



# Software Engineering and Project Management (21CS61)

## Links and Association

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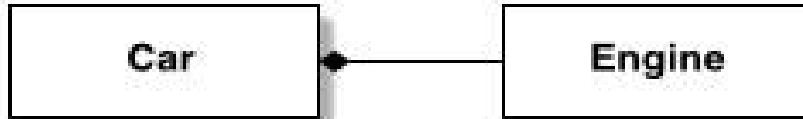
Department of Information Science and Engineering



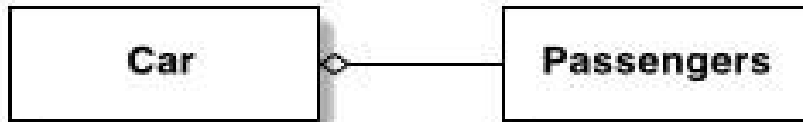
# Links

- Link: A link is an instance of an association. It connects specific instances of classes, representing a concrete relationship between objects.
- In UML, while an association describes a relationship at the type level (i.e., between classes), a link describes a relationship at the instance level (i.e., between objects).

# Links



Composition: every car has an engine.

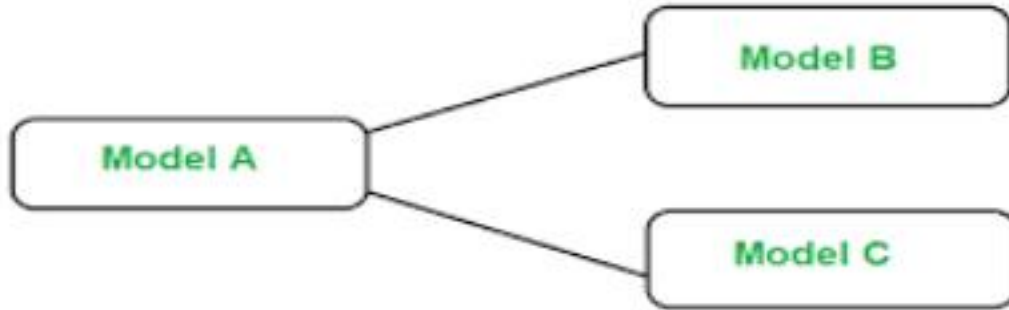


Aggregation: cars may have passengers, they come and go

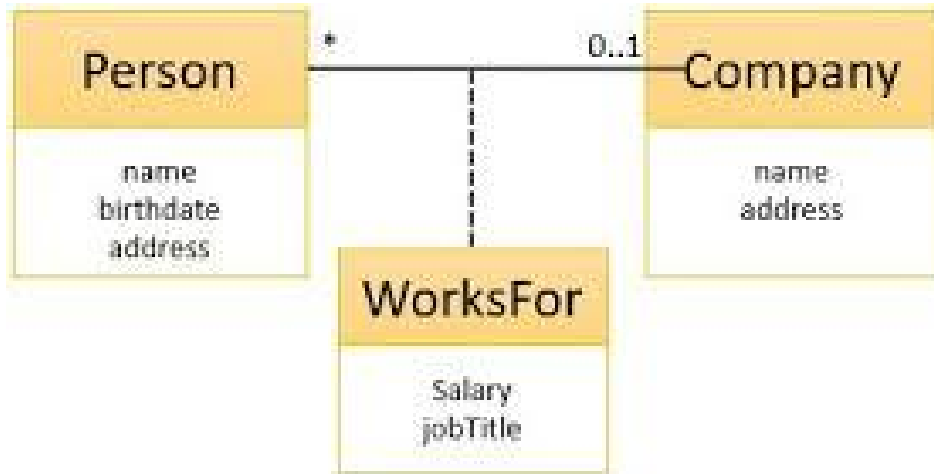
# Associations

- An association represents a relationship between two or more classes that defines how objects of those classes can interact with each other.
- This relationship can describe various types of connections, such as one-to-one, one-to-many, or many-to-many.
- Example : Imagine the relationship between a doctor and a patient. A doctor can be associated with multiple patients.

# Associations



**Association**

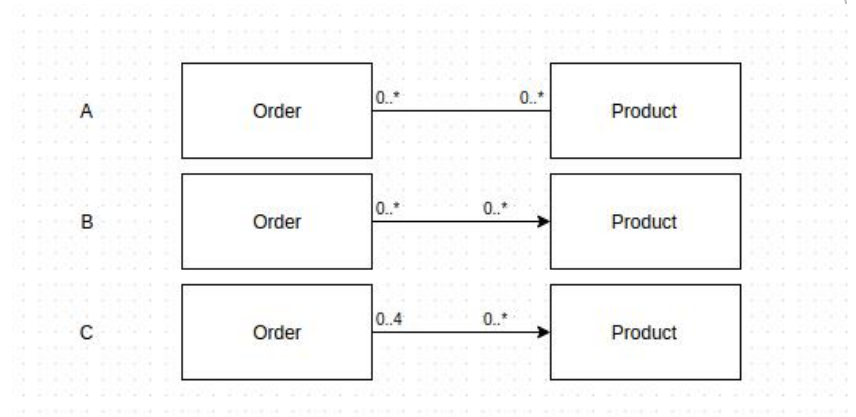
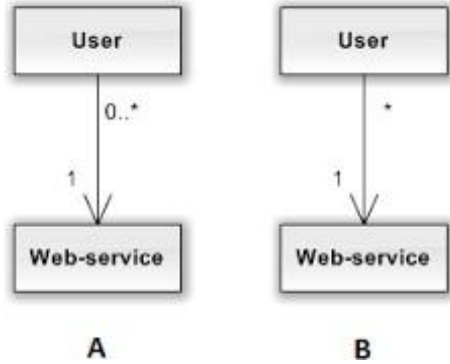


Association Class

# Multiplicity And Directionality

- Multiplicity: Indicates how many instances of one class can be associated with instances of another class.
- Example : one-to-one, one-to-many, many-to-many.
- Directionality: Associations can be unidirectional (one class knows about the other) or bidirectional (both classes know about each other).
- Example: A Customer class might have an association with an Order class, indicating that a customer can place multiple orders.

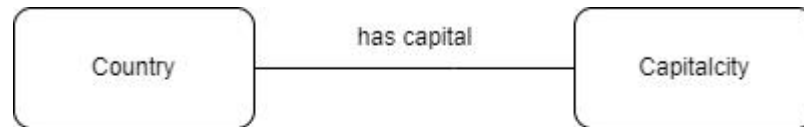
# Multiplicity:







Zero or one multiplicity



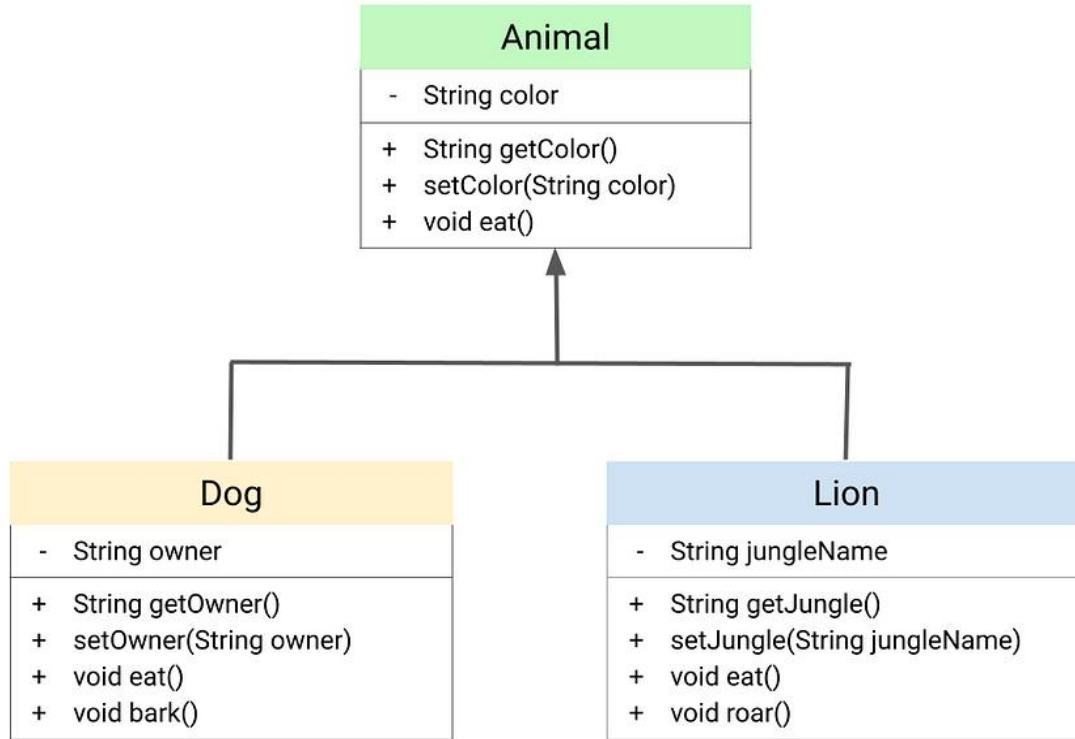
One to one multiplicity

# Generalization and Inheritance :

- Generalization and inheritance are fundamental concepts in object-oriented programming (OOP) and design. These concepts help to create more reusable, scalable, and maintainable code by establishing relationships between classes and defining common behaviors.
- Example: Suppose we have Cat and Dog classes. Both have common characteristics such as name, age, and methods like eat(), and sleep(). We can generalize these into a Pet superclass.

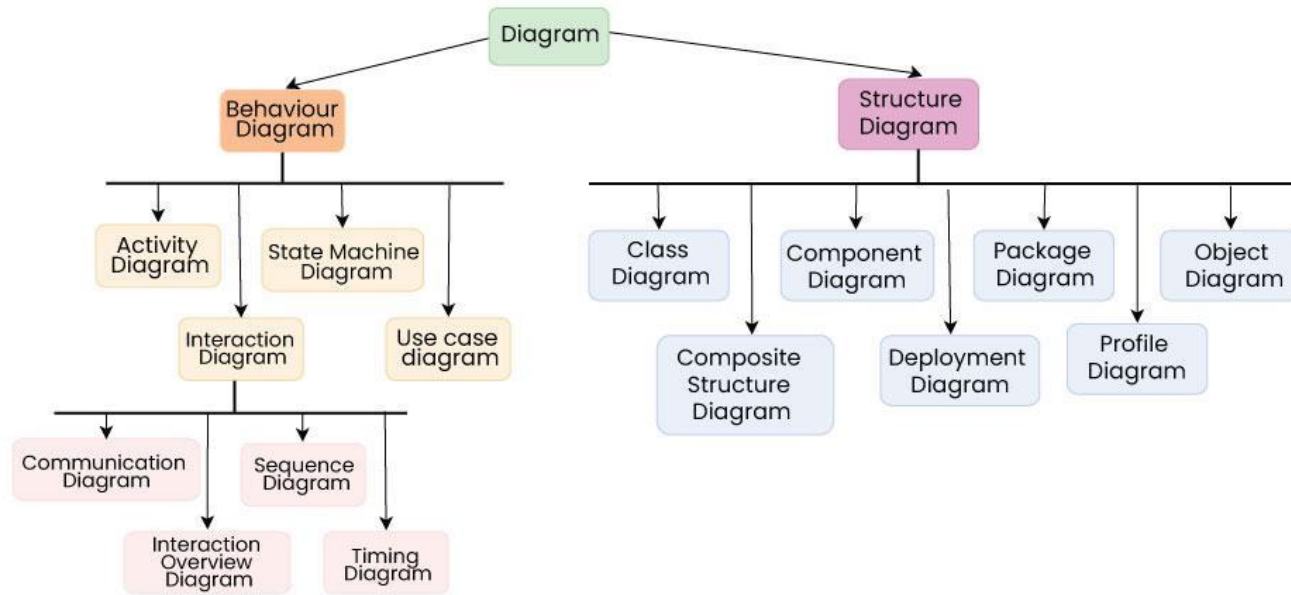
# Inheritance

- Inheritance: In object-oriented programming, inheritance is a mechanism where a new class (derived or subclass) inherits the properties and behaviors (attributes and methods) of an existing class (base or superclass).
- This allows for code reuse and the creation of a hierarchical relationship between classes.
- Single Inheritance: A subclass inherits from one superclass.
- Multiple Inheritance: A subclass inherits from more than one superclass (not supported in some languages like Java, but supported in Python).



# UML Designs :

- A UML diagram is a way to visualize systems and software using Unified Modeling Language (UML).
- Software engineers create UML diagrams to understand the designs, code architecture, and proposed implementation of complex software systems.
- UML diagrams are also used to model workflows and business processes.



The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern, layered effect on the right side of the slide.

**THANK YOU**