

# Object Oriented Software Engineering (SE 313)

## Lab Session # 05

### Objective: Working with the State Transition Diagrams of UML

#### THEORY

##### State Transition Diagrams

State transition diagrams show the life history of a given class, the events that cause a transition from a state, and the actions that result from a state change. They are created for classes whose objects exhibit significant dynamic behavior.

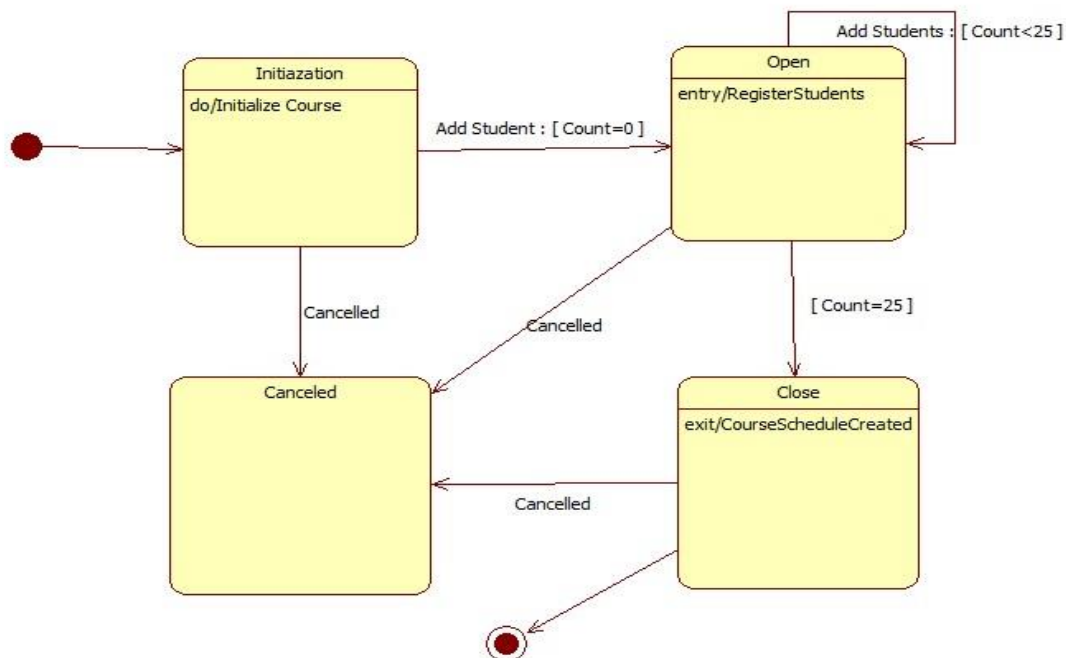


Figure 5.1: State Transition Diagram

##### To create a state transition diagram:

1. Right-click to select the class in the browser and make the shortcut menu visible.
2. Select the State Diagram menu command.

##### To open a state transition diagram

1. Click the + next to the class to expand the tree
2. Double-click on the State Diagram for the class

##### States

A state is represented by a rectangle with round corners.

**To create a state**

1. Click to select the State icon from the toolbar.
2. Click on the state transition diagram to place the state.
3. While the state is still selected, enter its name.

**State Transitions**

A state transition is represented as an arrow which points from the originating state to the successor state.

**To create a state transition**

1. Click to select the state transition arrow from the toolbar.
2. Click on the originating state and drag the arrow to the successor state.

**State Actions**

Behavior that occurs while an object is in a state can be expressed in three ways: entry actions, activities, and exit actions. The behavior may be a simple event or it may be an event sent to another object.

**To create an entry action, exit action or activity**

1. Point to the state and double click to make the State Specification dialog box visible.
2. Select the appropriate red icon (On Entry to create an entry action, On Exit to create an exit action, or Entry Until Exit to create an activity).

