



The OO Solution

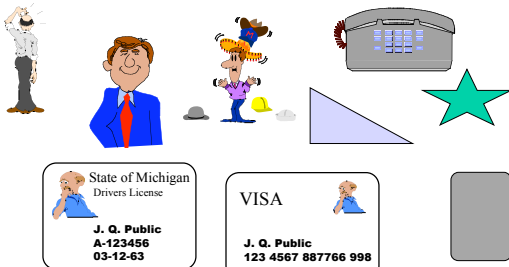
- The OO model closely resembles the problem domain
 - Base your model on the objects in the problem domain
- Iteratively refine the high-level model until you have an implementation
 - Attempt to avoid big conceptual jumps during the development process

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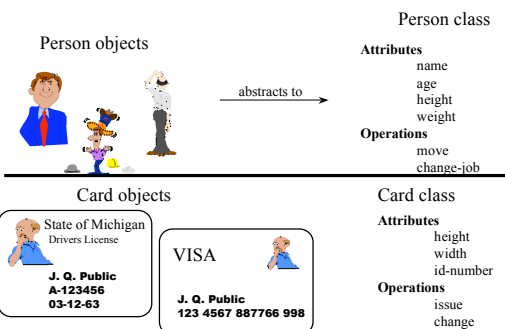
Objects



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Attributes and Operations





Characteristics of Objects

- Identity
 - Discrete and distinguishable entities
- Classification
 - Abstract entities with the same structure (attributes) and behavior (operations) into classes
- Polymorphism
 - The same operation may behave differently on different classes
- Inheritance
 - Sharing of attributes and operations based on a hierarchical relationship

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The Class Diagrams

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Objects

- Something that makes sense in the application context (application domain)
 - J.Q. Public
 - Joe's Homework Assignment 1
 - J. Q. Public's drivers license
- All objects have identity and are distinguishable
- NOT objects
 - Person
 - Drivers license

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Classes

- Describes a group of objects with similar properties (attributes), common behavior (operations), common relationships to other classes, and common semantics
- Person
 - J. Q. Public
 - Joe Smith
 - D. Q. Public
- Card
 - Credit card
 - Drivers license
 - Teller card

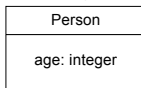
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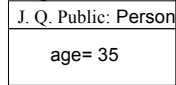
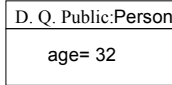


Class Diagrams

Class diagram

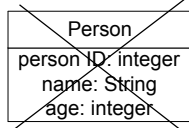


Instance diagram



Class with attributes

Objects with values



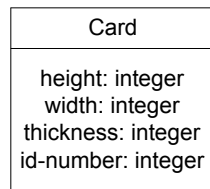
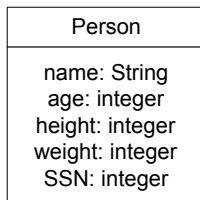
Objects have an identity
Do not explicitly list object identifiers
SSN OK!

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Examples



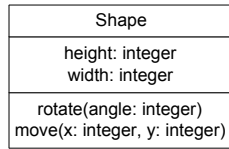
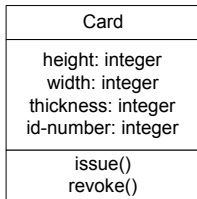
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Operations and Methods

- Transformation that can be applied to or performed by an object
- May have arguments

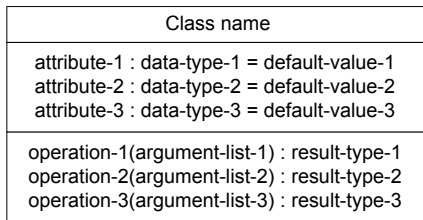


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Object Notation - Summary



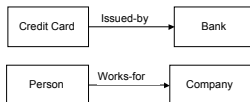
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Associations

- Conceptual connection between classes
 - A credit card is issued-by a bank
 - A person works-for a company



Class diagrams



Instance diagram

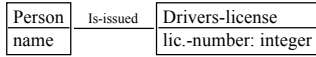
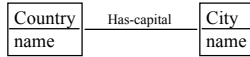
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Associations are Bi-directional

- There is no direction implied in an association (Rumbaugh - OMT)



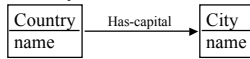
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Associations Have Direction

- Unified adds a direction indicator
 - Inconsistently used



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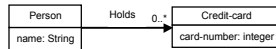
Multiplicity

One person holds one credit card



- One object can be related to many objects through the same association

One person can hold zero or more credit cards



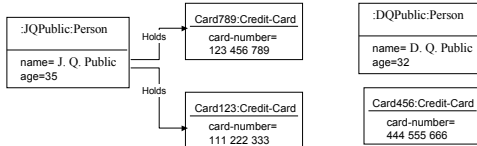
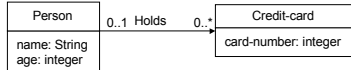
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Multiplicity (Cont.)

- One person can hold zero or more credit cards (0..*)
- Each card has zero or one holder (0..1)



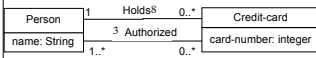
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Multiplicity (Cont.)

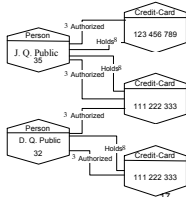
- One person can hold zero or more credit cards (0..*)
- Each card has one holder (no indication or 1)
- Each card has one or more authorized users (1..*)
- One person can be authorized to use zero or more cards



Note: hexagons should be rectangles to represent instances

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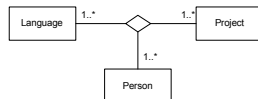
Explicit enumeration is also possible (2, 3, 2..5, etc.)





