

## Chapter 5: Class and Object Modeling

- Review the Database Concept
- Class Diagram
  - Class Compartment
  - Class Association (Multiplicity, Reflexive, Aggregation, Composition, Generalization, etc.)
  - Example of Class Diagram (POS System)
- Object Diagram
  - Element of Object Diagram
  - Comparing the Object Diagram and Class Diagram
  - Example of Object Diagram

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## Review the Database Concept

- Relational Database
- DBMS
- Entity and Entity Set
- Primary Key, Foreign Key
- Entity Relationship Model
  - 1 to 1
  - 1 to Many
  - Many to Many
- Normalization

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## Class Diagram - Introduction

- **Introduction**

- Class Diagram represents classes, and the way in which classes are related to one another.
- A class is a definition for a type of object.
- We can use Class Diagram to model the association between classes in Object-Oriented Programming.
- We can use Class Diagram to model database entity relationship instead of Entity Relationship Diagram.
- In this chapter we use Class Diagram for the purpose to model the Entity Relationship.

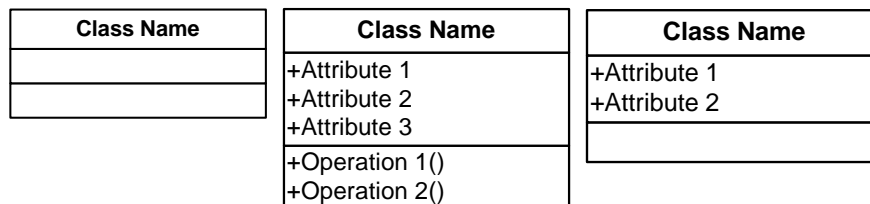
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## Class Diagram: Class Compartment

- **Class Compartment**

- There are 3 compartments of class
  - Class Name
  - Attribute (property)
  - Operation (method)
- Syntax of Class

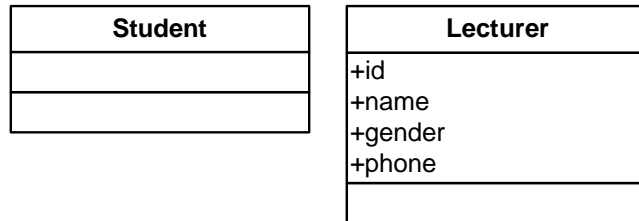


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## Class Diagram

– Example of Class



– Attribute and Operation Visibility (importance use with OOP)

- +: Public
- -: Private
- #: Protected

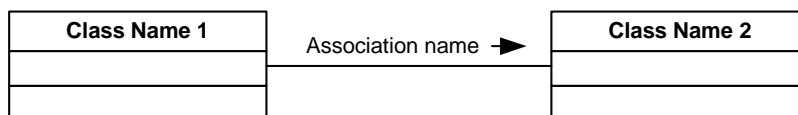
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## Class Diagram: Association

- **Association and Association Name**

- Association is the relationship between objects of one class and objects of another class.
- The purpose of association can be expressed in a name, a verb or verb phrase that describes how objects of one class relate to objects of another class.
- Syntax

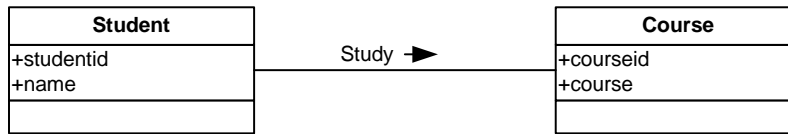


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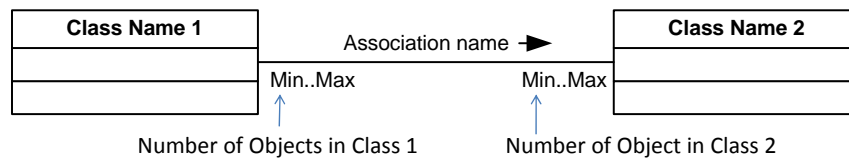
## Class Diagram: Association

– Example of Association Name



### • Association Multiplicity

– Define the number of participating objects between two classes.



