

UML Examples



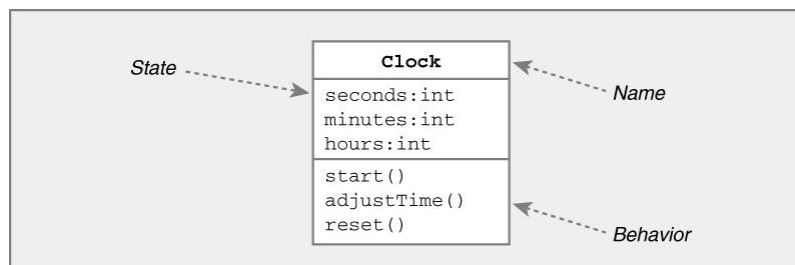
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UML Class Diagrams

■ Represent the (static) structure of the system

■ General	In Java
■ Name	Name
■ State	Variables
■ Behavior	Methods

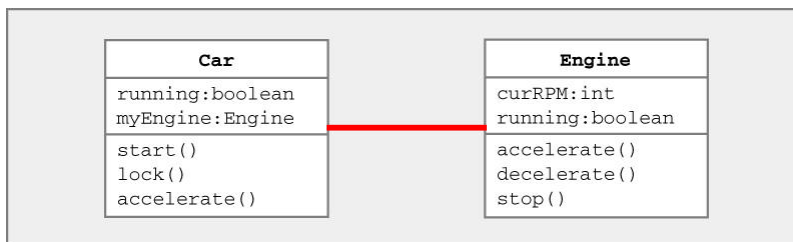


Relationships Between Classes

- **Association**  OR 
 - Permanent, structural, “has a”
 - Solid line (arrowhead optional)
- **Dependency** 
 - Temporary, “uses a”
 - Dotted line with arrowhead
- **Generalization** 
 - Inheritance, “is a”
 - Solid line with open (triangular) arrowhead
- **Implementation** 
 - Dotted line with open (triangular) arrowhead

Association

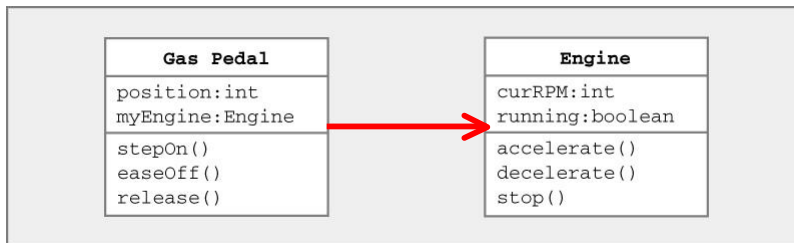
- Denotes permanent, structural relationship
- State of class A contains class B
- Represented by solid line (arrowhead optional)



Car and Engine classes know about each other

Associations w/ Navigation Information

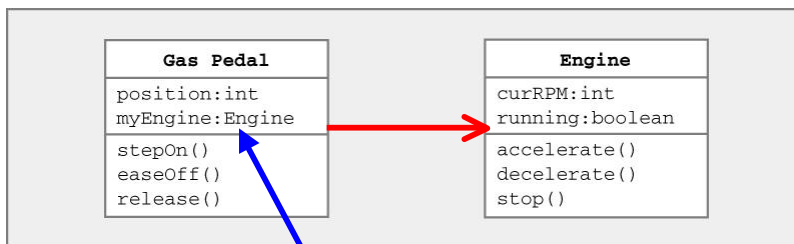
- Can indicate direction of relationship
- Represented by solid line with arrowhead



Gas Pedal class knows about Engine class
Engine class doesn't know about Gas Pedal class

Associations w/ Navigation Information

- Denotes “has-a” relationship between classes
- “Gas Pedal” has a “Engine”



State of Gas Pedal class contains instance
of Engine class ⇒ can invoke its methods

Multiplicity of Associations

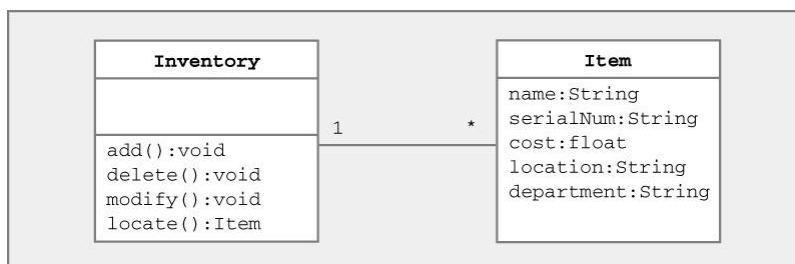
- Some relationships may be quantified
- Multiplicity denotes how many objects the source object can legitimately reference
- Notation
 - * ⇒ 0, 1, or more
 - 5 ⇒ 5 exactly
 - 5..8 ⇒ between 5 and 8, inclusive
 - 5..* ⇒ 5 or more

Multiplicity of Associations

- Many-to-one
 - Bank has many ATMs, ATM knows only 1 bank

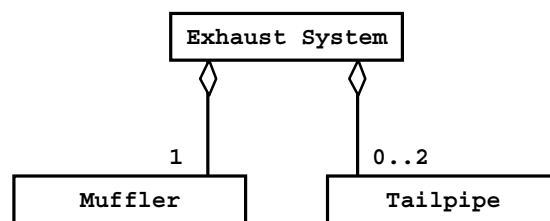


- One-to-many
 - Inventory has many items, items know 1 inventory



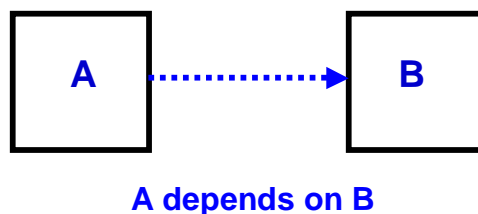
Association – Aggregation

- Special case of association denotes a “consists of” hierarchy
 - *Aggregate* is the parent class
 - *Components* are the children class
- Represented by line ending in open diamond



Dependency

- Denotes **dependence** between classes
- Always directed (Class **A** depends on **B**)
- Represented by dotted line with arrowhead



Dependency

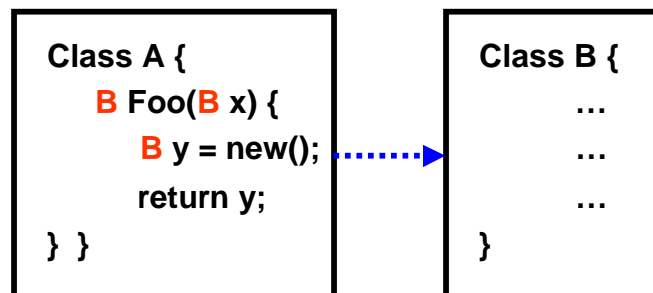
- Caused by class methods
- Method in Class **A** temporarily “uses a” object of type Class **B**
- Change in Class **B** may affect class **A**



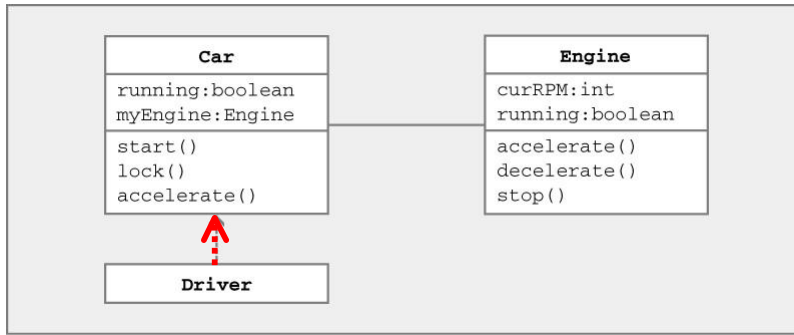
A uses object of class B

Dependency

- Dependence may be caused by
 - Local variable
 - Parameter
 - Return value
- Example



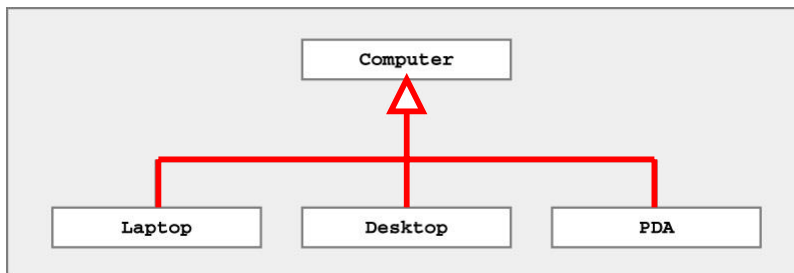
Dependency Example



Class Driver depends on Class Car

Generalization

- Denotes **inheritance** between classes
- Can view as “**is-a**” relationship
- Represented by line ending in (open) triangle



Laptop, Desktop, PDA inherit state & behavior from Computers

Implementation

- Denotes class **implements** Java interface
- Represented by dotted line ending in (open) triangle