Higher order associations

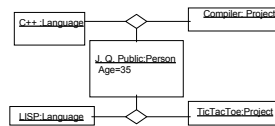
- Ternary association
 - Project, language, person
- Seldom needed (and should be avoided)



Note: hexagons should be rectangles to represent instances

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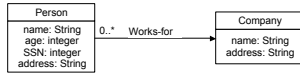
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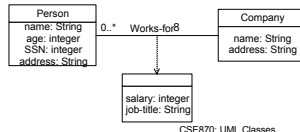


Link Attributes

- Associations can have properties the same way objects have properties



How to represent salary and job title?



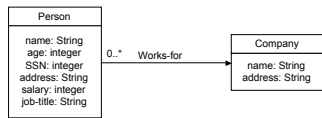
Use a link attribute!

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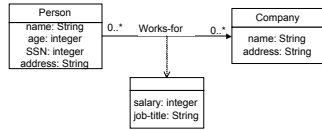


Folding Link Attributes



Why not this?

Salary and job title are properties of the job **not** the person



In this case, a link attribute is the only solution

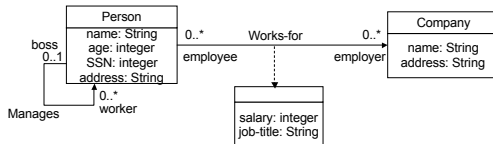
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Role Names

- Attach names to the ends of an association to clarify its meaning



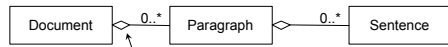
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Aggregation

- A special association, the is-part-of association
 - A sentence is part of a paragraph (a paragraph consists of sentences)
 - A paragraph is part of a document (a document consists of paragraphs)



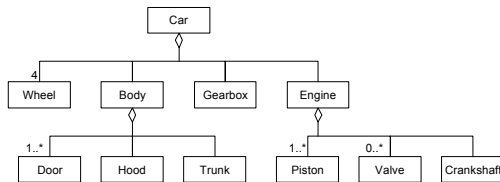
Aggregation symbol
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Aggregation (Cont.)

- Often used in parts explosion



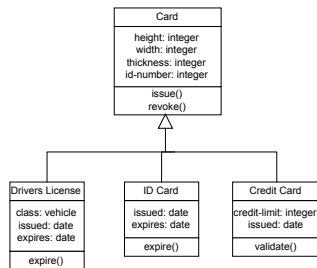
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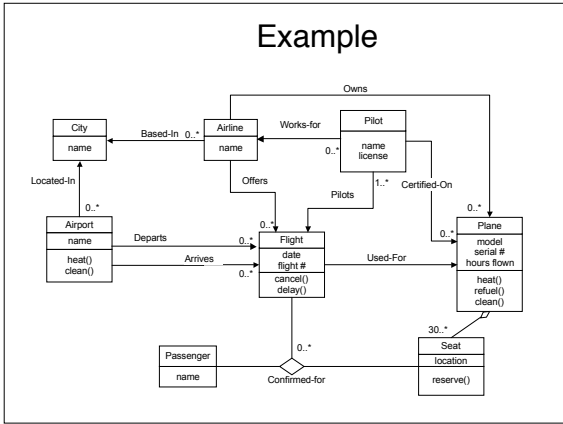
Generalization and Inheritance

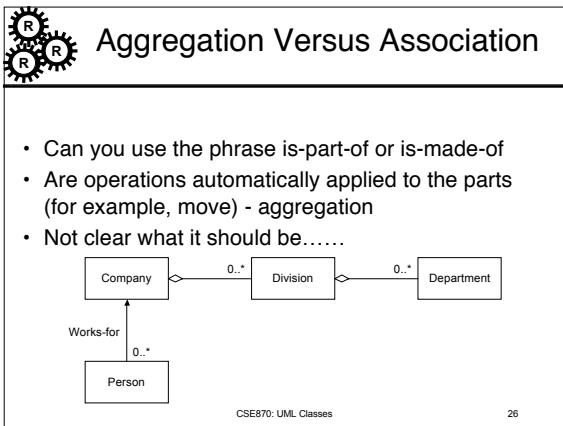
- The is-a association
 - Cards have many properties in common
 - Generalize the common properties to a separate class, the base-card
 - Let all cards inherit from this class, all cards is-a base-card (plus possibly something more)

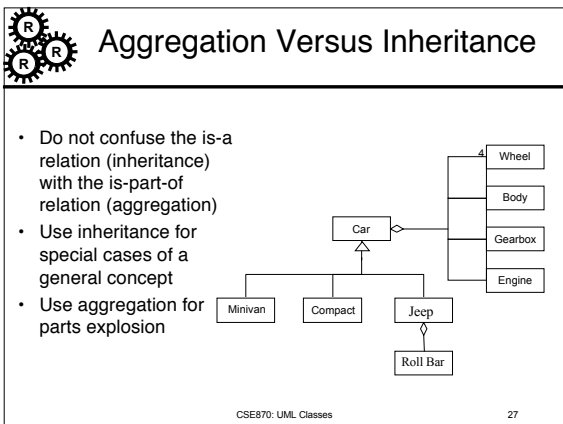


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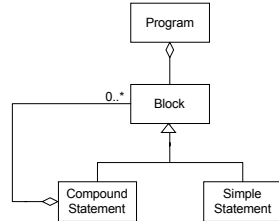






Recursive Aggregates

- A recursive aggregate contains (directly or indirectly) an instance of the same kind of aggregate



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Object Modeling Summary

- Classes
 - Name
 - Attributes
 - Operations
- Associations
 - Roles
 - Link attributes
- Aggregation
- Inheritance

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