Object Oriented Analysis and Design with Java

UE19CS353

Dr. Phalachandra and Prof.J.Ruby Dinakar
Department of Computer Science and Engineering

Acknowledgements: Significant portions of the information in the slide sets presented through the course in the class, are extracted from the prescribed text books, information from the Internet. Since these are only intended for presentation for teaching within PESU, there was no explicit permission solicited. We would like to sincerely thank and acknowledge that the credit/rights remain with the original authors/creators only

PES UNIVERSITY ONLINE

UE19CS353: Object Oriented Analysis and Design with Java

Class Modelling: OO-Relationships

Dr. Phalachandra and Prof.J.Ruby Dinakar

Department of Computer Science and Engineering

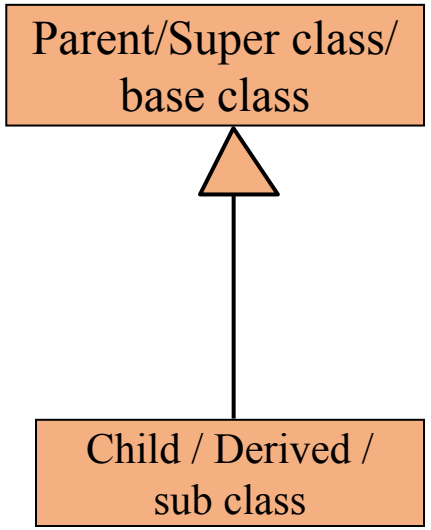
OO-Relationships

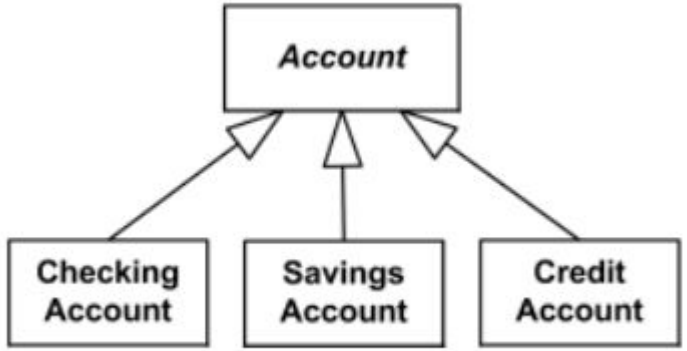
In UML, object interconnections (logical or physical), are modeled as relationships. The type of relationships are listed below:

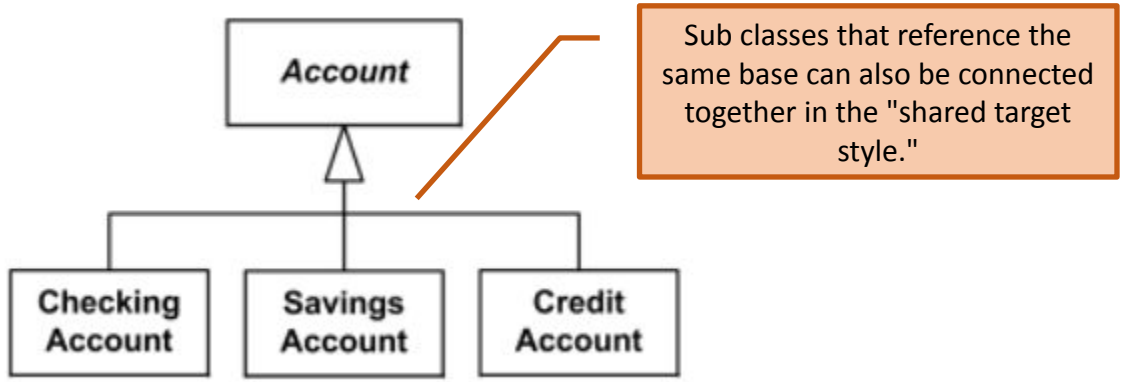
- Generalization- an inheritance relationship
- Abstraction
- Realization - interface implementation
- Dependency
- Association – using relationship
    - Aggregation
    - Composition

Generalization

- Also known as Inheritance.
- It represents “is a” or “is a kind of” relationship since the child class is a type of the parent class.
- It is used to showcase reusable elements in the class diagram.
- The child classes “inherit” the common functionality(attributes and methods) defined in the parent class.
- A generalization is shown as a line with a hollow triangle as an arrowhead.
- The arrowhead points to the super class

