CSc 131
Computer Software Engineering

Fall 2022

Lecture # 7

Object Oriented Design
UML Interaction Diagrams
(Sequence, Collaboration and State Chart Diagrams)

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Interaction Diagrams

❑ UML Specifies a number of interaction diagrams to model dynamic aspects of the system

❑ Dynamic aspects of the system
- Messages moving among objects/classes
- Flow of control among objects
- Sequences of events

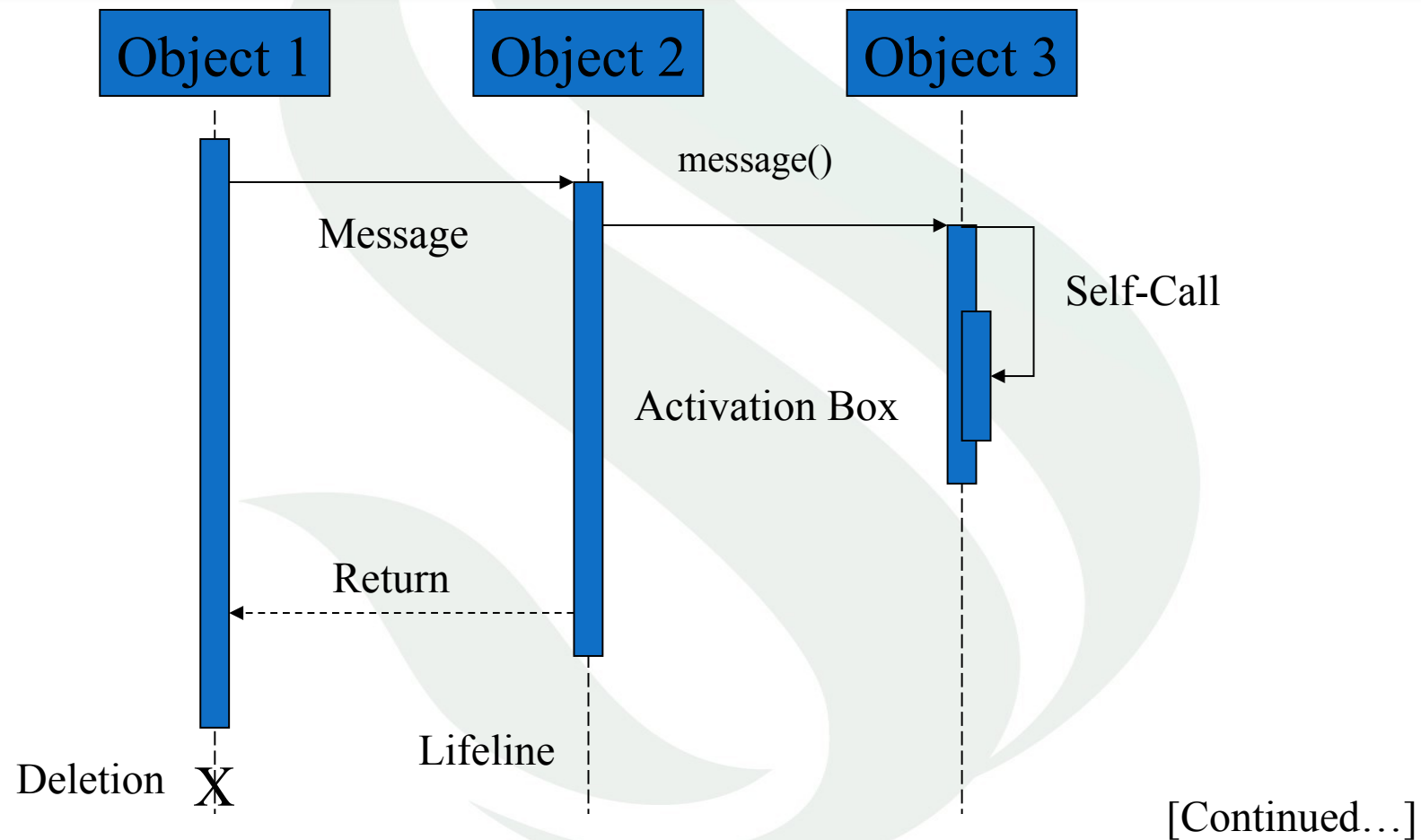SACRAMENTO STATE
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Dynamic Diagram Types

❏ **Interaction Diagrams** - Set of objects or roles and the messages that can be passed among them.