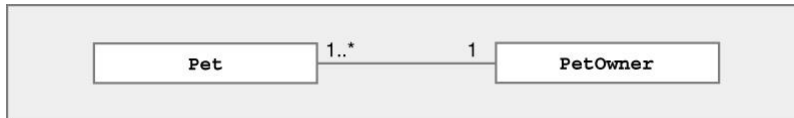
A implements interface B

UML Examples

- Read UML class diagram
- Try to understand relationships
- Examples
 - Pets & owners
 - Computer disk organization
 - Library books
 - Banking system
 - Home heating system
 - Printing system

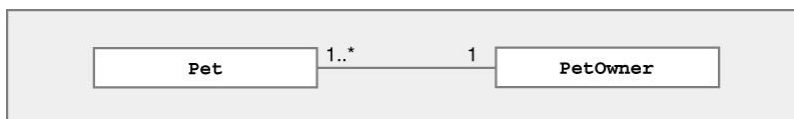
UML Example – Veterinary System

- Try to read & understand UML diagram



UML Example – Veterinary System

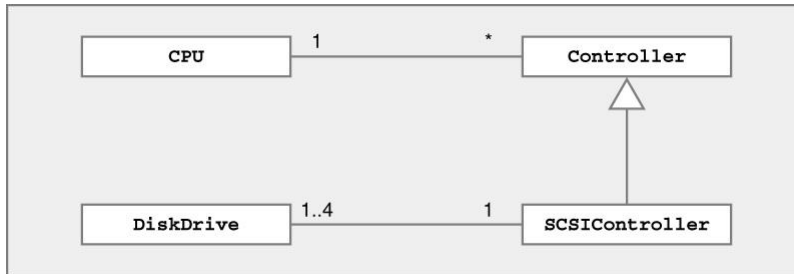
- Try to read & understand UML diagram



- 1 or more Pets associated with 1 PetOwner

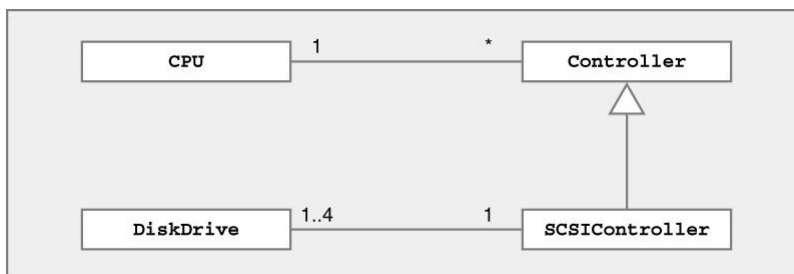
UML Example – Computer System

- Try to read & understand UML diagram



UML Example – Computer System

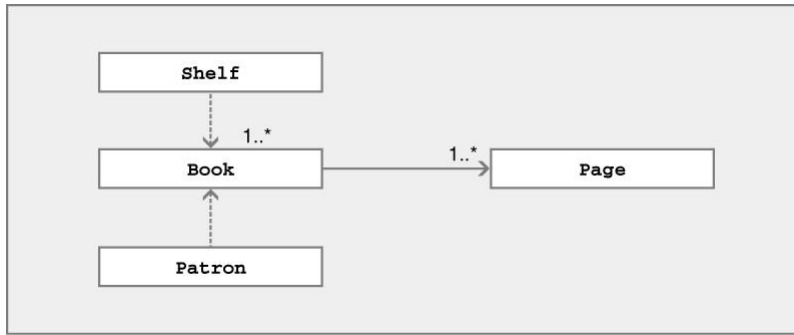
- Try to read & understand UML diagram



- 1 CPU associated with 0 or more Controllers
- 1-4 DiskDrives associated with 1 SCSIController
- SCSIController is a (specialized) Controller