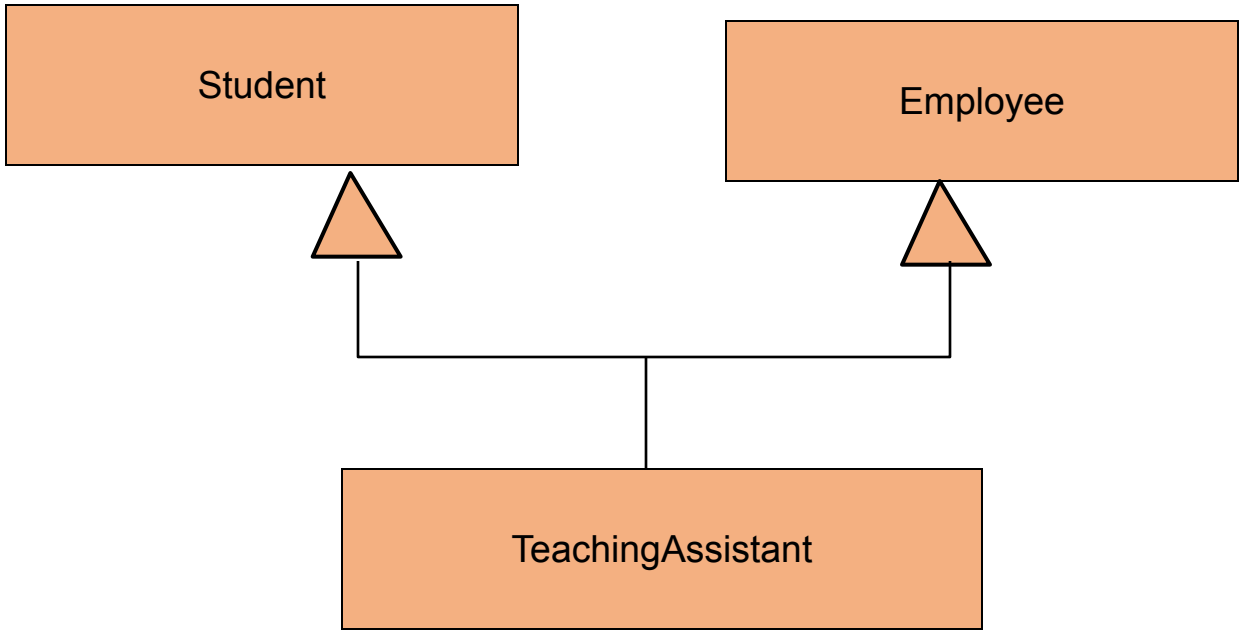






Generalization Relationships (Cont'd)

UML permits a class to inherit from multiple super classes, although some programming languages (*e.g.,* Java) do not permit multiple inheritance.

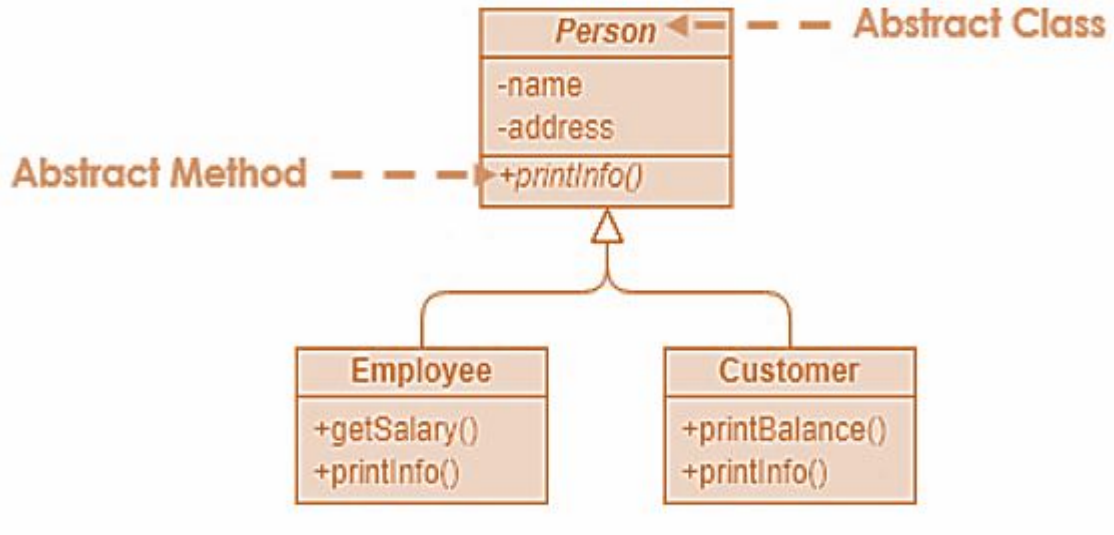


Abstraction

In an inheritance hierarchy, subclasses implement specific details, whereas the parent class defines the framework its subclasses. The parent class also serves as a template for common methods that will be implemented by its subclasses.

The name of an abstract Class is typically shown in italics; alternatively, an abstract Class may be shown using the textual annotation, also called stereotype {abstract} after or below its name.

An abstract method is a method that do not have implementation. In order to create an abstract method, create a operation and make it italic.



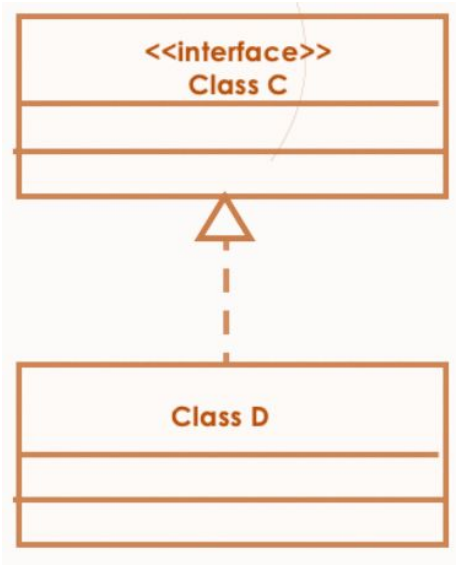
Object Oriented Analysis and Design with Java

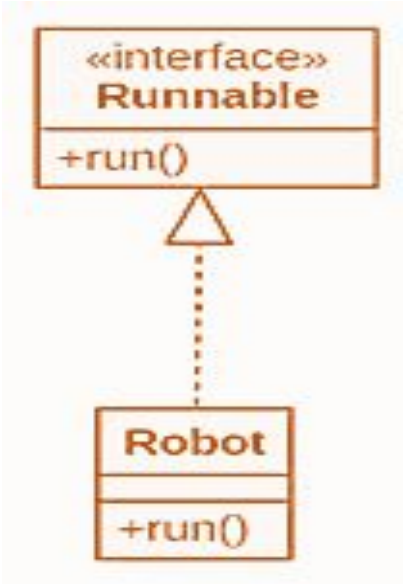
Realization / Interfaces

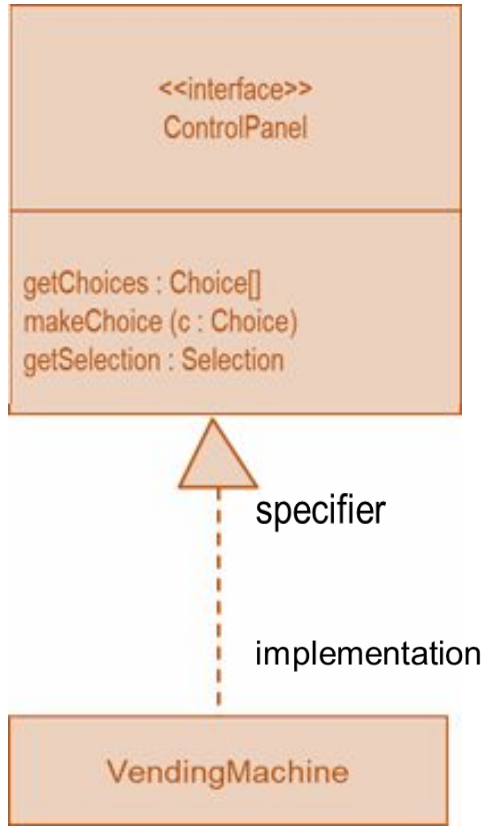
Realization is a specialized abstraction relationship between two things where one thing (an interface) specifies a contract that another thing (a class) guarantees to carry out by implementing the operations specified in that contract.

Interface defines a set of functionalities as a contract and the other entity “realizes” the contract by implementing the functionality defined in the contract.

Realization is shown as a dashed directed line with an open arrowhead pointing to the interface.





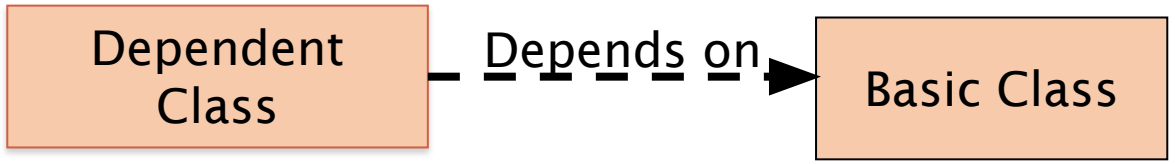


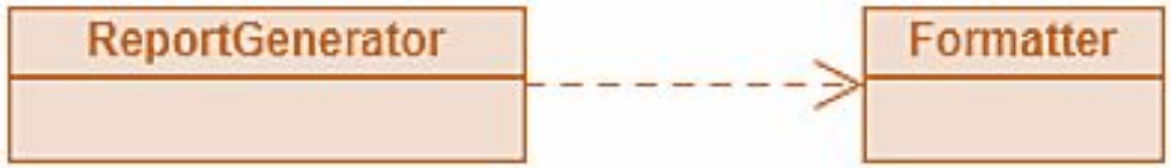
Dependency

•Dependency means "**One class uses the other**"

•A dependency relationship indicates that a **change** in **one class** may **affect** the **dependent class**, but not necessarily the reverse.

•A dependency relationship is often used to show that a **method has object** of a class **as arguments**.



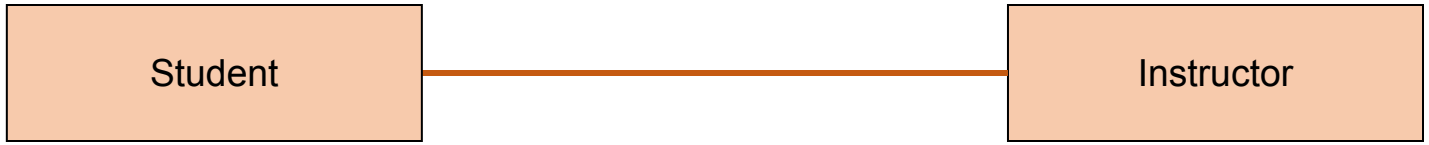


Object Oriented Analysis and Design with Java

Association Relationships

If two classes in a model need to communicate with each other, there must be link between them.

An *association* denotes that link.



Association Relationships (Cont'd)

- We can constrain the association relationship by defining the *navigability* of the association.
- In a uni-directional association, two classes are related, but only one class "knows" that the relationship exists.
- A uni-directional association is drawn as a solid line with an open arrowhead pointing to the known class.
- Uni-directional association includes a role name and a multiplicity value, but only for the known class.
- In this example Orderdetails class only knows that it has a relationship with Item class but Item class does not know about their relationship.