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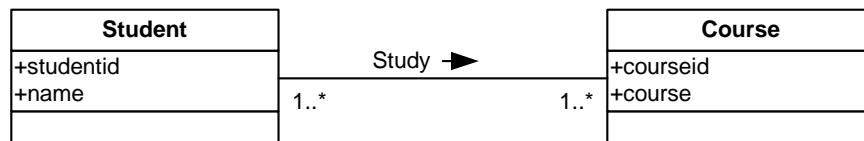
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## Class Diagram: Association

– Min..Max can be

- 0..1: The number is zero or 1
- 0..\*: The number is zero to many
- 1..\*: The number is at least 1
- 1..1: The number is 1 and must be 1
- \*: Many (At least 0 – same to 0..\*)

– Example



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## Class Diagram: Association

- **Common Type of Association**

- One to One Association: 1 object of 1<sup>st</sup> Class associate to at most 1 object (can be 0) in 2<sup>nd</sup> Class and 1 object of 2<sup>nd</sup> Class must associate to 1 and only 1 object of 1<sup>st</sup> Class.
- One to Many Association: 1 object of 1<sup>st</sup> Class associate to Many (can be 0) objects in 2<sup>nd</sup> Class and 1 object of 2<sup>nd</sup> Class associate to 1 and only 1 object of 1<sup>st</sup> Class.
- Many to Many Association: 1 object of 1<sup>st</sup> Class associate to Many (can be 0) of 2<sup>nd</sup> Class and 1 object in 2<sup>nd</sup> Class associate to Many (at least 1) object of 1<sup>st</sup> Class. The middle class will be created from this association type.

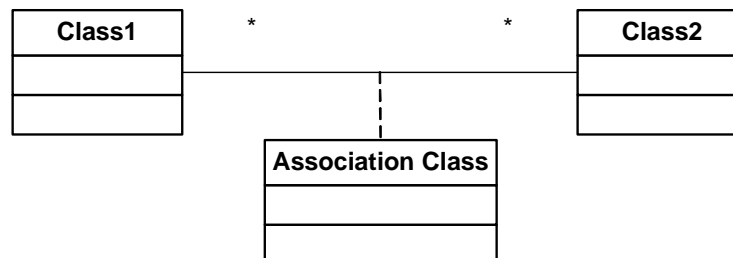
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## Class Diagram: Association

- **Association Class**

- Is a class that act as an association of other two classes. The Association Class is the middle class created by Many to Many relationship between two classes.



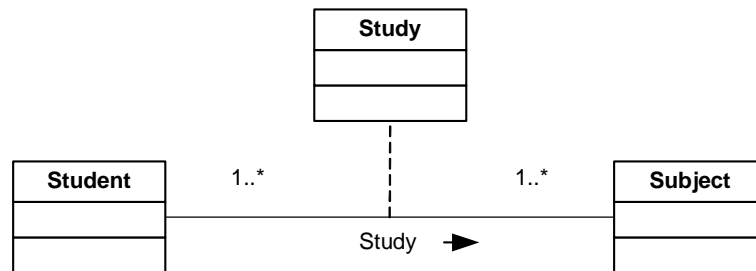
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## Class Diagram: Association

– Example of Association Class

- Association between Class **Student** and **Subject**: one student study at least one subject or more than one and one subject studied by at least one student or more than one. This is Many to Many association between **Student** and **Subject**.



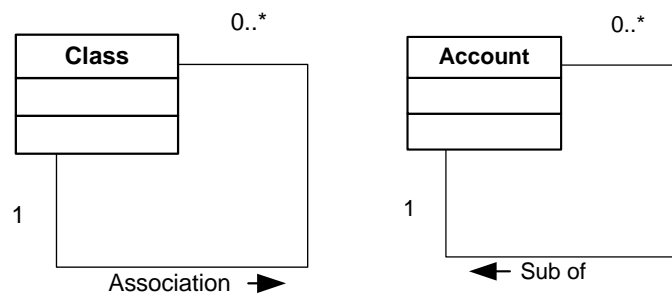
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## Class Diagram: Association

- **Reflexive Association**

– Is the association of the class itself. This mean that object of the class associate to others object in the same class.