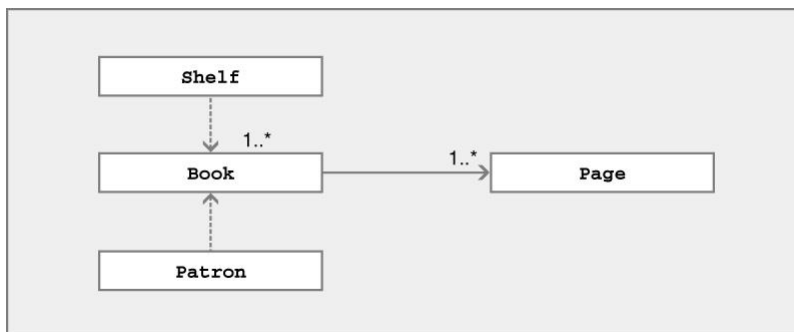
UML Example – Library System

- Try to read & understand UML diagram



UML Example – Library System

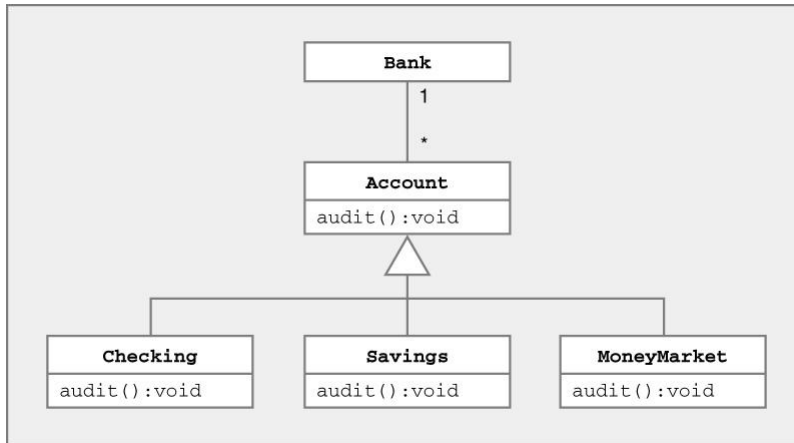
- Try to read & understand UML diagram



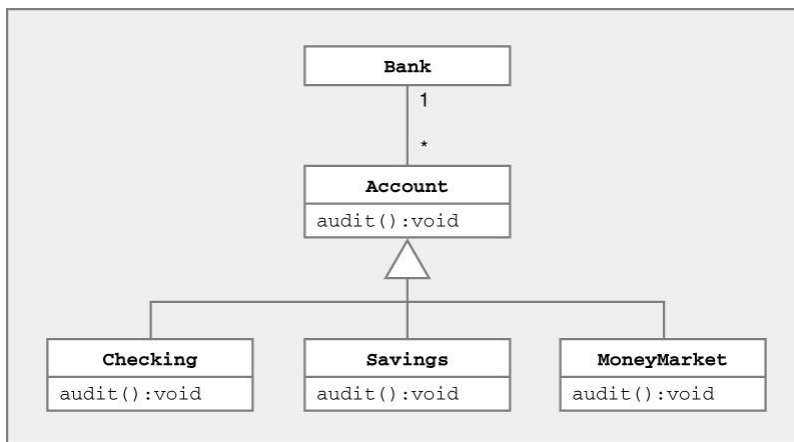
- 1 or more Book associated with 1 or more Pages
- Patron & Shelf temporarily use (depend on) Books

UML Example – Banking System

- Try to read & understand UML diagram



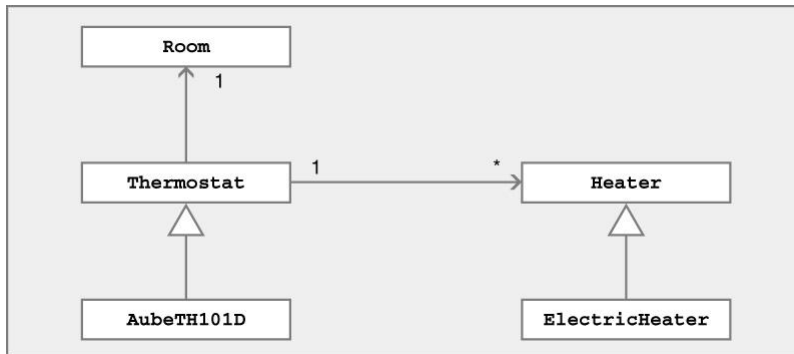
UML Example – Banking System



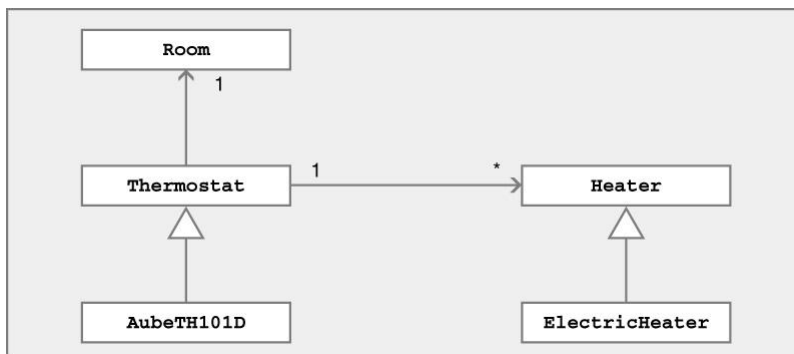
- 1 Bank associated with 0 or more Accounts
- Checking, Savings, MoneyMarket are Accounts

UML Example – Home Heating System

- Try to read & understand UML diagram



UML Example – Home Heating System



- Room has 1 Thermostat
- Each Thermostat associated with 0 or more Heaters
- ElectricHeater is a specialized Heater
- AubeTH101D is a specialized Thermostat

UML Example – Printing System