- **Sequence Diagrams** - emphasize time ordering

❏ **State-chart Diagrams**

- State machine consisting of states, transitions, events and activities of an object

❏ **Activity Diagrams**

- Emphasize and show flow of control among objects

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Sequence Diagrams

❑ Describe the flow of messages, events, actions between objects

❑ Show concurrent processes and activations

❑ Show time sequences that are not easily depicted in other diagrams

❑ Typically used during design to document and understand the logical flow of the system

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Sequence Diagram Basics

Object 1   Object 2   Object 3

message()

Message

Self-Call

Activation Box

Return

Lifeline

Deletion   X

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Sequence Diagram Rules

❑ Options ,loops, and alt/else

- These constructs complicate a diagram and make them hard to read/interpret.
- Often it is better to create multiple simple diagrams

❑ Create sequence diagrams for use cases when it helps clarify and visualize a complex flow

❑ Remember: the goal of UML is communication and understanding

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Sequence Diagram

❑ A sequence diagram provides a detailed view of a use case.

❑ It shows an interaction arranged in a sequence over time.

❑ It helps document the flow within the application.

❑ In a comprehensive software system, the sequence diagram can be quite detailed, and can include thousands of messages.

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Elements of the Sequence Diagram

❑ Objects appear along the top margin

❑ Each object has a life line , a dashed line that represents the life of the object

❑ A focus of control- is a tall, thin rectangle that sits on top of an object's lifeline

❑ Messages that show the actions that objects perform on each other and on themselves.

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Security System Example
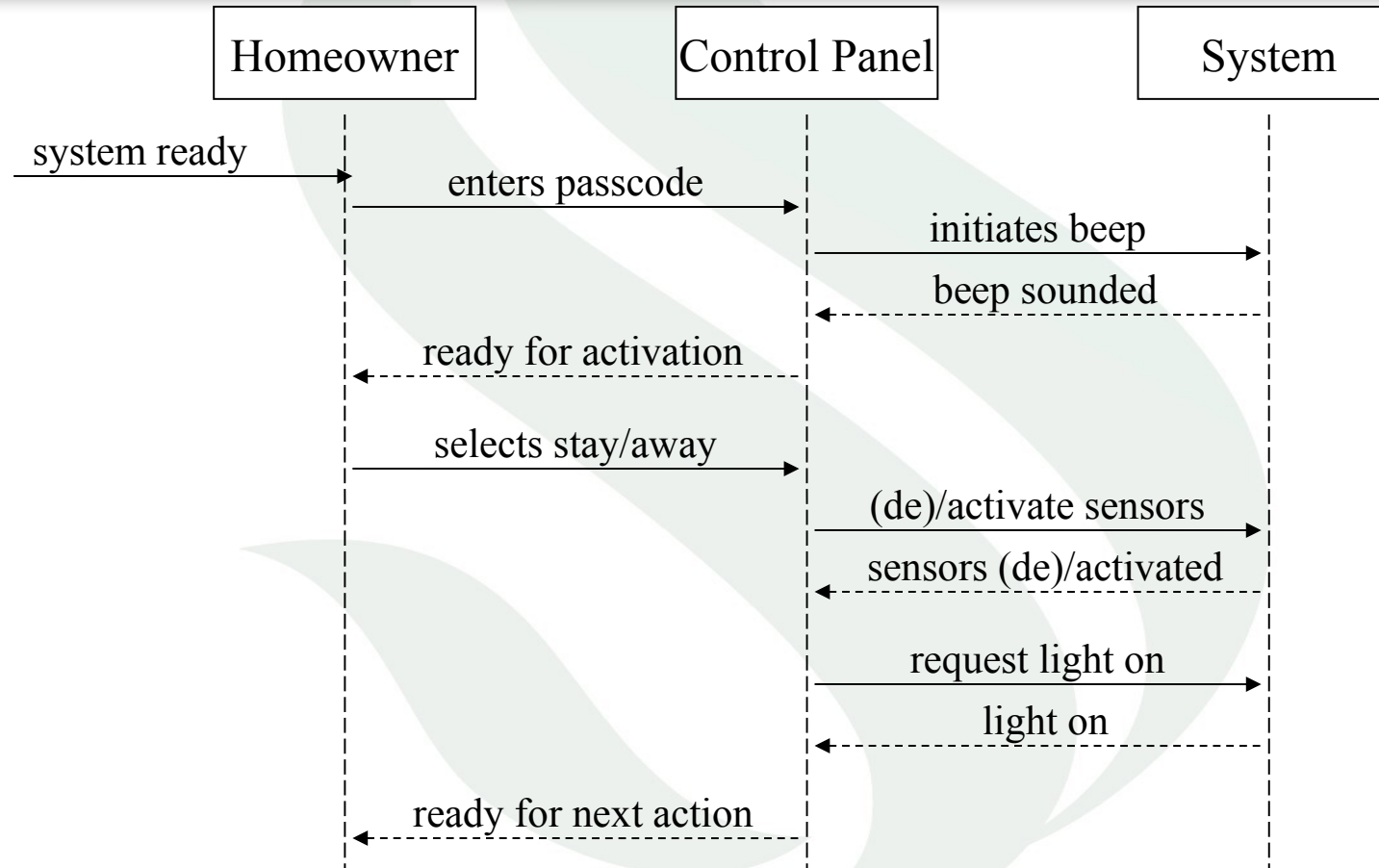
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Sequence Diagram –Another Example

