

Introduction to Object-Oriented Technologies

**Basic Concepts
to represent the world**

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Schedule(1/3)

- Feb. 20th
 - 13:00 Scope and Goal (History of SPMs and SDMs, History of OO-technologies)
 - 14:30 **Basic Concepts on Representing the World**
(object, class, association, aggregation...)
- Feb. 21th
 - 13:00 Basic Concepts on Interaction
(message passing, operation and method, polymorphism)
 - 14:30 Basic Concepts on Reuse
(super class, class inheritance, interface inheritance)

Basic Concepts for Representation and Description

- Objects and their Interaction
- Object and Link
- Class
- Attribute
- Association
- Aggregation
- Operation and Method
- Polymorphism

A Lazy Lodger (Scene 1)

- One night in some apartment house, the “hungry boy” is alone in his room. He looks for “something to eat” Unfortunately, There is nothing to eat in the room. There is a “convenience store” across the street. He knows the convenience store sells “something to eat”. He needs money to buy “something sold”. He checks the amount of money in his “purse” and gets out of his room to buy something to eat. There are one “thousand-yen bill”, six “100-yen coins” and three “10-yen coins”.

Ochimizu, Higashida, ”Object Modeling”, Addison-Wesley Publishers Japan

Scene 2

- A car passes through in front of him when he wants to across the street to go to the convenience store. He looks at it and thinks: Color of the body is white; A tire is a radial tire; How much is the displacement of the engine.

Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

Scene 3

- This is the convenience store. It sells many something to eat. There are "apples", "big red ones" and "blue small ones", and many "instant-noodles", soybean-paste-tasted ones, salt-tasted ones, and soy-sauce-tasted ones. There are bottles of juice next to them. Everything seems to be delicious. He takes a "big red apple", fresh one, and a bag of soy-sauce-tasted noodle. He buys a bottle of orange juice because he knows he will be thirsty after eating them. He pays 520 yen at the checkout counter, feeling it is too expensive. He thinks this convenience store is not good because the goods sold in this store are too expensive. He decides to go to another convenience store 30 meters far from here next time when he lefts the store.

Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

Scene 4

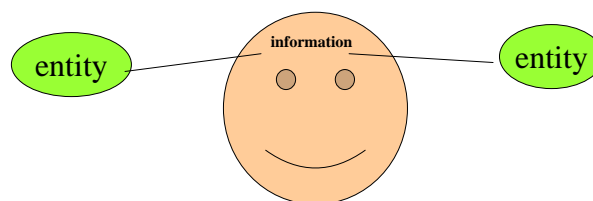
- Next night, he is dull this time. He goes to a convenience store again to buy a magazine. He goes to the same store because he thinks price of a magazine is the same at every convenience store, He hesitates over to buy a paper book or a cartoon. He finally buys a paper book and a bottle of Coca-Cola. He thinks he must go to the bank and withdraw money tomorrow because the amount of money in his purse is not enough to buy anything.

Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

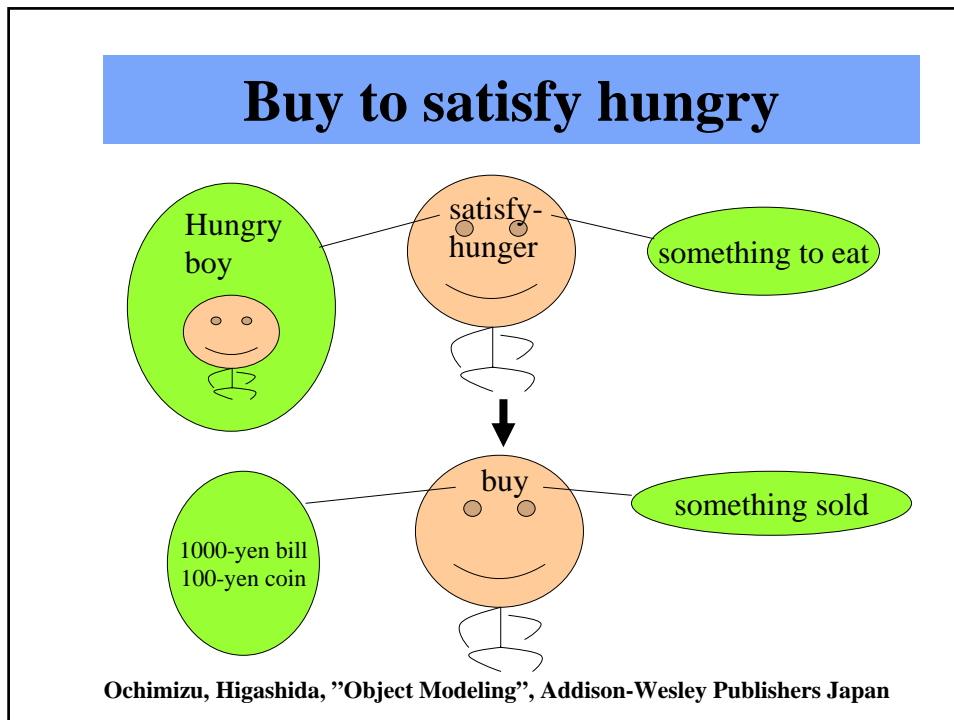
What is information ?

- Information is created when two entities are linked together. The view and role of each entity is decided by the link.

(W.Kent , "Data and Reality")



Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

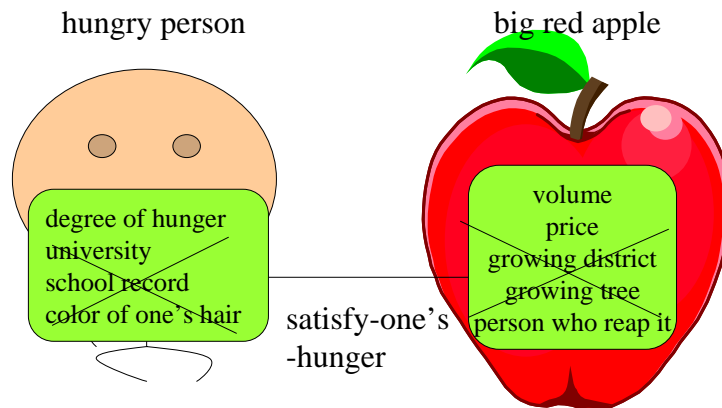


**Object and Message passing
(Notations for representing
and describing the world)**

object, class, association

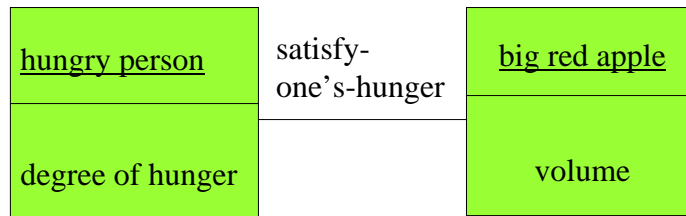
What is an Object ?

An **Object** is an abstraction of an **Entity** from some information processing point of view



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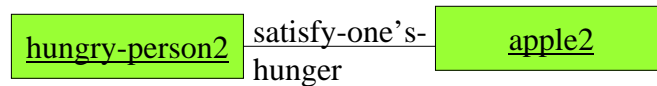
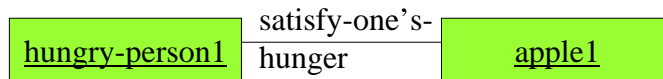
UML Representation



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Object and Link

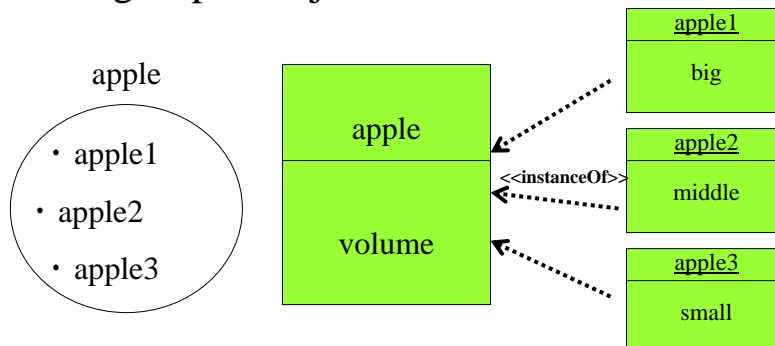
- Objects and a link can represent the fact happened in the world.



Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

What is a Class ? (temporary)

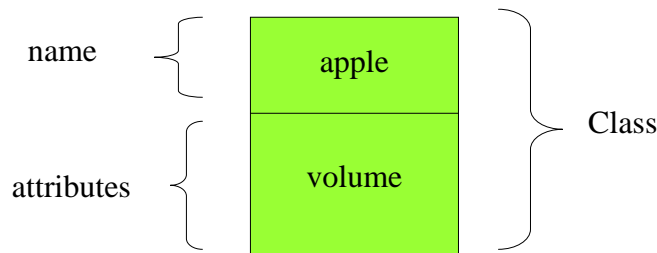
- A class is a definition of properties common to a group of objects.



Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

What is an attribute ?

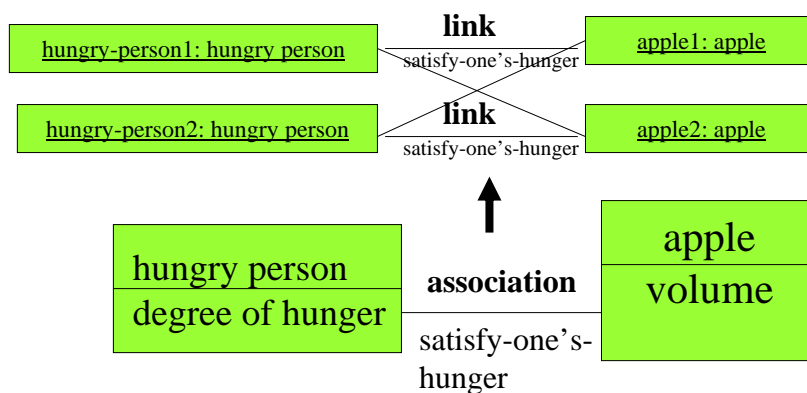
- Attributes are data that characterize a class. Attributes are obtained by abstracting an entity from the information processing point of view.