Association Relationships (Cont'd)

We can indicate the *multiplicity* of an association by adding *multiplicity adornments* to the line denoting the association.

The multiplicity of an association is the number of possible instances of the class associated with a single instance of the other end.

Multiplicities are single number or ranges of numbers.

Multiplicities	Meaning
0..1	zero or one instance.
0..* *or* *	no limit on the number of instances (including none).
1	exactly one instance
1..*	at least one instance
n..m	***n*** to ***m*** instances (n and m stand for numbers, e.g. **0..4**, **3..15**)
n	exactly n instance (where n stands for a number, e.g. **3**)

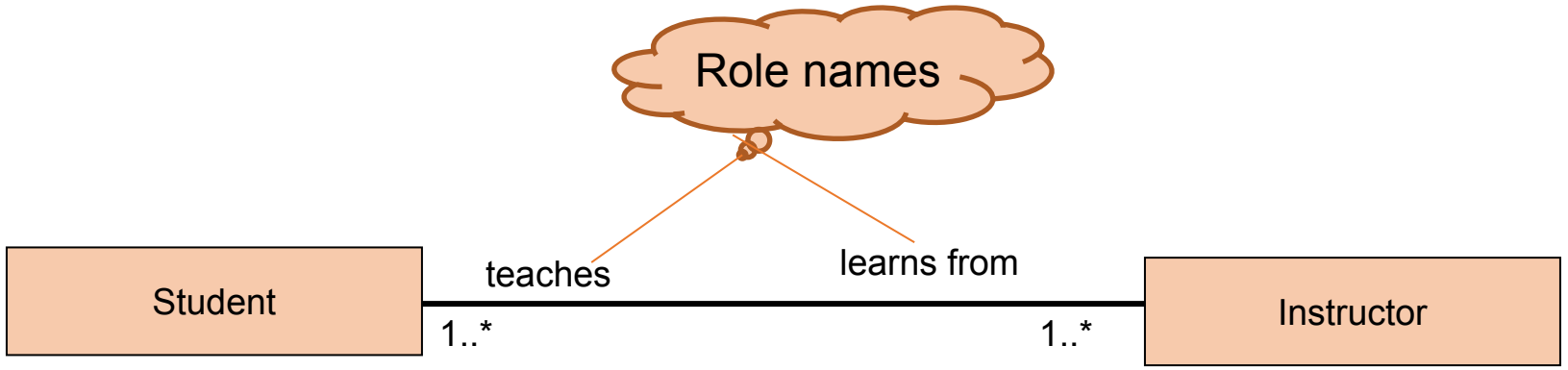
Association Relationships (Cont'd)

The example indicates that a *Student* has one or more *Instructors*:

The example indicates that every *Instructor* has one or more *Students*:

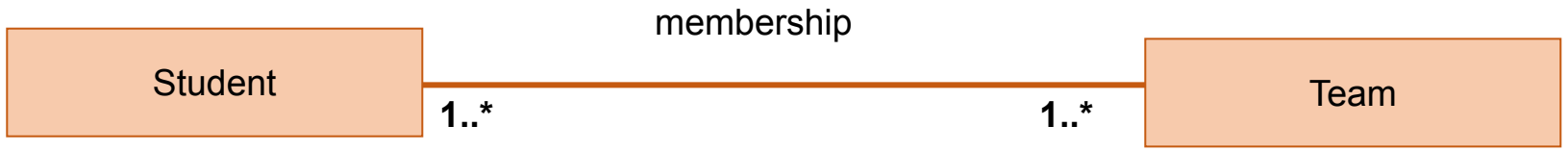
Association Relationships (Cont'd)

We can also indicate the behavior of an object in an association (*i.e.,* the *role* of an object) using *rolenames.*



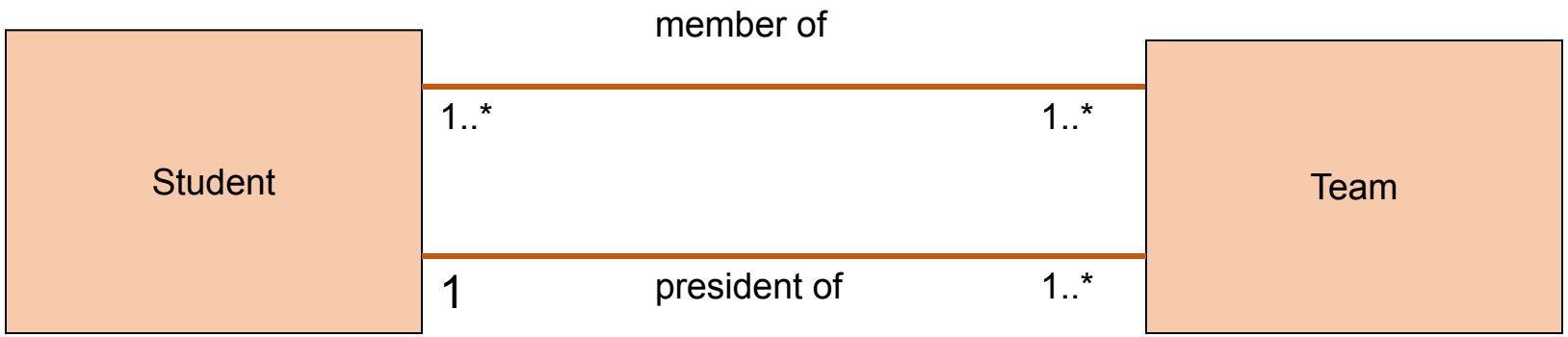
Association Relationships (Cont'd)

We can also name the association.