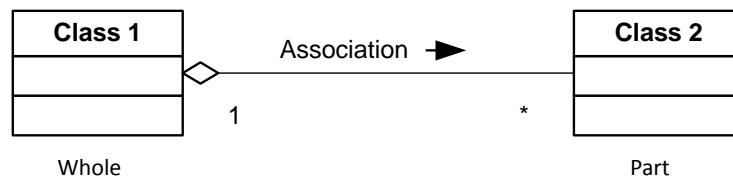
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## Class Diagram: Association

- **Aggregation Association**

- Show the whole and part association: object of the 1<sup>st</sup> Class act as whole object created by the participation of objects of 2<sup>nd</sup> Class, but objects of the 2<sup>nd</sup> Class are still exists whether object of 1<sup>st</sup> Class is destroyed.



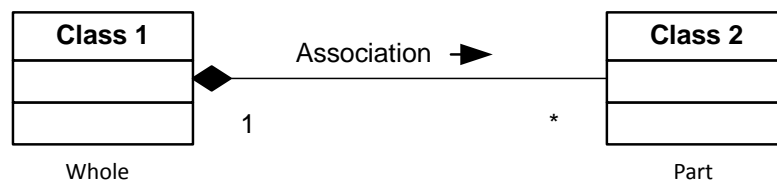
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## Class Diagram: Association

- **Composition Association**

- Is the aggregation association that objects of 2<sup>nd</sup> Class depend on object of the 1<sup>st</sup> Class. This mean that is object of 1<sup>st</sup> Class is destroyed then the associated objects of 2<sup>nd</sup> Class will destroy too.

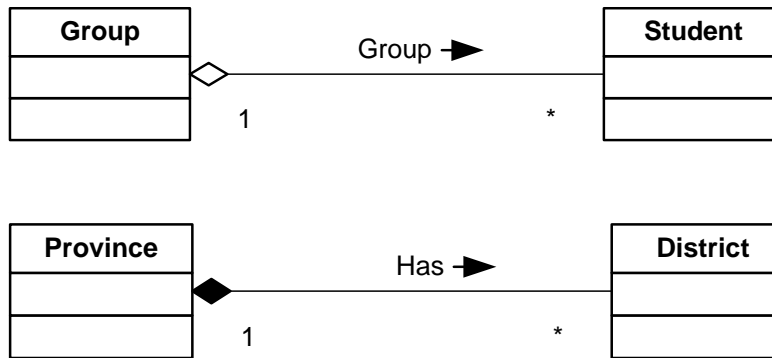


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## Class Diagram: Association

– Example of Aggregation and Composition



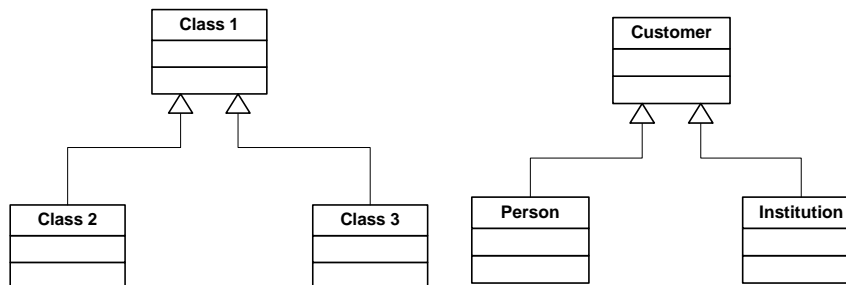
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## Class Diagram: Association

- **Generalization Association**

– Is the association of classes in term of inheritance or ISA hierarchy.