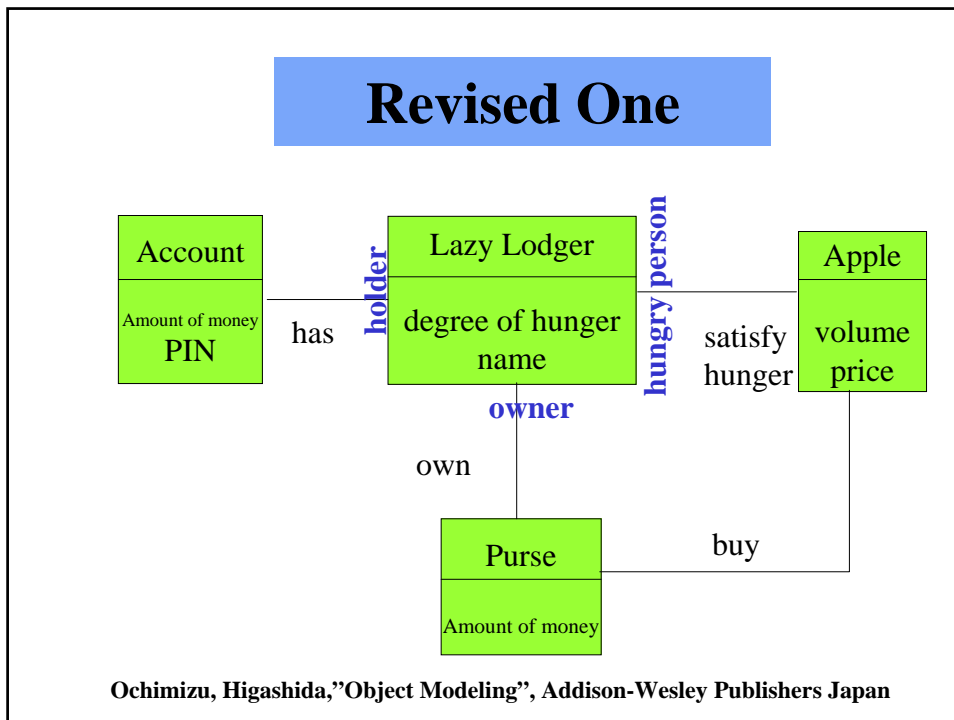
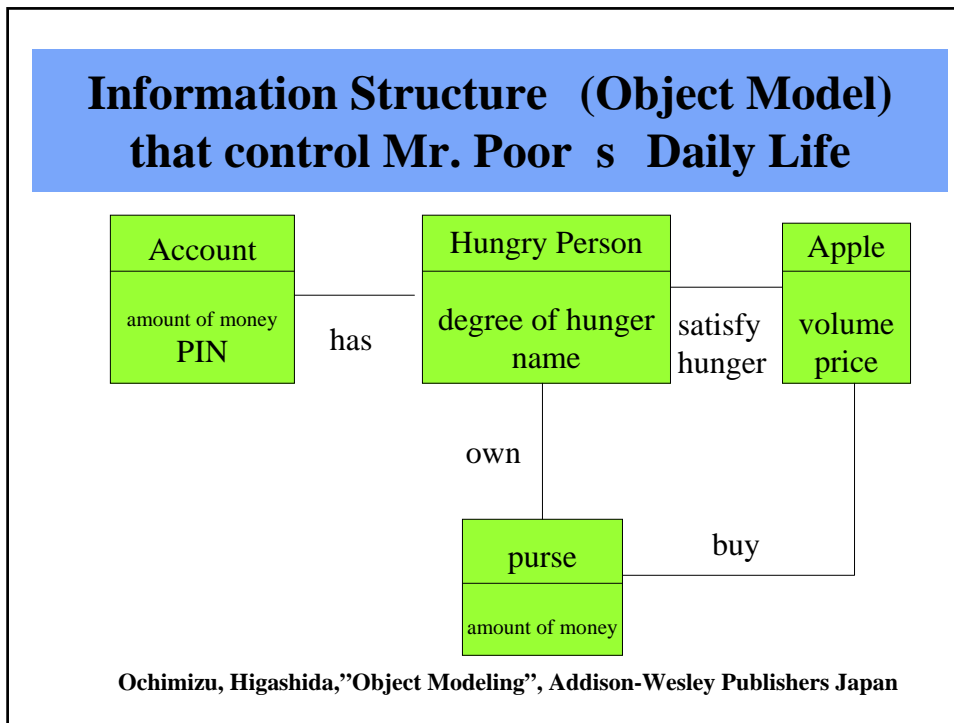
Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

What is an association ?

- An association represents a possibility for being able to make links between objects.