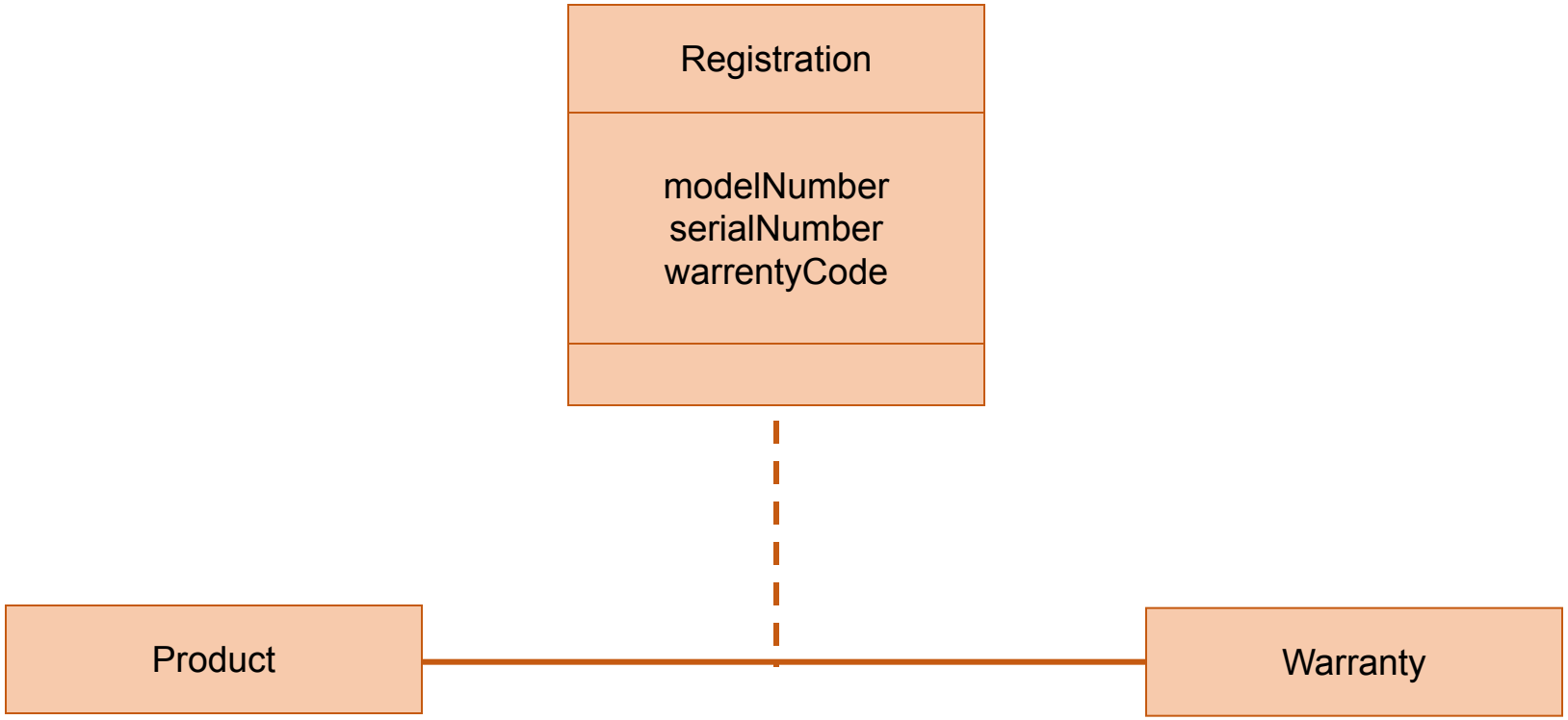
Association Relationships (Cont'd)

We can specify dual associations.



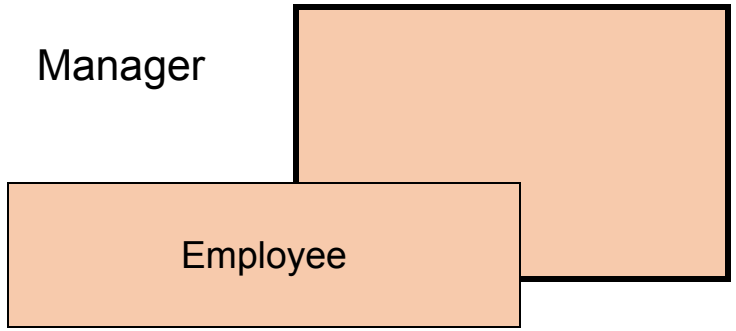
Association Relationships (Cont'd)

Associations can also be objects themselves, called *link classes* or an *association classes*.
An association class is represented like a normal class, but it is linked to an association line with a dotted line.