Syntax

Example

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## Step to Build Class Diagram

- Identify Objects to be Managed (data)
- Identify Class by grouping objects of the same or similar data and operation
- Identify the Common Attributes for Class
- Identify Common Association of Class
- Finding Additional Reflexive Association, Generalization Association, Aggregation Association, and Composition Association
- Building Class Diagram

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## Example of Class Diagram – POS System

- This POS system is targeted to minimart.
  - Object to be manage in this system are:  
(imagine the object we want to track their data and manage data to produce reports)
    - Cashier: the person who process sale
    - Product: objects to sell to customers
    - Receipt paper: act as the agreement paper with customer and shop about buying products.
  - Three main classes are found:
    - Cashier
    - Product
    - Receipt

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## Example of Class Diagram – POS System

### – Common Attributes

- Cashier
  - Name, Gender, Phone
- Product
  - Barcode, Product name, Price
- Receipt
  - Receipt no, Date, Item List, Total Amt

### – Object Specification

- Product: we should categorize products into different categories in order to see summary report by category of product. So one class named Category is created.
- Category Class
  - Category name

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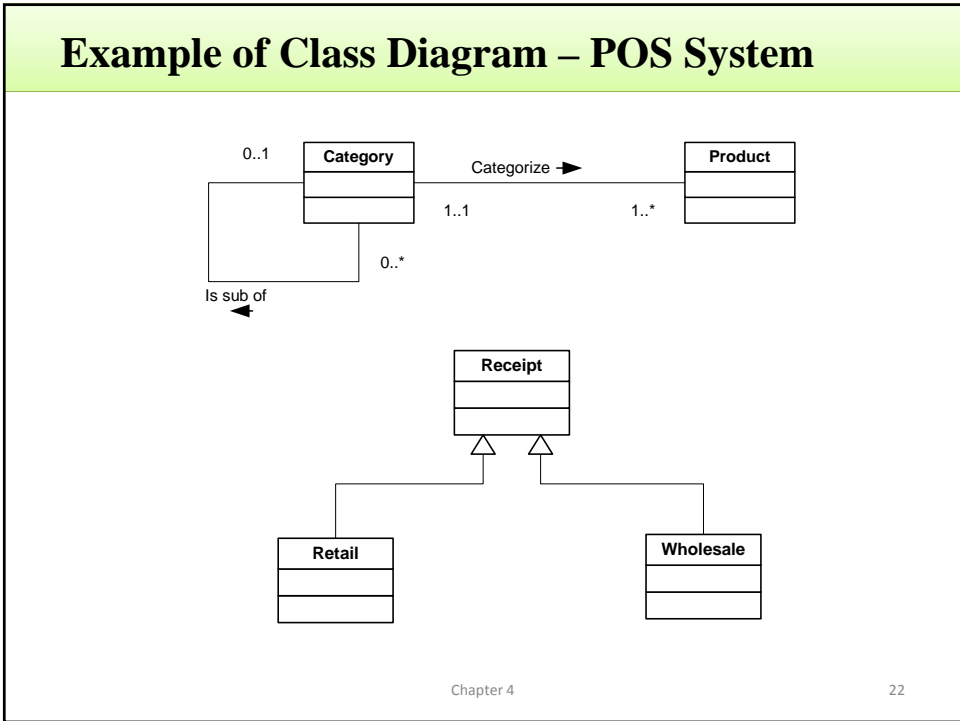
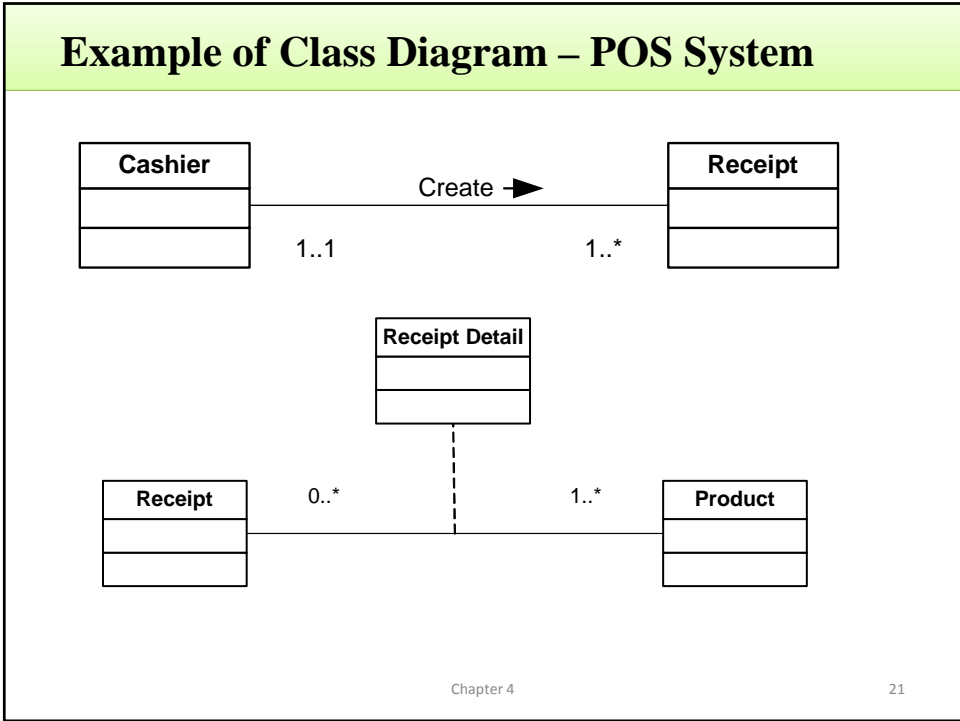
## Example of Class Diagram – POS System