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Usage of Association

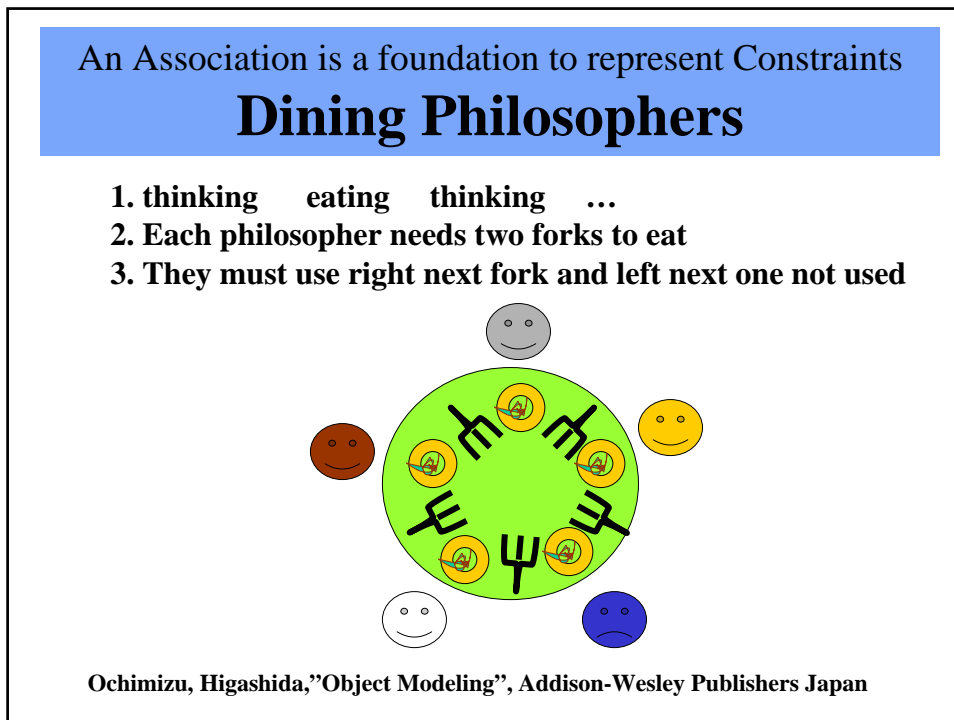
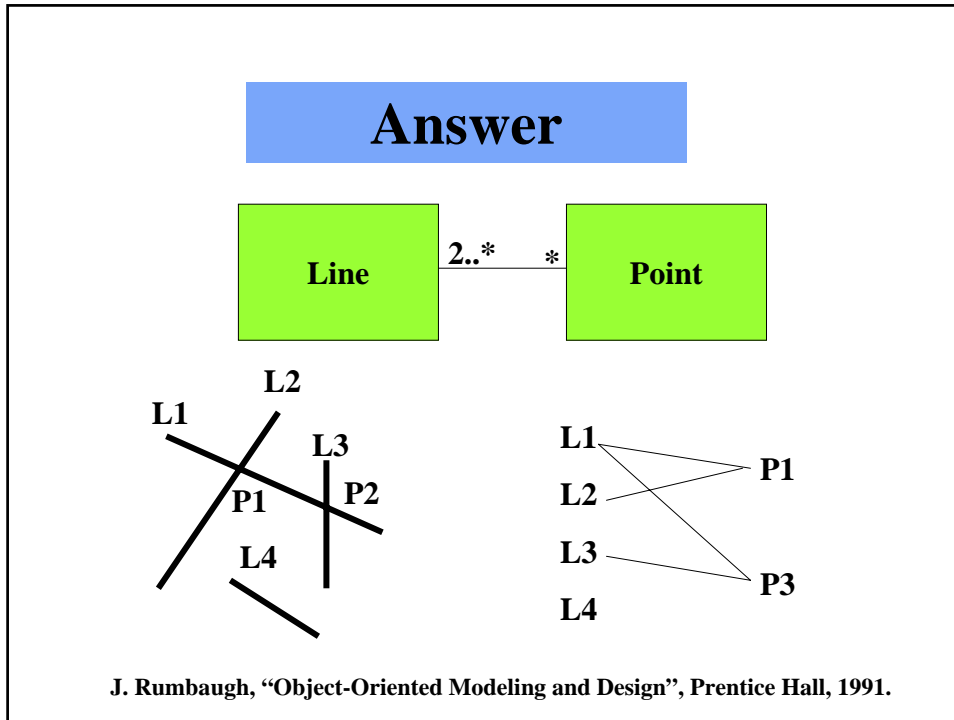
- An association represents structural relations between classes and a route of message passing.
- An association is a foundation to represent constraints existing in the domain.
- We can set the viewpoint of information by an association and classes and associations represent the information structure of the domain

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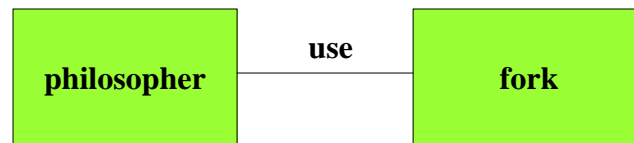
Example of a Structural relation