**Start and Stop States**

There are two special states associated with state transition diagrams – the start state and the stop state. The start state is represented by a filled in circle and the stop state is represented by a bull's eye.

**To create a start state**

1. Click to select the start state icon from the toolbar.
2. Click on the diagram to place the start state on the diagram.
3. Click to select the state transition icon from the toolbar.
4. Click on the start state and drag the state transition arrow to the successor state.

**To create a stop state**

1. Click to select the stop state icon from the toolbar.
2. Click on the diagram to place the stop state on the diagram.
3. Click to select the state transition icon from the toolbar.
4. Click on the originating state and drag the state transition arrow to the stop state.

## **EXERCISES 1**

Consider the bank account system where a bank account in either is Active or Dormant (inactive). If it is active, it could be either with zero balance or with some funds.

Create State Machine Diagram of the above banking system, mention all events and possible guards. Also include appropriate Entry, Do and Exit activities.

Save the model and Attach printout for the Final State transition Diagram

## EXERCISES 2

1. Create a state transition diagram for the Course Offering class (developed in previous laboratory session). Create the following states: Initialization, Open, Closed, Canceled.
2. Open the state transition diagram for the CourseOffering class. Create the state transitions as shown in the tables below.

From State	To State	Event Name
Initialized	Open	Add student
Open	Open	Add student
Open	Closed	None
Open	Canceled	Cancel course
Closed	Canceled	Cancel course

From State	To State	Action
Initialized	Open	set count = 0
Open	Open	None
Open	Closed	None
Open	Canceled	None
Closed	Canceled	None

From State	To State	Guard
Initialized	Open	None
Open	Open	count < 25
Open	Closed	count = 25
Open	Canceled	None
Closed	Canceled	None

3. Open the state transition diagram for the CourseOffering class
  - Add a start state with a transition to the Initialization state to the diagram.
  - Add a transition from the Canceled state to a stop state to the diagram.
  - Add a transition from the Closed state to a stop state to the diagram.

Save the model and Attach printout for the Final State transition Diagram

### EXERCISES 3

Consider the Scenario of Payroll Application

- The manager first login and the system check the required credential provide by the manager.
- It authenticates and if it is successful, it moves to the next state where the manager can add employee.
- If the authenticate fails, it moves to a state where it again ask to reenter the credentials.
- The manager can add employee and move to record deletion state or the report generation state or payment calculation state.
- For payment calculation, the manger gives the requirements and system calculates the payments.
- The report generation state generate report for manager which is followed by updating state where all the records of an employee is updated
- The payment calculation state goes to error recovery state in case of error. after deletion of record state or updating of record state, the system ends the operation.

States detail are as below.

**Idle:** when no operation is performing in the system.

**Admin Login:** The manager logs and the system

**Retry login:** if login fail, this state gives chance to retry login again

**Adding employee:** this state add employee and their detail.

**Adding new record:** creates new employee.

**Deleting record:** Delete records of employee

**Report Generation:** Generate reports

**Payment calculation:** Calculate payment of employee

**Error Recovery:** If error occurs, this state helps to recover that state

**Update Record:** Updates records of an employee.

Create State Machine Diagram of the above Payroll Application, mention all events and possible guards. Also include appropriate Entry, Do and Exit activities.

Save the model and Attach printout for the Final State transition Diagram

## Students Task

Librarians categories the library books into loanable and non-loanable books. The non-loanable books are the reference books. However, the loanable books are the no reference books. After cataloguing the books, the books are available for loan. Students who borrow the library books should return them back before the due date. Books that are 12 months over the due date would be considered as a lost state. However, if those books are found in the future, they must be returned back to the library. When the books are found not required in the library or have been damaged, the book would be disposed.

You can consider following states for your diagram:

Purchased, Catalogued, Not available for loan, Available for loan, Disposed, Borrowed, Overdue, Lost

Create a State Machine diagram for an object of Book class. The following scenario provides about life cycle of a book for a library system: