Links and Associations:

- Association represents static relationship shared among the objects of two classes
- A link is a physical or conceptual connection between objects instances
- Links and associations are usually drawn as a solid line

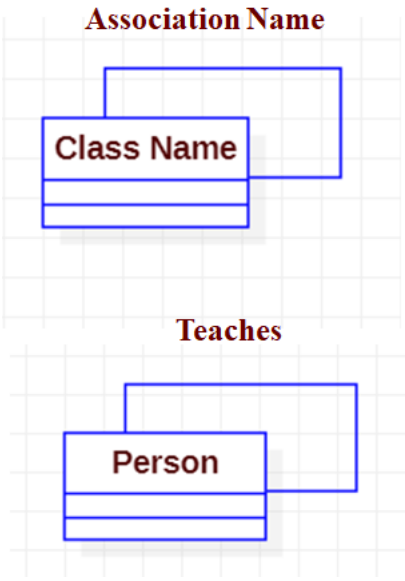
Types of Association

- An association can be

1. Unary
2. Binary
3. Ternary or n-ary

Unary Association

- Unary association is **between the same class**
- Connects a class with itself
- The association is between two instances of the same class



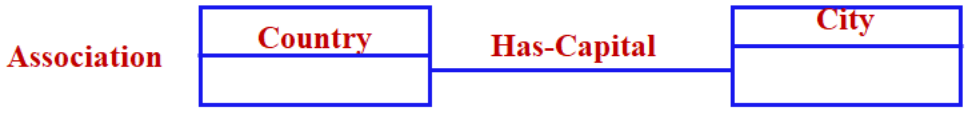
Binary Association:

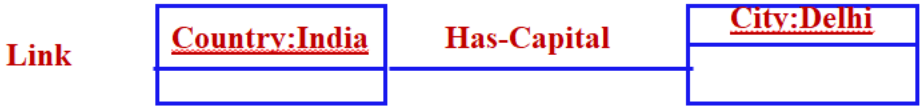
- Associations are generally **bidirectional** (traverse either direction)
- A binary association is an association **between two classes**
- A binary association may be labeled with a name

Links and Association:

(i) Link is a relationship between objects

(ii) Association is a relationship between classes





Association Ends:

- An association end is an endpoint of the line drawn for an association

✓ Role name

✓ Multiplicity

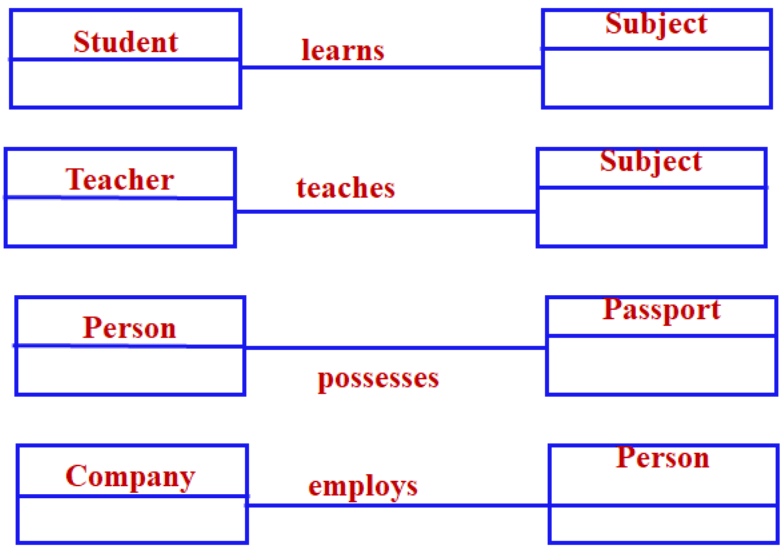
✓ Aggregation

- ✓ Qualifier

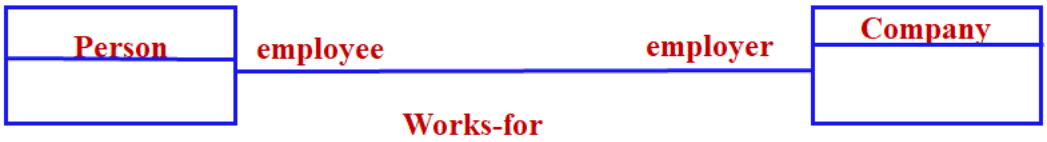
Role Names:

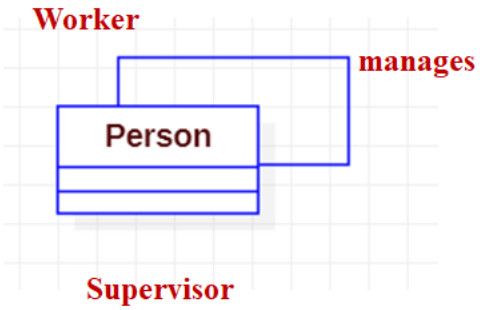
- A role is one end of association
- A binary association has two rules
- It is necessary for association between two objects of the same class

Binary Association Example



Example:





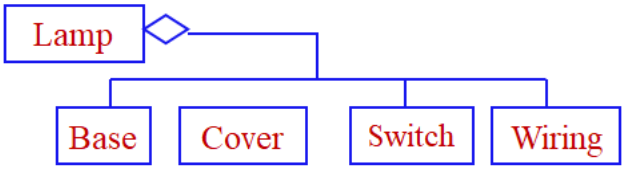
Qualifier:

- A *qualifier is an attribute* may be used in an association
- Distinguishes objects at many end of association

A qualified association

Aggregation:

- Aggregation is the “part-whole” or “a-part-of” relationship between classes
- OMT symbol is a small diamond at the assembly end of the relationship



Multiplicity:

- Multiplicity specifies how many instances of one class may relate to a single instance of an associated class.
- It is often described as being one or more, but it is a subset of non-negative integers.
- Associations may have different cardinality (multiplicity)

✓ ***One-to-one***

✓ ***One-to-many***

✓ **Many-to-many**

✓ A **solid ball** is the OMT symbol for **"many"**, meaning **zero or more**

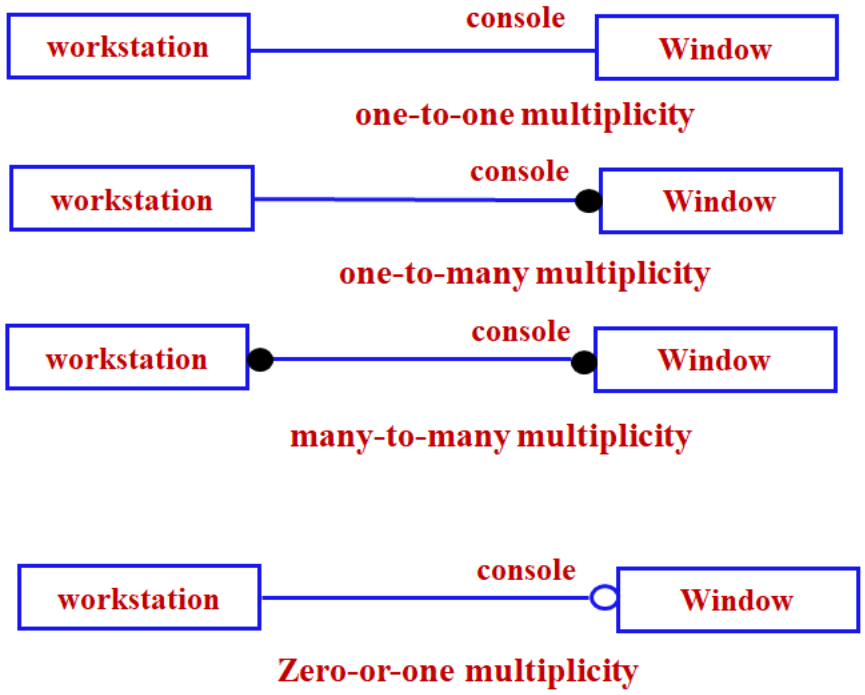
✓ A **hollow ball** indicates **"optional"**, meaning **zero or one**

✓ A line without multiplicity symbols indicates a **one-to-one association**

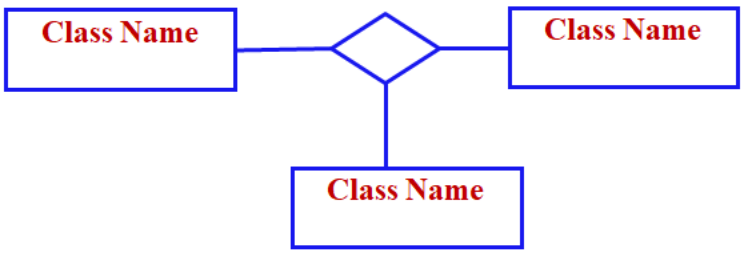
Ternary or n-ary association:

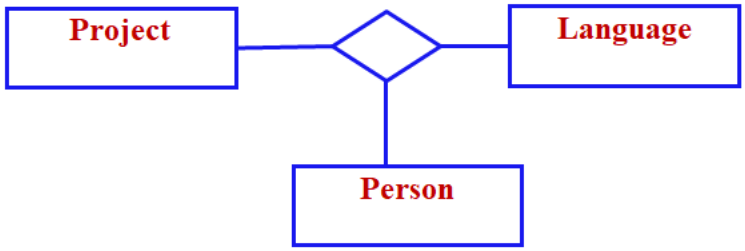
- **N-ary association** is an association among three or more classes.
- The OMT symbol is a diamond with lines connecting to related classes

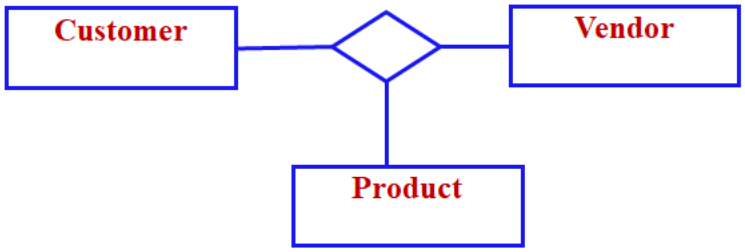
Multiplicity Example:



Ternary Association Example:

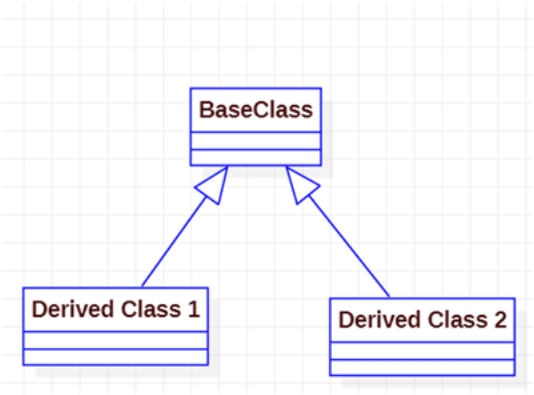




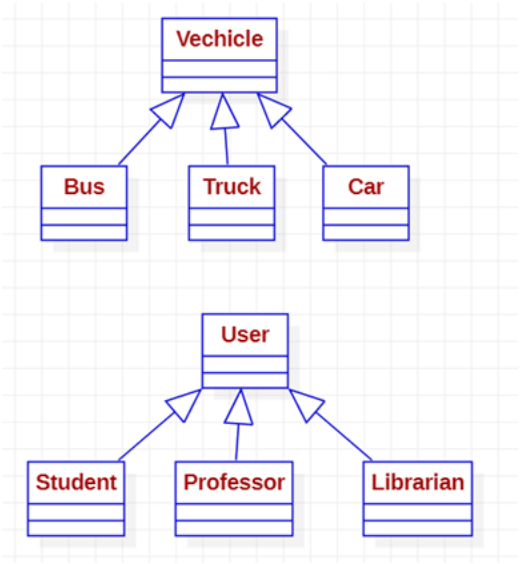


Generalization and Inheritance:

- It allows for sharing similarities among classes while preserving their differences
- Generalization is the relationship between a classes
- The class being refined is called the super class.
- Each refined version is called a sub-class
- Generalization is some-times called the is-a relationship
- The notation for generalization is a triangle connecting a super class to its subclasses
- The super class is connected by a line to the apex(top) of the triangle
- The subclasses are connected by lines to horizontal bar attached to the base of the triangle



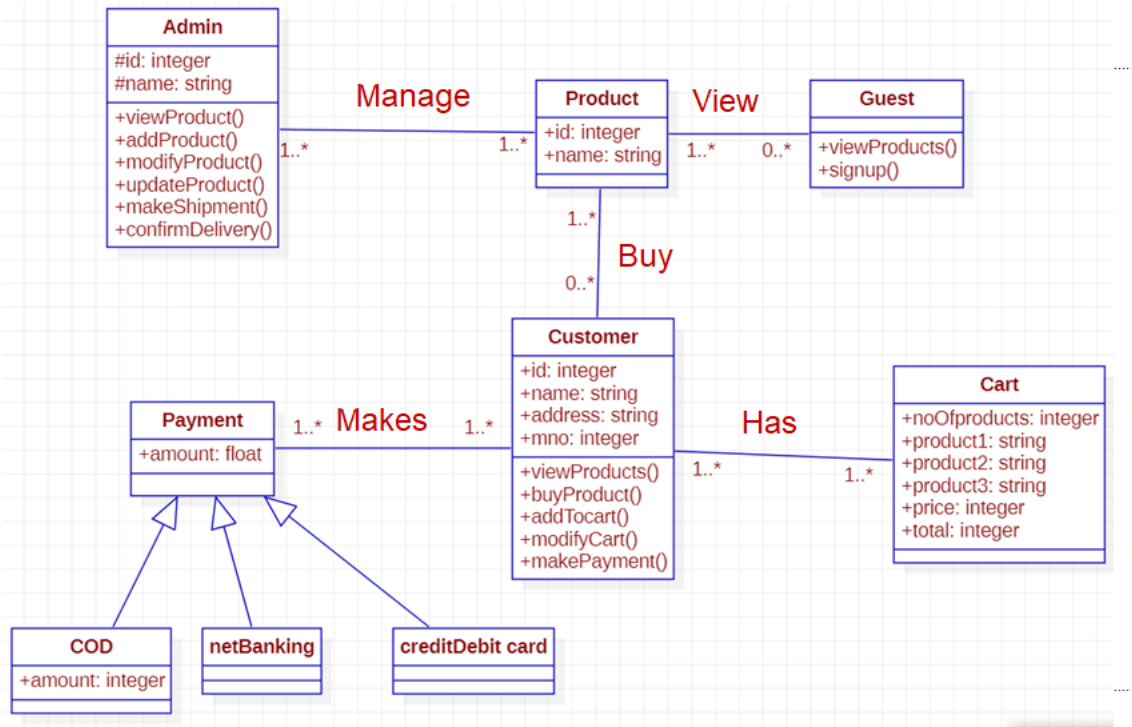
Example:



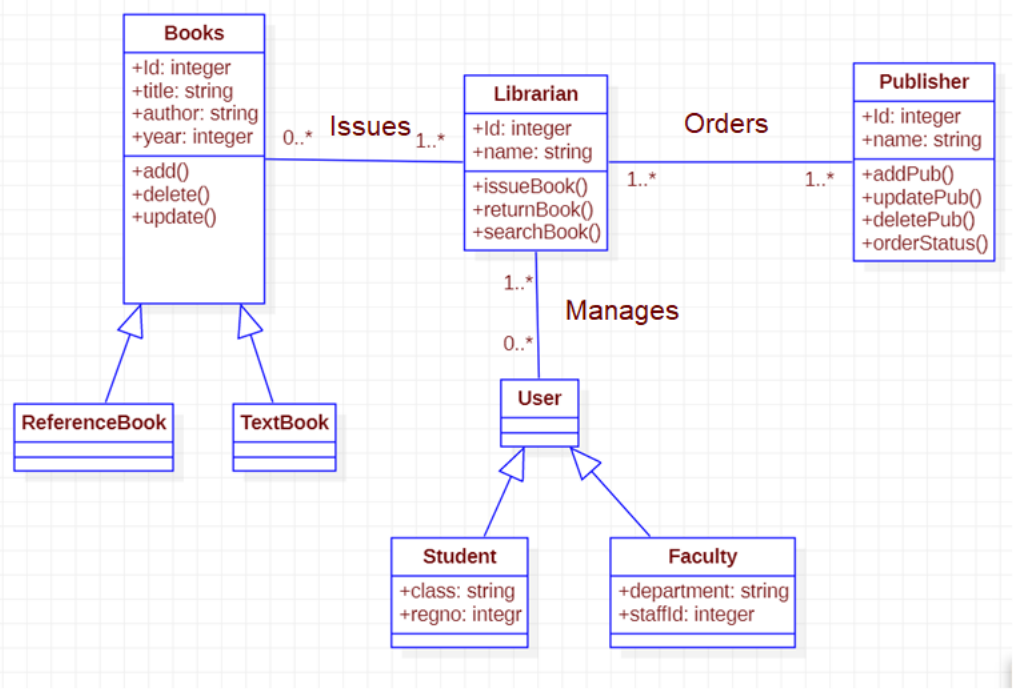
Grouping constructs:

- There are two grouping constructs:
  - module and
  - sheet.
- Module is logical construct for grouping classes, associations and generalizations.
- Sheet is the mechanism for breaking a large object model into a series of pages.

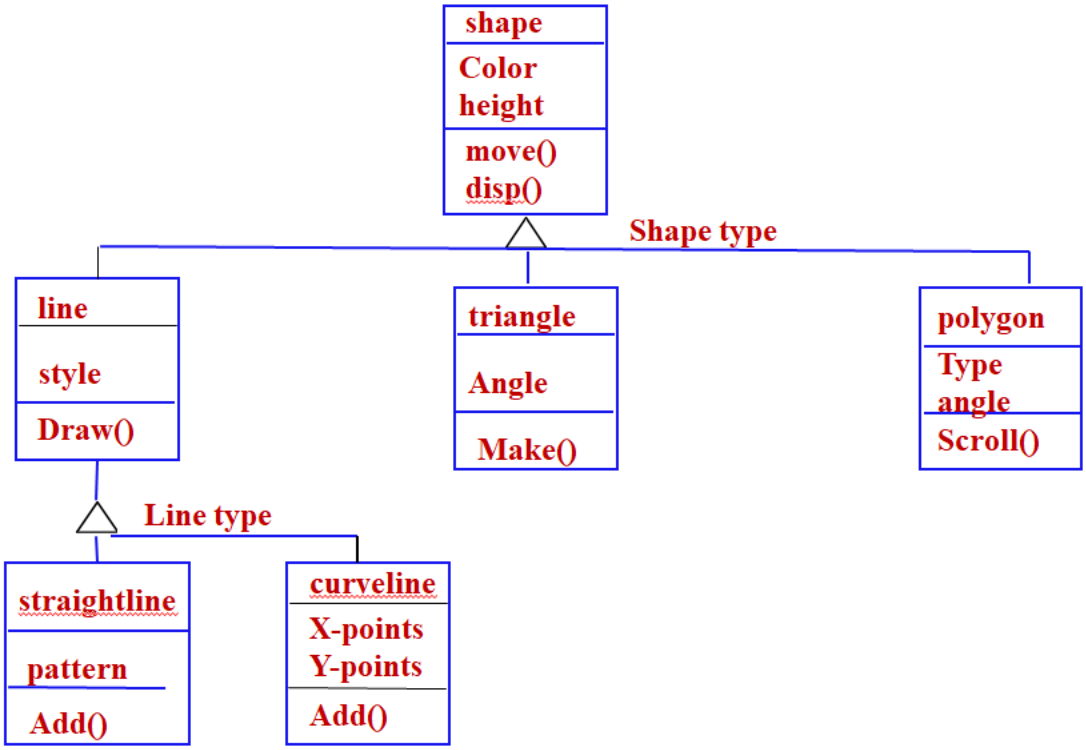
Sample Class Model- Online Shopping System



Sample Class Model –Library Management System



Sample Class Model – Shape Class Hierarchy



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2. Ali Bahrami. Object Oriented System Development, McGraw-Hill Higher Education, 2015