### – Association

- **Cashier** create **Receipt** (1 to Many)
  - 1 Cashier will create 1 or more Receipt
  - 1 Receipt will be created by only 1 and must be 1 cashier
- **Receipt** consist of **Product** (Many to Many)
  - 1 Receipt consist of 1 or Many Products
  - 1 Product will include to Many Receipts (or 0)
- There are two specifications of Receipt – Retail Receipt and Wholesale Receipt (Generalization Association)
- **Product** is categorized by **Category** (Many to 1)
  - 1 Product is categorized to only 1 and must be 1 Category
  - 1 Category has 1 or Many Products
- **Category** is sub of Other **Category** (Reflexive)
  - 1 Category has 0 or Many sub Category
  - 1 Category (sub) is sub of 0 or 1 Category (parent)

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## Example of Class Diagram – POS System

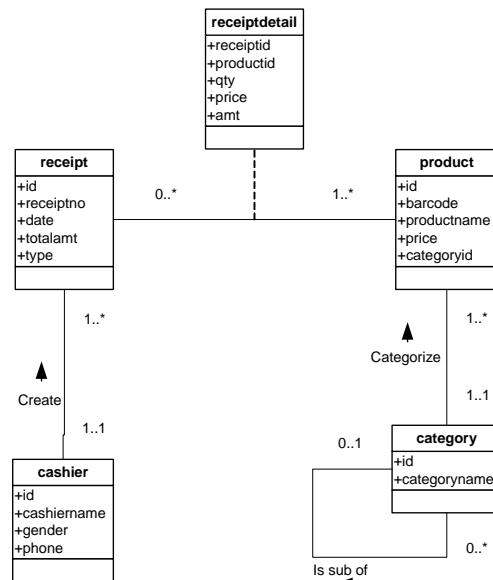
– Design logical class and attributes (find more attributes) – Create Database Schema

- cashier
  - id, name, gender, phone
- product
  - id, barcode, productname, price, *categoryid*
- receipt
  - id, receiptno, date, totalamt, type
- receiptdetail (Receipt Detail – Association Class)
  - *receiptid*, *productid*, qty, price, amt
- category(Receipt Detail – Association Class)
  - id, categoryname, parentid

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## Example of Class Diagram – POS System



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## Object Diagram

- **Introduction**

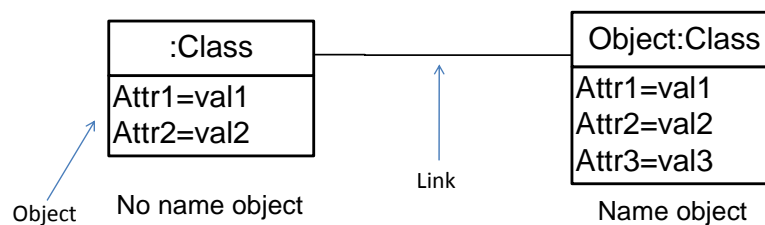
- Object Diagram models facts (real objects) about specific entities.
- Object Diagram models the relationship between objects in system.
- Object Diagram use to test Class Diagram by giving example of the real facts.