- There are several line segments on a plane. Draw the class diagram that can represent the following facts. "point is formed by the intersection of two or more line segments. Each line segment has zero or more intersection points

J. Rumbaugh, "Object-Oriented Modeling and Design", Prentice Hall, 1991.



Definition of the characters (classes) and stage setting (associations)



Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

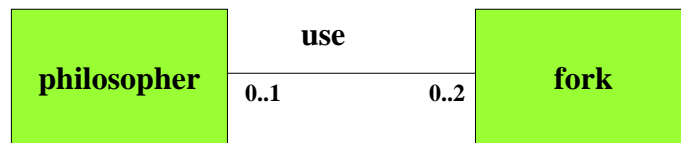
Representing the Constraints by Multiplicity

1. Each philosopher uses at most two forks
2. Each fork is used by at most one philosopher
3. Philosophers and forks form a circle by turn

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First two Constraints

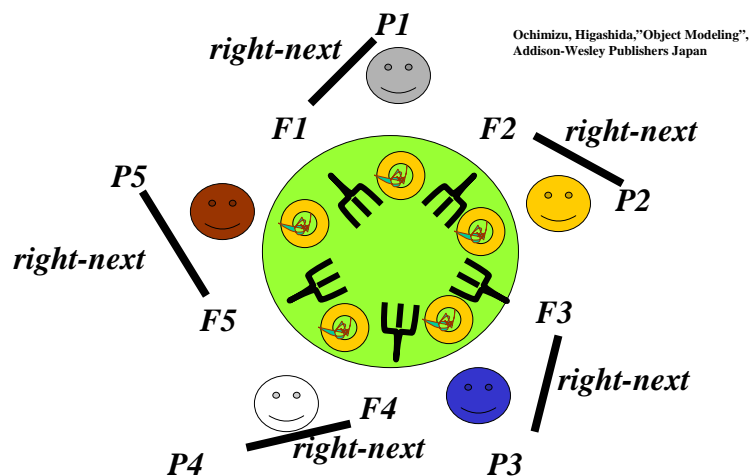
1. Each philosopher uses at most two forks
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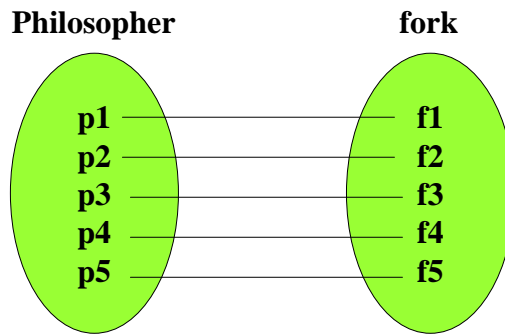
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Right Next

- We assume the world begins from the scene: all five philosopher are seated and prepared for thinking and eating



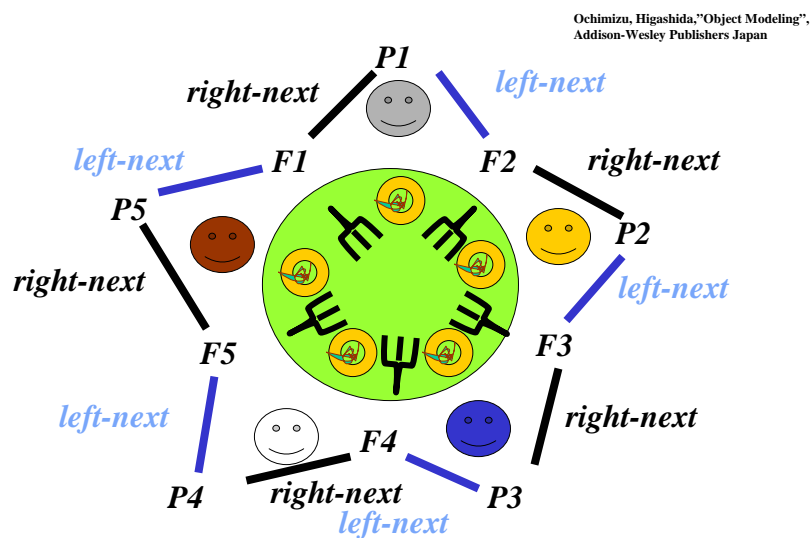
Philosophers and forks form a circle by turn 1