Benefits of using UML Sequence Diagrams

❑ Allow the software engineer to flush out details before implementation.

❑ Useful tools to find architectural, interface and logic problems early in the design process.

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☐ Allows software engineer to validate architecture, interfaces, and logic by exploring how the system architecture would handle different basic scenarios and special cases.

☐ It forces the software engineer to think about details such as interfaces, states, message order, assignment of responsibilities, and special/error cases ahead of

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Benefits of using UML Sequence Diagrams

❑ Valuable collaboration tools during design meetings because they allow software engineer to discuss the design in concrete terms.

❑ To document the dynamic view of the system design at various levels of abstraction, which is often difficult to extract from static diagrams or even the complete source code.

❑ Can abstract much of the implementation detail and provide a high level view of system behavior.

Collaboration Diagrams

❑ UML collaboration diagram is a diagram, that focus on the organization of the objects that participate in a given set of messages.

❑ They show objects and messages, but no lifelines or focus of control rectangles.

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Collaboration Diagrams

❑ A collaboration diagram is another type of interaction diagram.

❑ Like a sequence diagram, it shows how a group of objects in a use case work with one another.

❑ Each message is numbered to document the order in which it occurs.

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Collaboration Diagrams
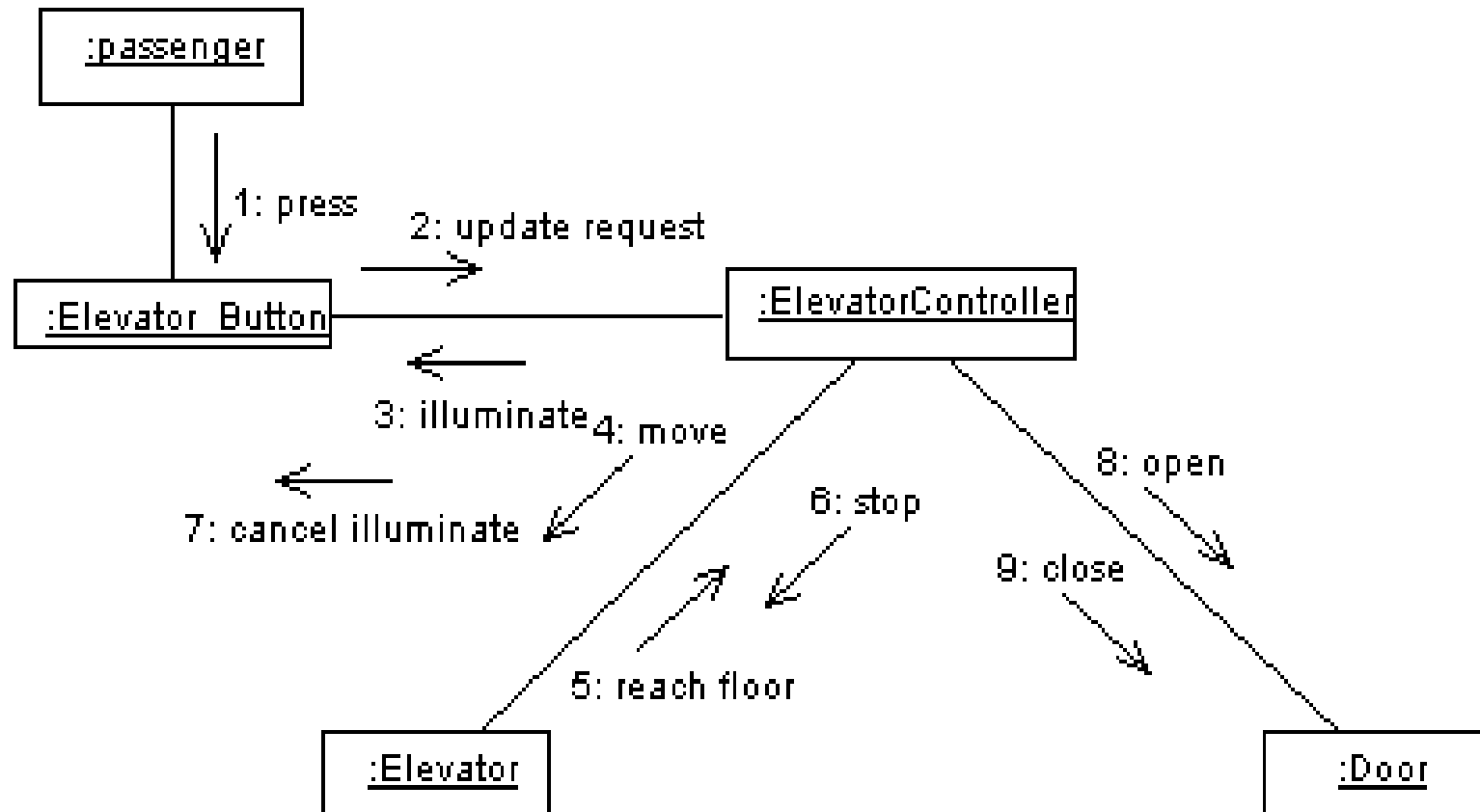
State Chart Diagrams

❑ Very similar to those in Structured Analysis

❑ Describe the lifecycle of an object

- All the possible states of an object

- How the object's state changes as a result of events that reach the object

❑ Good at describing the behaviour of an object across several use cases

❑ Use state diagrams only for classes that exhibit interesting behaviour

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State Chart Diagram

Shows the following:

☐ The life history of a given class
☐ The events that cause a transition from on state to another
☐ The actions that result from a state change
☐ State charts are created for objects with significant dynamic behavior

