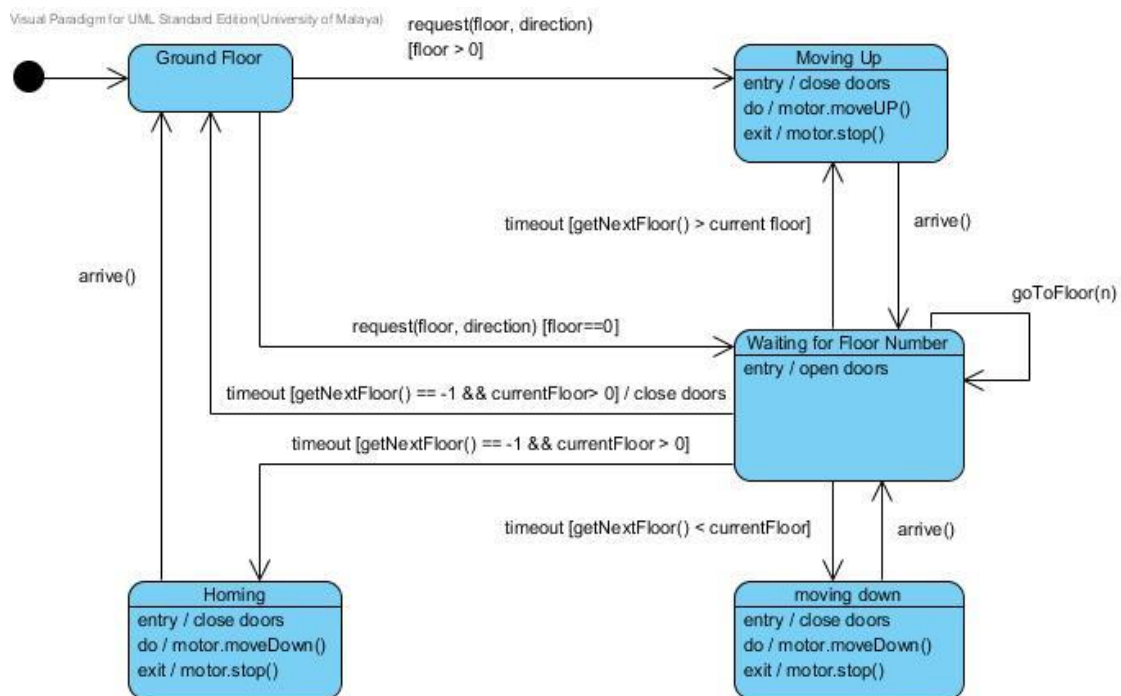


WIA2002 Software Modelling
Semester 1, 2016/17
Tutorial 9 (Ans)

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.

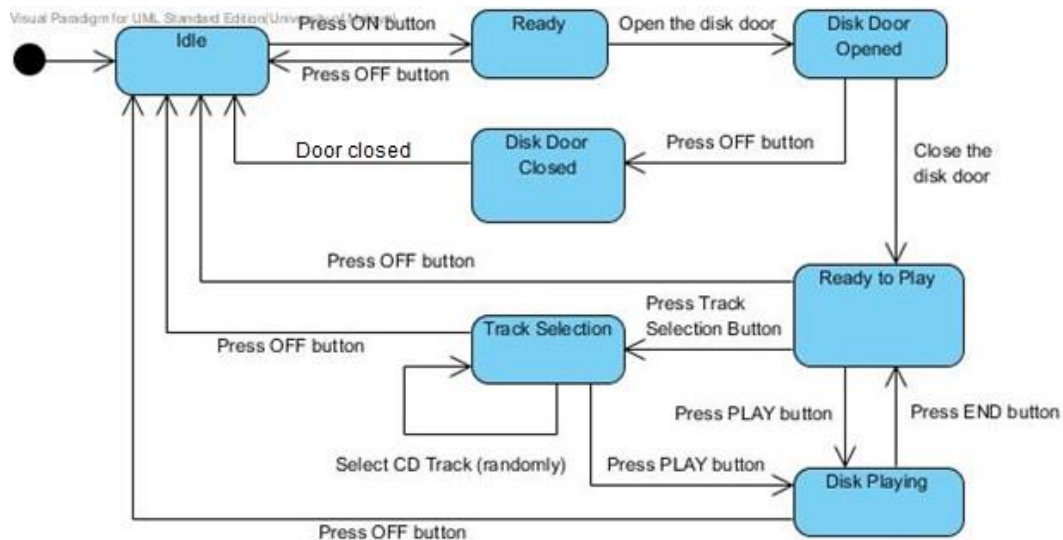
Sample State Machine Diagram:



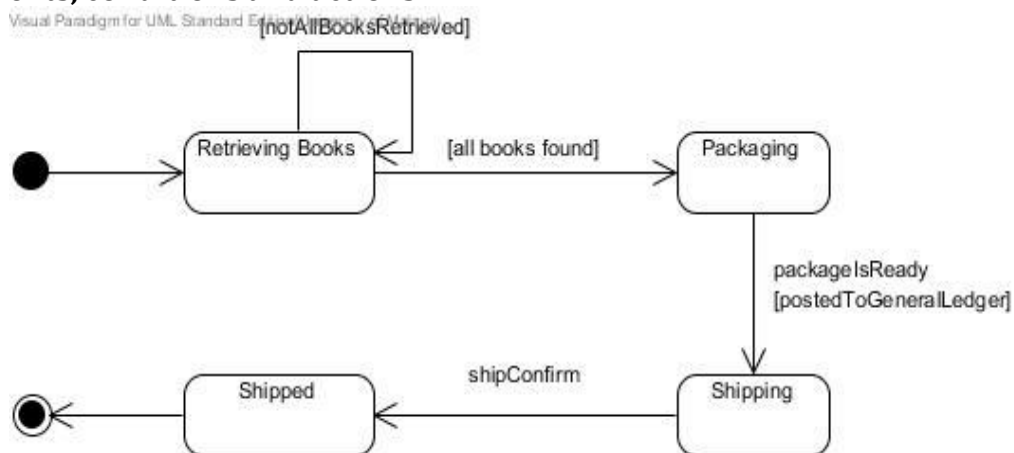
2. Model a State Machine Diagram to illustrate the life cycle of a CD Player object and specify how a CD Player object behaviour causes it to change from one state to another state. Indicate all states and transitions in your answer. For each transition, specify relevant events, conditions and actions.

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.

Sample State Machine Diagram:



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.



Sample Answer:

- The object is instantiated as an **Order** in the Retrieving Books state. The shipping activity starts with retrieving each book in the order from inventory.
- The order object stays in the Retrieving Books state if the order object has not retrieved all of the books that the customer requested.
- When all the books found, the **Order** will enter the Packaging state.
- When the package is ready and it has been established that the associated **Order** has been posted to the General Ledger (GL), the order object will enter the Shipping state.
- Once the shipping is confirmed, the **Order** state will be changed to Shipped state.

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.

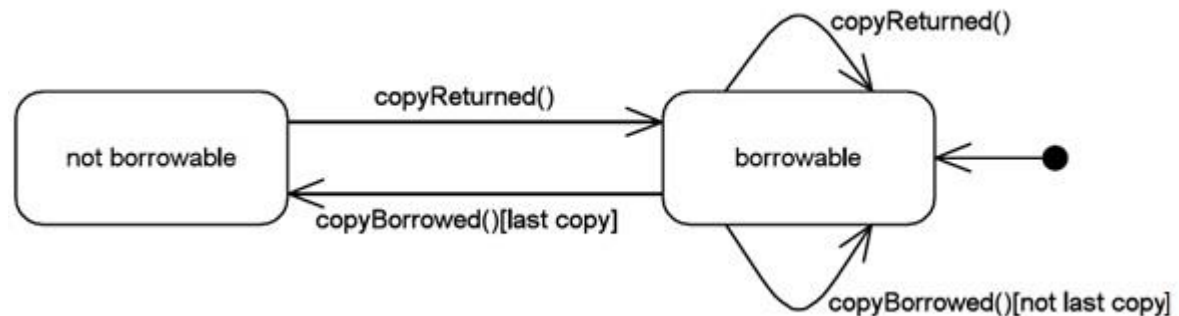


Figure 2: State Machine Diagram for a Book object

Sample Answer:

- The Book object start off in the **Borrowable** state.
- The Book object will remain in the **Borrowable** state if it is not the last copy of the book or a copy of borrowed book has returned to the library.
- Once the last copy of the Book is borrowed, the Book change to **Not Borrowable** state.
- The Book object change back to Borrowable state once the a copy of the book is returned to the library.

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".

Sample State Machine Diagram:

