diagrams for the following doctor’s office system. Whenever new patients are seen for the first time, they complete a patient information form that asks their name, address, phone number, and brief medical history, which are stored in the patient information file. When a patient calls to schedule a new appointment or change an existing appointment, the receptionist checks the appointment file for an available time. Once a good time is found for the patient, the appointment is scheduled. If the patient is a new patient, an incomplete entry is made in the patient’s file; the full information will be collected when the patient arrives for the appointment. Because appointments are often made far in advance, the receptionist usually mails a reminder postcard to each patient two weeks before the appointment.

Task / Exercise P6 :

Draw a behavioral state machine that describes the various states that a travel authorization can have through its approval process. A travel authorization form is used in most companies to approve travel expenses for employees. Typically, an employee fills out a blank form and sends it to his or her boss for a signature. If the amount is fairly small (<$300), then the boss signs the form and routes it to accounts payable to be input into the accounting system. The system cuts a check that is sent to the employee for the right amount, and after the check is cashed, the form is filed away with the canceled check. If the check is not cashed within 90 days, the travel form expires. When the amount of the travel voucher is a large amount (>$300), then the boss signs the form and sends it to the CFO, along with a paragraph explaining the purpose of the travel; the CFO signs the form and passes it along to accounts payable. Of course, the boss and the CFO can reject the travel authorization form if they do not feel that the expenses are reasonable. In this case, the employee can change the form to include more explanation or decide to pay the expenses