State Chart Diagram Example
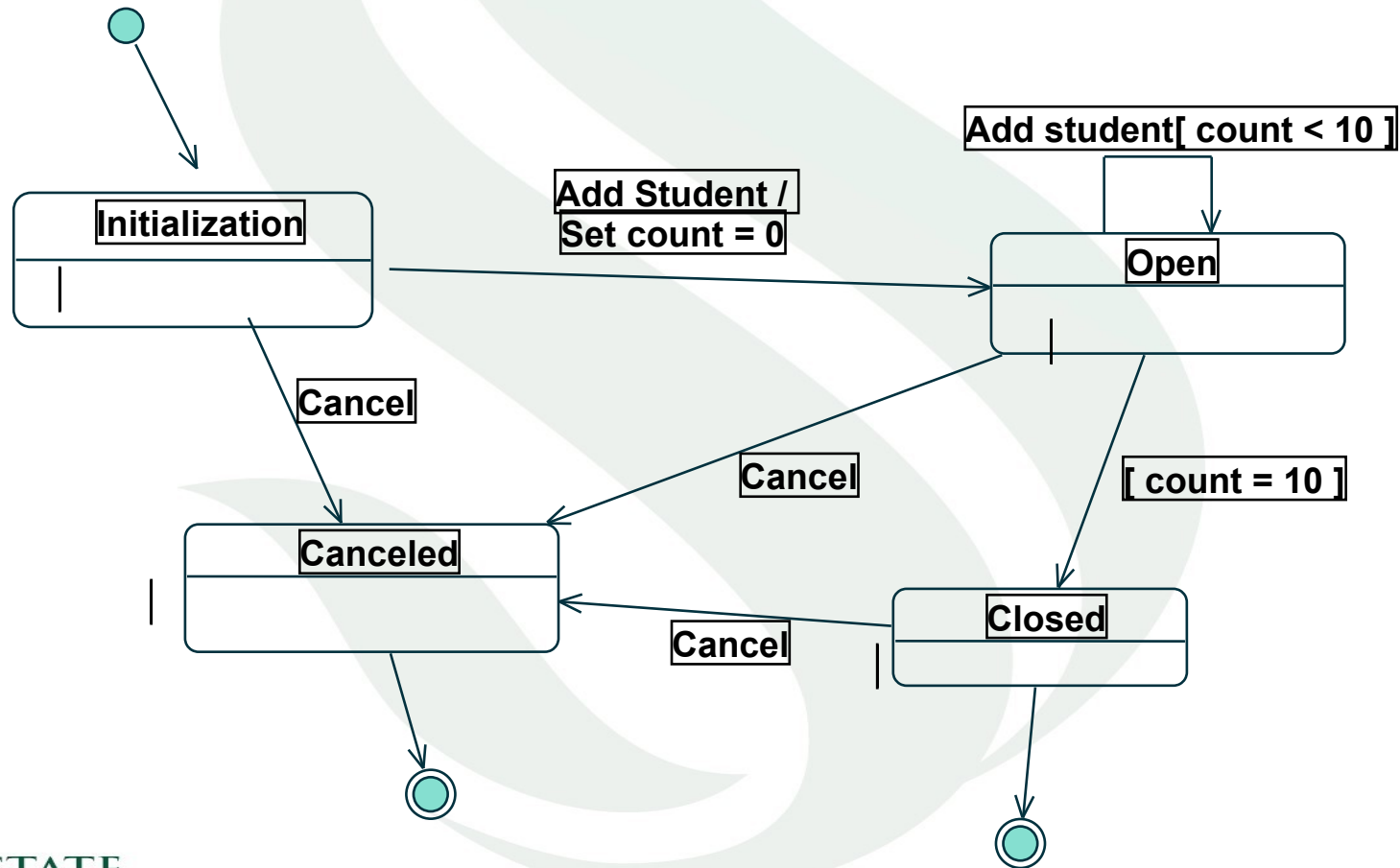
Summary

Use collaboration and sequence diagrams to:

- ❑ Capture the behaviour of a single use case.
- ❑ Show collaborations among objects.

Use state chart diagrams to:

- ❑ Describe the behaviour of an object across several use cases.
- ❑ Model classes that exhibit interesting behaviour.

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USE CASE Driven…

❑ A use case leads to a sequence diagram.

❑ The sequence diagram is used to allocate behavior among objects mentioned in the use case.

❑ This behavior becomes methods

❑ These methods becomes operations on the classes

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What is Next

❑ More On UML Class and Sequence Diagrams

❑ Continue on the SDD & Implementation

Questions?