

# CMSC 132: OBJECT-ORIENTED PROGRAMMING II



## UML (Unified Modeling Language)

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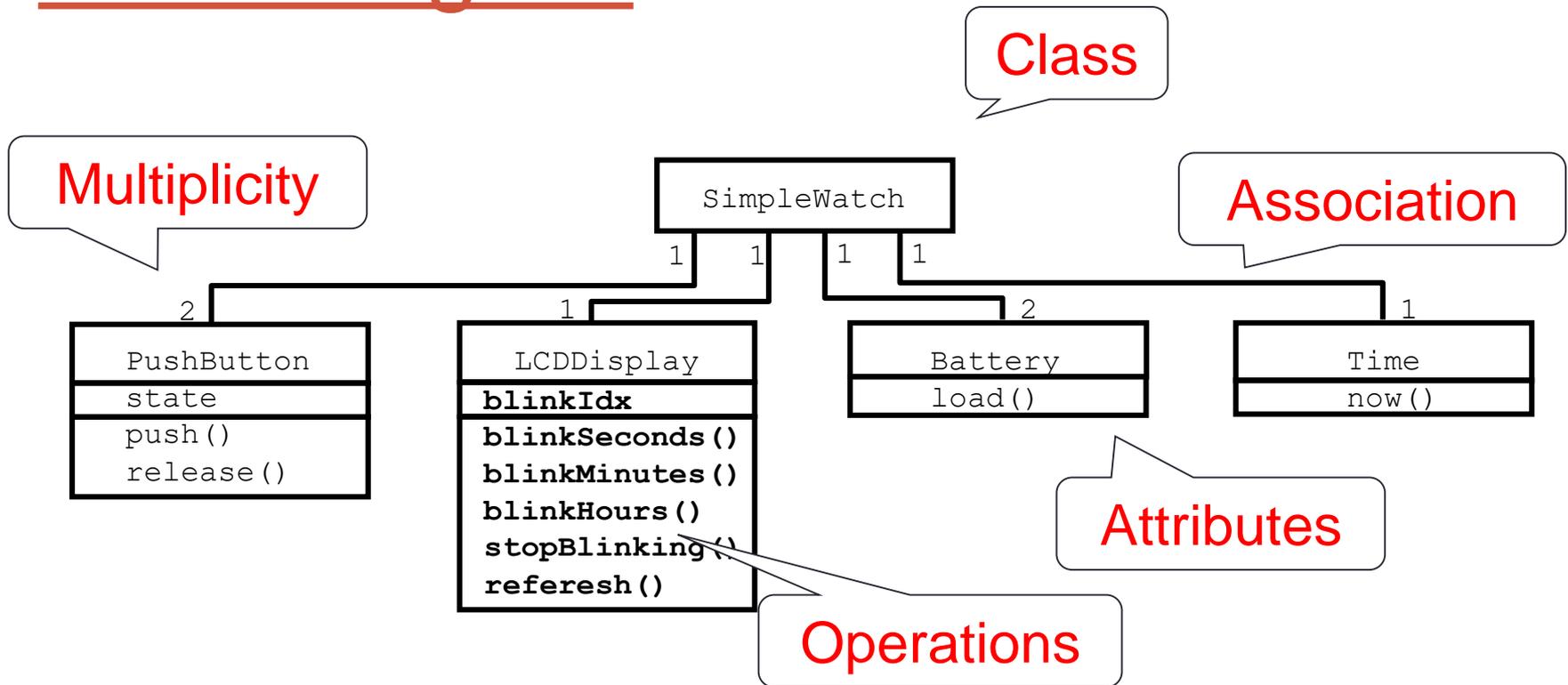
# UML (Unified Modeling Language)

- UML is a modeling language for object-oriented software that allow us to specify, visualize, construct and document systems
- Use UML to help visualize design of software
- UML provides a number of **diagrams** that
  - Describe a **model** of all or part of system
  - From a particular point of **view**
  - With varying level of abstraction
- We want to use class diagrams to describe our designs

# UML (Unified Modeling Language)

- Class diagram
  - Represents (static) structure of system
  - It displays
    - Information for class
    - Relationships between classes
- NOTE:
  - In this class we are going to use UML Class diagrams very informally (you don't need to adhere to UML class diagrams rules)
  - We will use them to provide description of designs
  - You may see UML formally in later courses

# Class Diagram

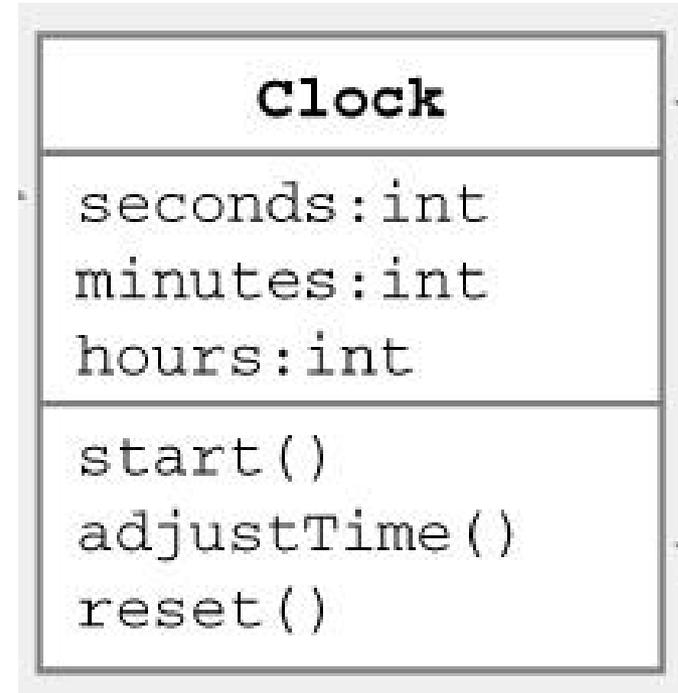


**Class diagrams represent structure of system**

# Java → UML : Clock Example

- Java

```
class Clock { // name
  // state
  int seconds;
  int minutes;
  int hours;
  // behavior
  void start();
  void adjustTime();
  void reset();
}
```

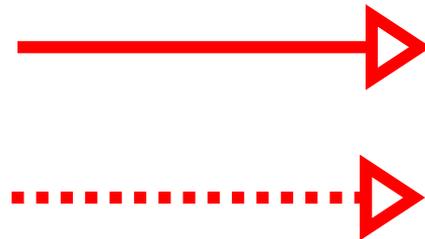


Java Code

Class Diagram

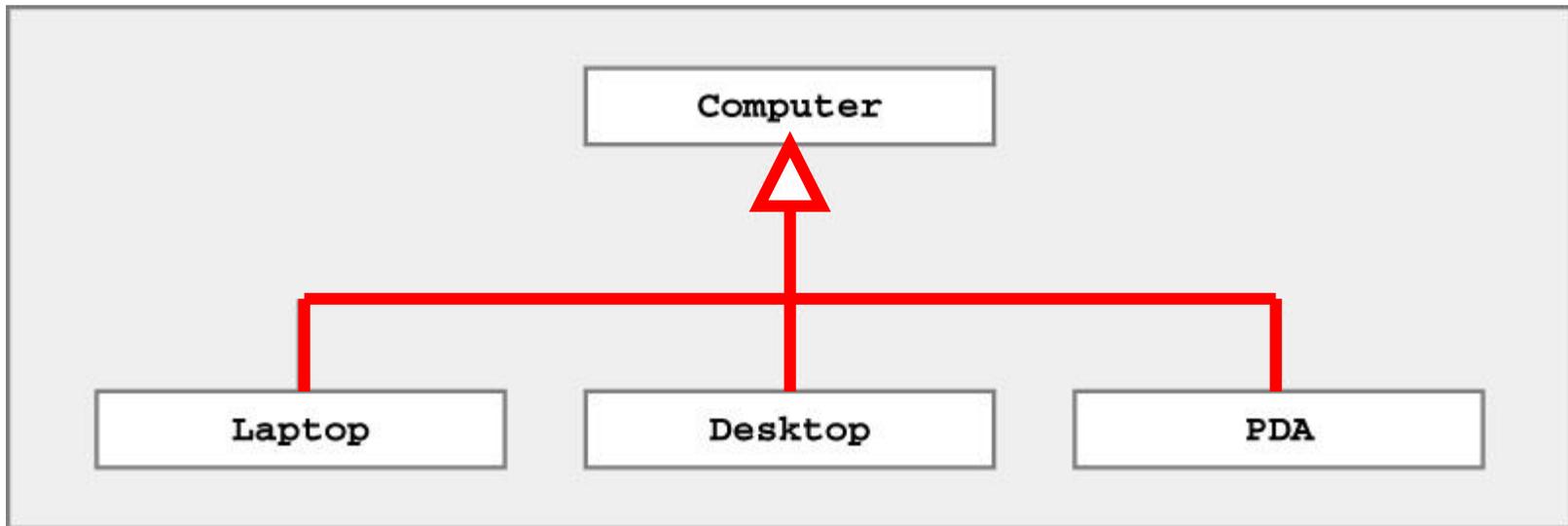
# Generalization

- Denotes inheritance between classes
  - Can view as “is a” relationship
- Example
  - Lecturer is a person (Lecturer extends Person class)
- Types of generalization
  - Subclass extends superclass
    - Solid line ending in (open) triangle
  - Class implements interface
    - Dotted line ending in (open) triangle



