WIA2002 Software Modelling
Semester 1, 2016/17
Tutorial 9

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1. **Create a state machine diagram to model the states of a lift controller object based on the following description. Indicate all states and transitions in your answer. For each transition, specify relevant events, conditions and actions.**

   - Before any interaction occurs, the lift is on the ground floor with its door closed; the lift controller is in the ground floor state before receiving any messages or events.
   - When the lift controller receives the request message from the UP button on the ground floor, the lift controller opens the door and changes its state to waiting for floor number, where it waits for the passenger to press the target floor number. Note that the lift passenger may press the floor number which he/she is currently on.
   - The passenger presses the sixth floor button and the lift controller will not do anything until the timeout even is received. Here, the lift controller's state does not change.
   - When the lift controller receives the timeout event, the lift controller closes the door, moves the motor to the UP direction because the destination floor is higher than the current floor and then changes its state. Since the action of going up takes a significant length of time, we name this state as moving up. The guard condition is that the destination floor number is greater than the current floor.
   - When the lift controller receives the arrival event, the lift stops the motor, opens the doors and waits for the passenger to press the destination floor again. Hence, the lift controller changes back to the waiting for floor number state.
   - When there is no request (no passenger), the lift controller receives the timeout event and the lift controller will move the lift back to the ground floor. We name this state as homing.
   - A passenger, Mary, is on the sixth floor. She presses the DOWN button at the lift lobby to call for a lift and waits. The lift, which is on the ground floor, then goes up to the sixth floor and opens. Mary walks into the lift and presses the ground floor button the control panel in the lift. The lift closes, goes down and stops at the ground floor. Since the action of going down takes a significant length of time, we name this state as moving down. The guard condition is that the destination floor number is less than the current floor.

2. **Model a State Machine Diagram to illustrate the life cycle of a CD Player object and specify how a CD Player object behaviour causes it to change from one state to another state. Indicate all states and transitions in your answer. For each transition, specify relevant events, conditions and actions.**

   For the CD player, most events correspond to button presses on its front panel. When the CD player is switched on, the CD player will be ready. Then, the user can open the CD player. After putting the CD inside the CD player and closing the disk door, the CD player will be ready-to-play. The CD player moves to the disk playing when pressing the play button when there is a disc in the tray. When the disk is playing the user can return to the ready-to-play state by pressing the end button. The CD player allows the users to play an entire disc, or start playing from any track using the track selection button. The CD player will be idle if it is switched off. Switching off the CD player could happen if the CD player: is ready, door is opened, is ready-to-play, disk is playing, or in the track selection. The disc door will be closed when the CD player is switched off.

3. **Analyse the following state machine diagram. Describe the object life cycles it is trying to show and specify how an order object behavior causes it to change from one state to another state. For each transition, specify relevant events, conditions and actions.**

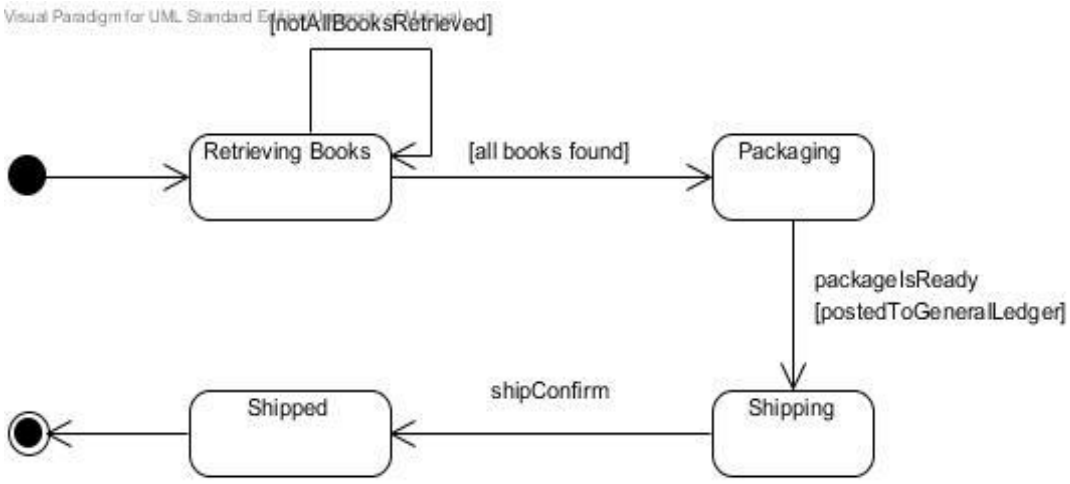

Figure 1: State Machine Diagram for an Order object

4. **Analyse the state machine diagram shown in Figure 2, which illustrates how the state of a Book object in a library software system changes between "borrowable" and "not borrowable". Describe the Book object life cycle it is trying to show and specify how a Book object behavior causes it to change from one state to another state. For each transition, specify relevant events, conditions and actions.**

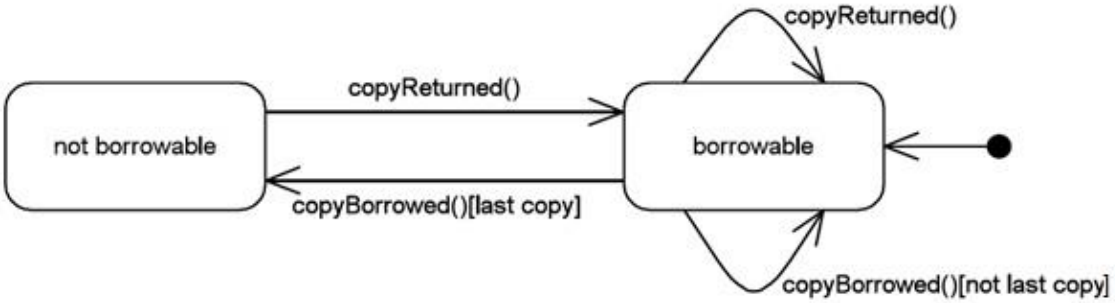

Figure 2: State Machine Diagram for a Book object

5. **Model a state machine diagram to model the lifecycle of a book, starting from the time when the book is on the library shelf, until the book is discarded by the LIS. Indicate all possible states and transitions of a book in your answer. For each transition, specify relevant events, conditions and actions.**

   You are asked to develop a library information system (LIS) for a public library. The LIS will be used to handle book loan and return procedures. Possible book availability statuses are “Checked in”, “Checked out”, “Hold” and “Overdue”. In the case of “Checked out”, the due date of the book is shown, whereas in the case of “Hold”, the number of holds is shown. The user can place or cancel a hold on the book when the book record is shown and the book has been borrowed. A book is removed from the LIS when it is discarded.

   When a user borrows a book (check out), he/she has to scan the barcode of his/her library card at an LIS user terminal. The LIS will display his/her personal loan records that contain details like books borrowed, due date of return, as well as the total overdue fine, if any. If there is an outstanding fine, the LIS will not allow the user further loan. The user terminal will automatically print a charge notice. Users can settle fine payment at the library counter, which is handled by the library assistants with an LIS administrator terminal. If there is no outstanding fine, the LIS will check whether the user has exceeded the loan limit. A user can borrow at most five books for one month. If the loan limit is not exceeded, the user can borrow a book by scanning the book barcode at an LIS user terminal. A new loan record is added to the user loan records. A receipt is then printed, indicating the book title, ISBN, publisher, author, date of loan and due date for return.

   Books are returned through a collection box at the library entrance. Library assistants check in the returned books with the LIS administrator terminals. The

system displays the book details and the due date of the book loan. If a book is returned late, an overdue fine is calculated and added to the borrower's fine record. Overdue fine is $1 per day. Once the book return is completed, the status of the corresponding book loan record is set to "returned". If the number of holds for the book is zero, the system updates the book record status to "checked in", otherwise the system updates book record status to "hold".