Association Relationships (Cont'd)

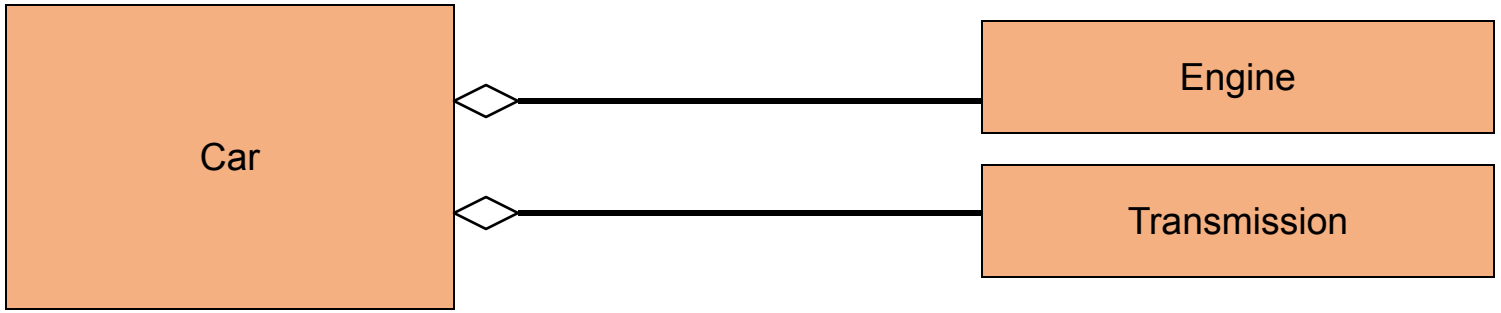
A class can have a *self association*.



Aggregation

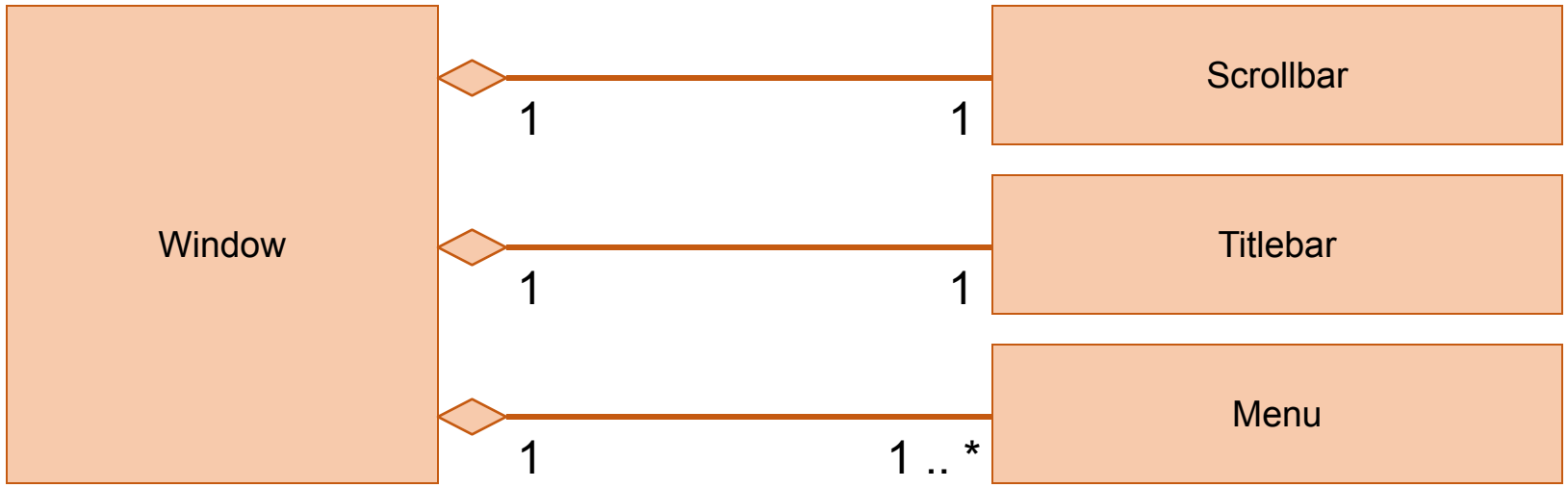
We can model objects that contain other objects by way of special associations called *aggregations* and *compositions. It is also known as "has a" relationship.*

An *aggregation* specifies a whole-part relationship between an aggregate (a whole) and a constituent part, where the part can exist independently from the aggregate. Aggregations are denoted by a hollow-diamond adornment on the association.

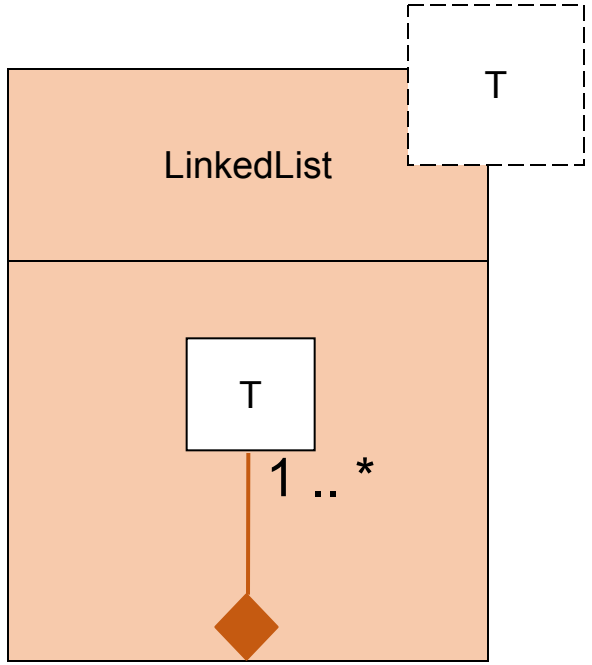


Composition

A *composition* indicates a strong ownership and coincident lifetime of parts by the whole (*i.e.,* they live and die as a whole). Compositions are denoted by a filled-diamond adornment on the association.