One to one correspondence right-next

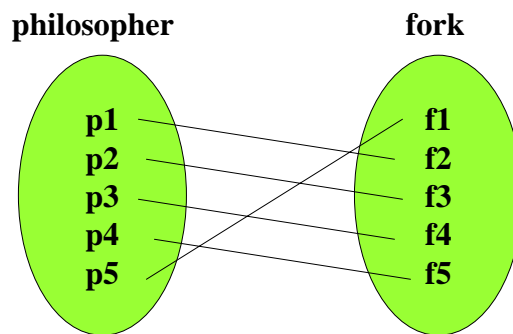
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Left-Next



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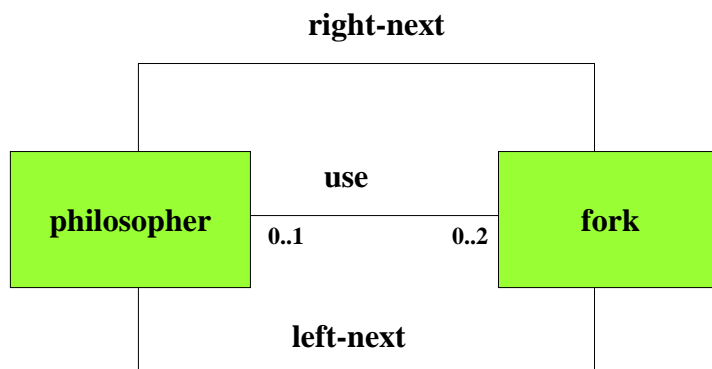
Philosophers and forks form a circle by turn 2



one to one correspondence left-next

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Object Model (completed one)

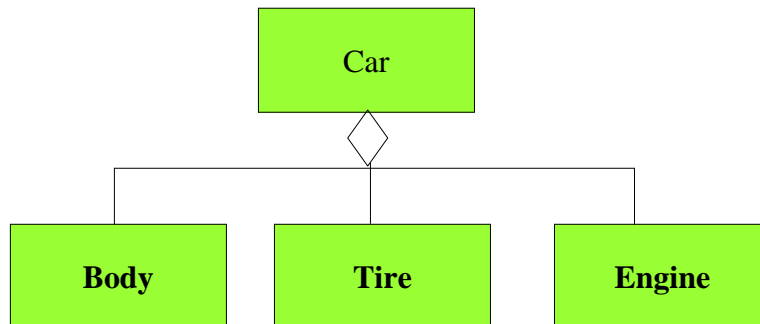


Each philosopher must use right next fork and left next one not used

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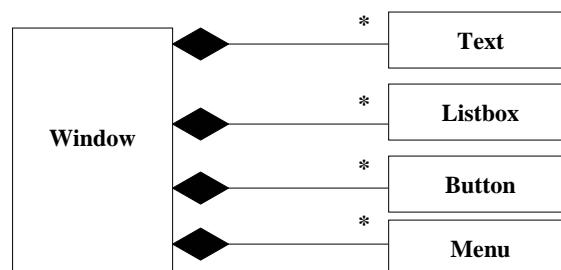
Aggregation

- Special Association that represent whole-part (is-part-of) relationship



Ochimizu, Higashida, "Object Modeling", Addison-Wesley Publishers Japan

Composition



If the whole object is deleted
then the part objects are deleted

H.E. Eriksson and M. Penker, "UML Toolkit" John Wiley & Sons, Inc.

Exercise

- **Review the content of my lecture by answering the following simple questions. Please describe the definition of each technical term.**
 1. **What is an object?**
 2. **What is a class?**
 3. **What is an attribute?**
 4. **What is an association?**
 5. **What is an aggregation?**
 6. **What is a composition?**