# Generalization Example

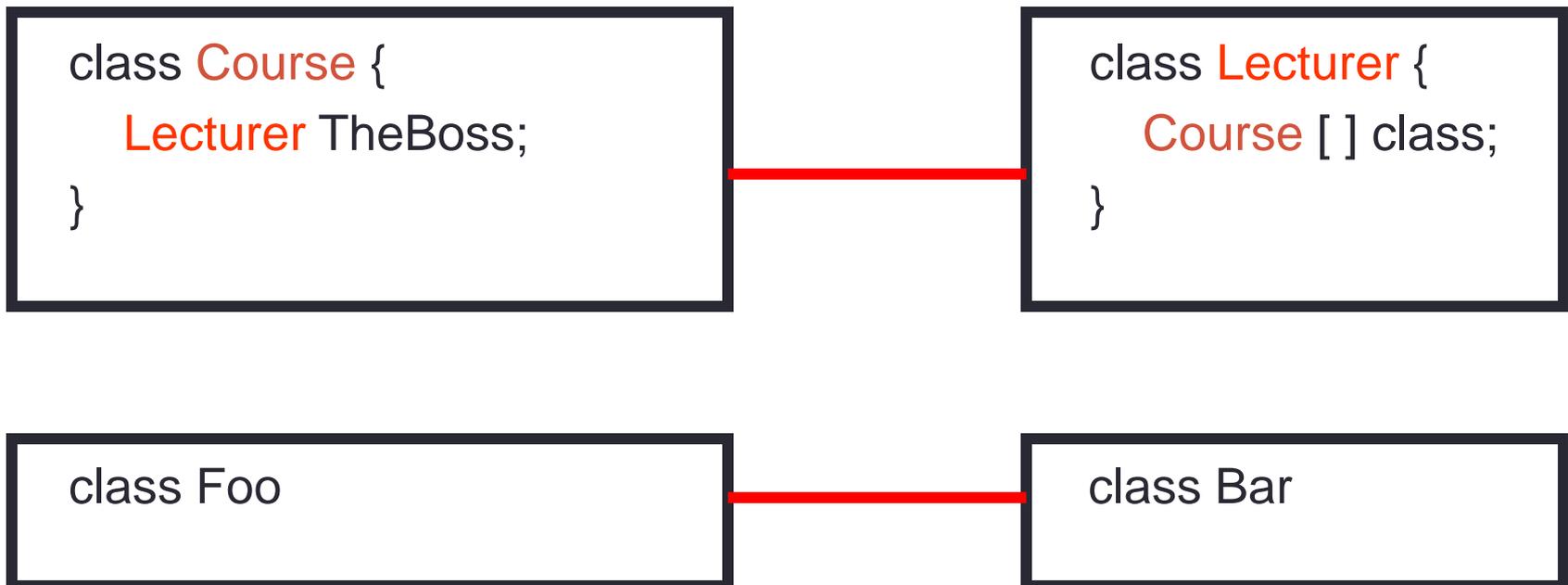
- Inheritance



**Laptop, Desktop, PDA inherit  
state & behavior from Computer**

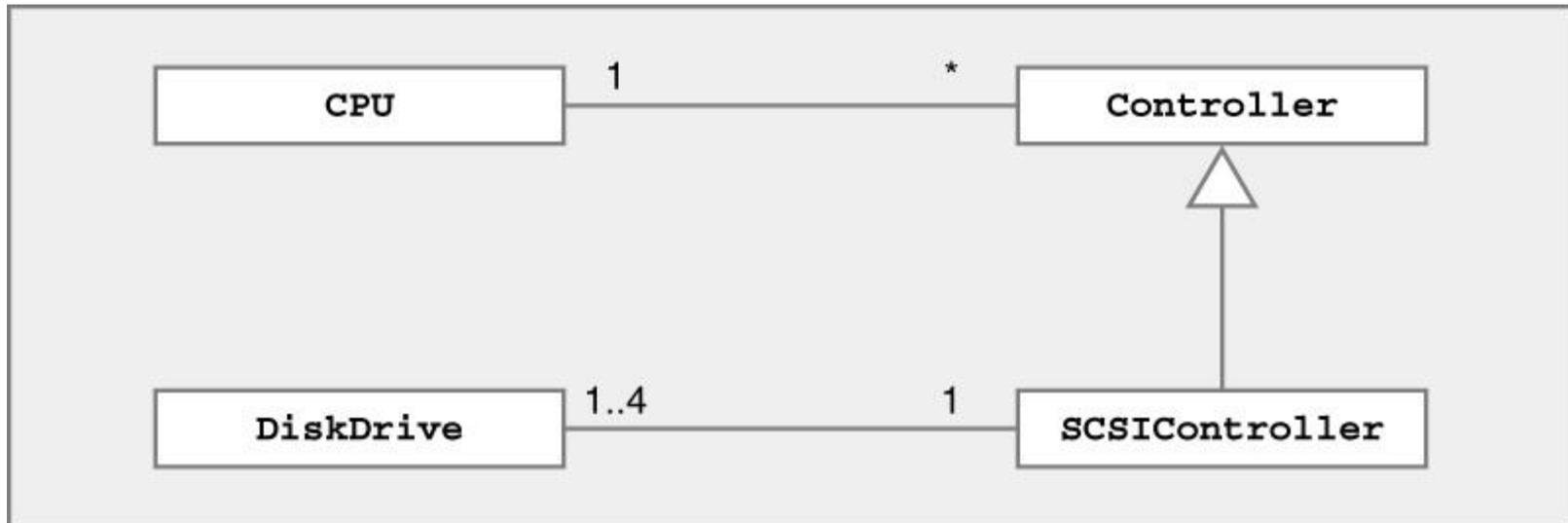
# Association w/o Navigation

- Undirected edge
  - Relationship between classes may be bi-directional
  - Direction of relationship may be unknown
- Examples



# UML Example – Computer System

- Try to read & understand UML diagram



- **CPU is associated with Controllers**
- **DiskDrive is associated with SCSIController**
- **SCSIController is a (type of) Controller**