Parameterized Class

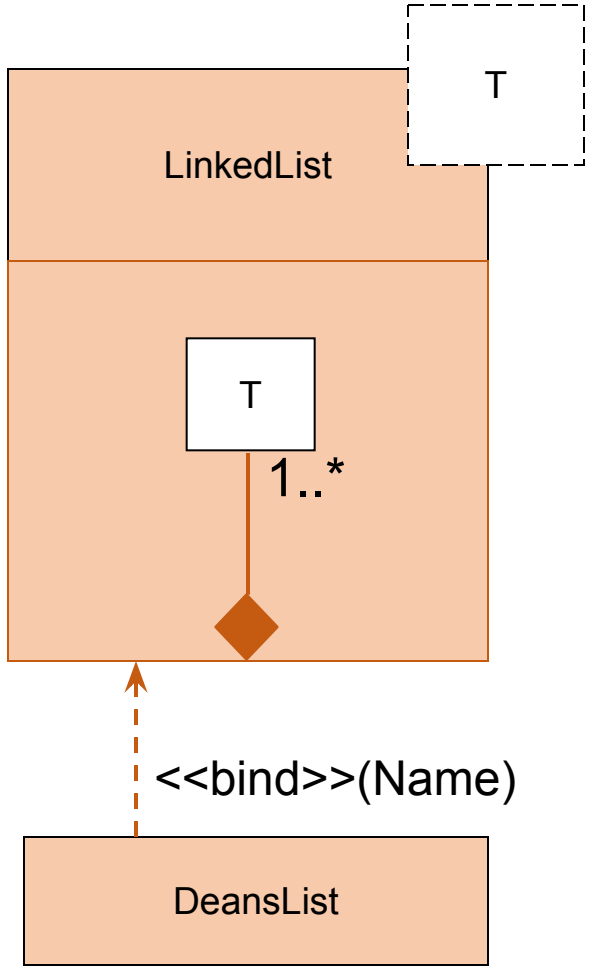


A *parameterized class* or *template* defines a family of potential elements.

To use it, the parameter must be bound.

A *template* is rendered by a small dashed rectangle superimposed on the upper-right corner of the class rectangle. The dashed rectangle contains a list of formal parameters for the class.

Parameterized Class (Cont'd)



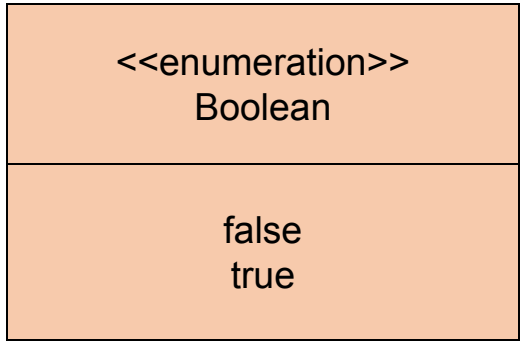
Binding is done with the <<bind>> stereotype and a parameter to supply to the template. These are adornments to the dashed arrow denoting the realization relationship.

Here we create a linked-list of names for the Dean's List.

Object Oriented Analysis and Design with Java

Enumeration

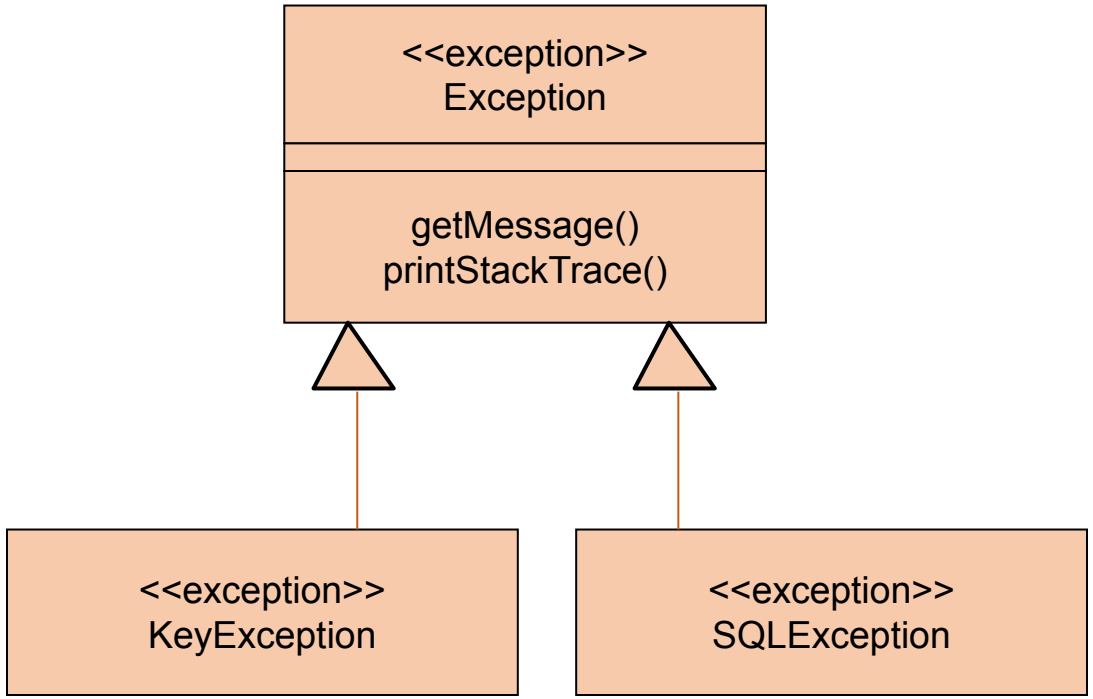
An *enumeration* is a user-defined data type that consists of a name and an ordered list of enumeration literals.