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## Object Diagram – Elements

- There are two main elements of Object Diagram:
  - Object: refer to real thing.
  - Link: refer to relationship link between object.



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### Comparing Object Diagram and Class Diagram

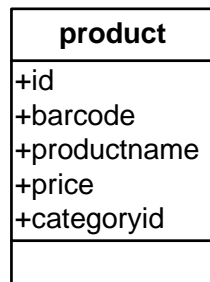
Class Diagram	Object Diagram
Has three compartment (name, attributes, operations)	Has two compartment (name and attributes)
Class name stand alone in the class name compartment	Object name is composed by object-name:class-name
Class attribute compartment defines the properties	Object attribute defines the current value of attribute being model
Operations are listed in class	Operations are not listed
Classes are connected with an association, multiplicity.	Objects are connected with a link and no multiplicity. All link are one-to-one relationship.

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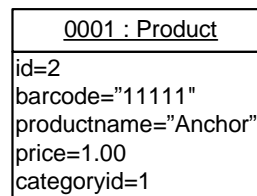
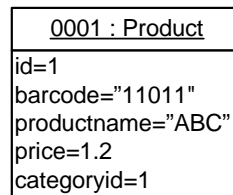
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### Example of Object Diagram

- Refer to **Class Product** in POS System



Class



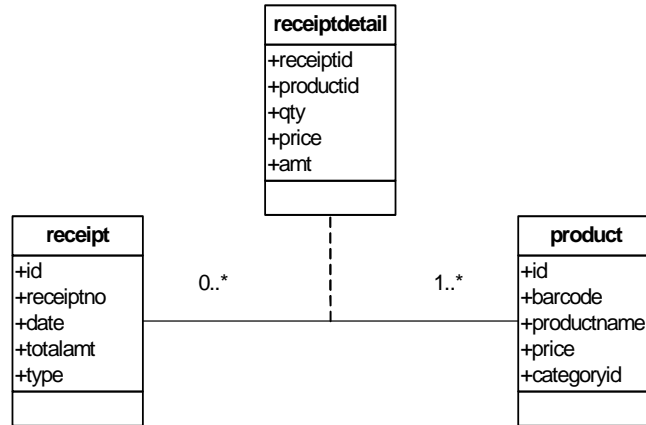
Object

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## Example of Object Diagram

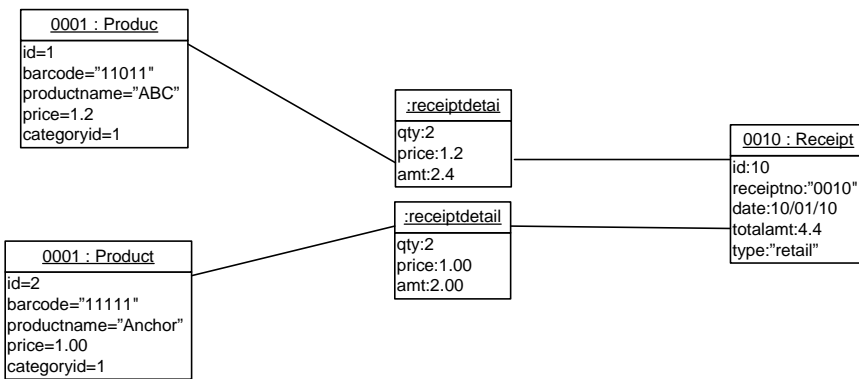
- Relationship between **Receipt** and **Product**



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## Example of Object Diagram



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