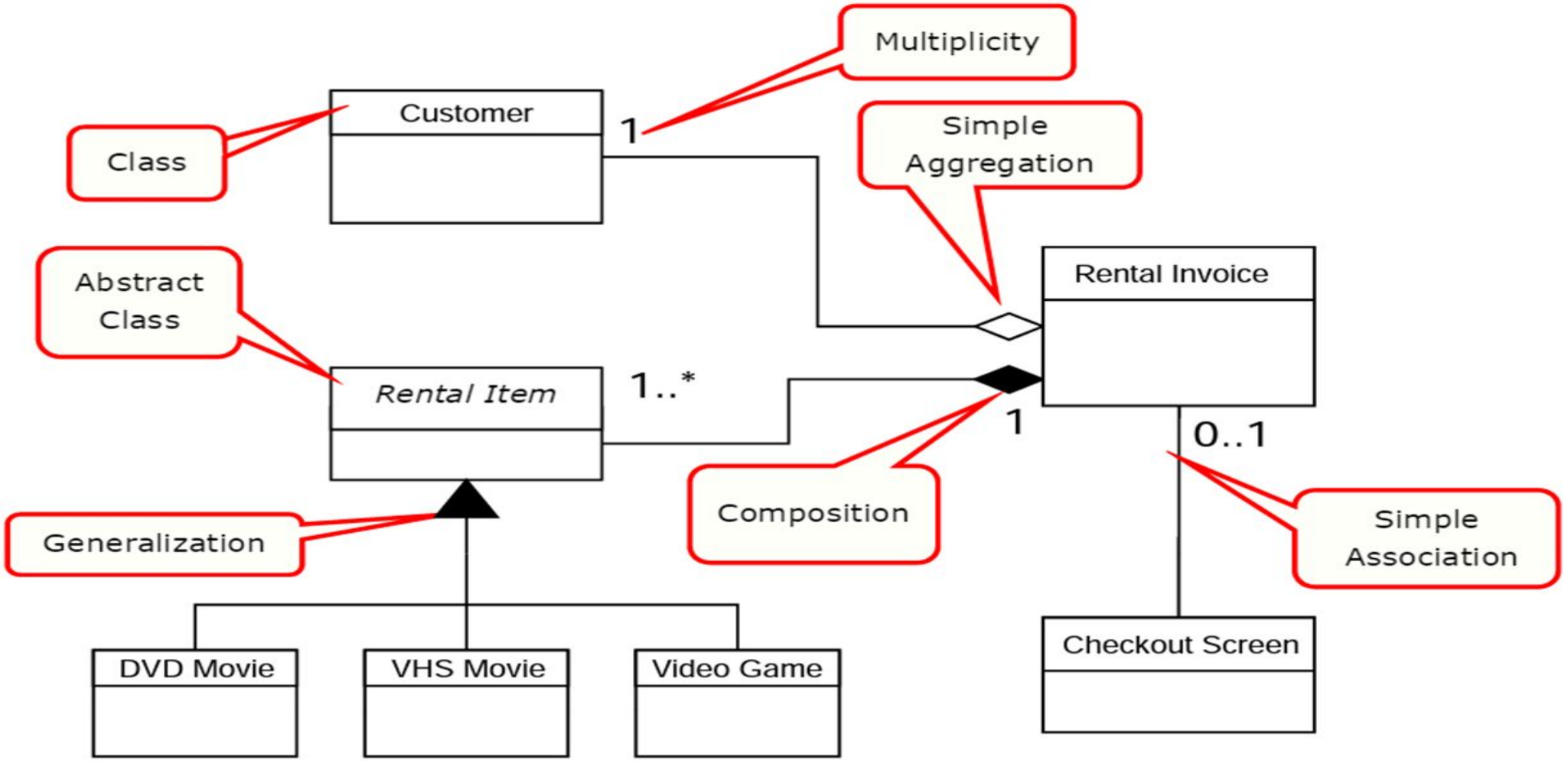
Exceptions

Exceptions can be modeled just like any other class.

Notice the <<exception>> stereotype in the name compartment.



Example class diagram –Video Store



THANK YOU

J.Ruby Dinakar

Department of Computer Science and Engineering

rubydinakar@pes.edu