



# Modelling Structure

## PA14 [13] 5

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# Discussion: Concepts and Attributes

- How can we find / What are:
  - Concepts
  - Attributes
  - Associations
- What is the difference between an *Attribute* and a *Concept*



# Identifying Concepts

| Category              | Examples  |                    |
|-----------------------|-----------|--------------------|
| Physical Objects      | POST      | Aeroplane          |
| Places                | Store     | Aerport            |
| Transactions          | Payment   | Reservation        |
| Containers            | Basket    | Aeroplane          |
| Things in Container   | Item      | Passenger          |
| Events                | Sale      | Flight             |
| Description of Things | Sale Item | Flight Description |
| Records, Contracts    | Receipt   | Ticket             |



# Finding Concepts

- Look for *nouns*
- Map nouns to concepts

## Sources:

- Textual description of problem domain
- Requirements
- Use-cases

## Cave!

- Natural language is ambiguous
- Concepts or Attributes?



# Attributes

- Logical value of an element
  - Examples: *name*, *quantity*, *status*, ...
  - Hint: Builtin data types
    - String, int, date
    - But also simple user-defined types such as *address*, *personnummer*, ...
- Keep Attributes Simple



# Associations

An association is a

- relationship between concepts
- indicates a meaningful and interesting connection

Types

- Need-to-know (preserved for some time; needs to be maintained by software)
- Comprehension-only (used to understand domain)



# Finding Associations

| Category                     | Examples   |
|------------------------------|--|
| A – is a part of – B         | Salesitem – Sale<br>Wing – Aeroplane                 |
| A – is contained in – B      | Item – Store<br>Seat – Flight                        |
| A – is a description for – B | ItemDescription – Item<br>FlightInformation – Flight |
| A – is known/recorded in – B | Sale – POST<br>Booking – Flight                      |
| A – is owned by – B          | Store – Company                                      |
| A – related transactions – B | Payment – Sale<br>Booking – Ticket                   |



# Discussion: Multiplicity

- Go through different types of multiplicity

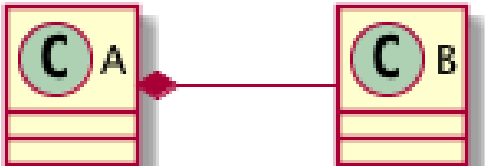
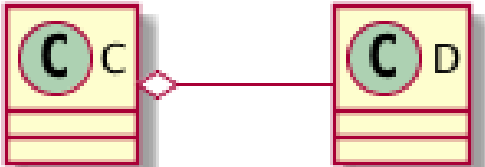




# Discussion: Concept or Class

- When does a conceptual diagram become a class diagram?

# Discussion: Aggregation or Composition



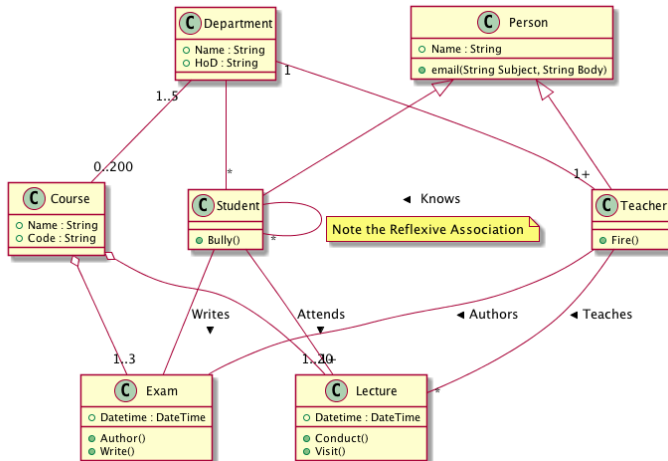


# Aggregation

- Aggregation
  - “Has-a”
  - Strong aggregation
- Composition
  - “Consists-of”
  - weak aggregation



# Discussion: An Example





# Example

- Conceptual Model for Discussion Forum Software



# Generalisation (Inheritance)

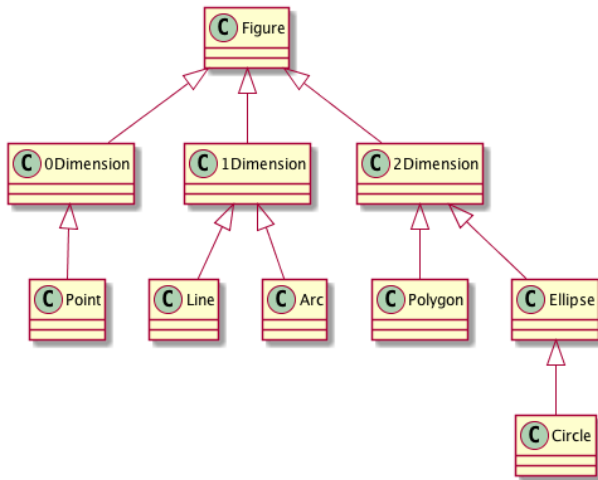
## Why

- Classification among concepts (is-a)
- Code reuse, identifying commonalities

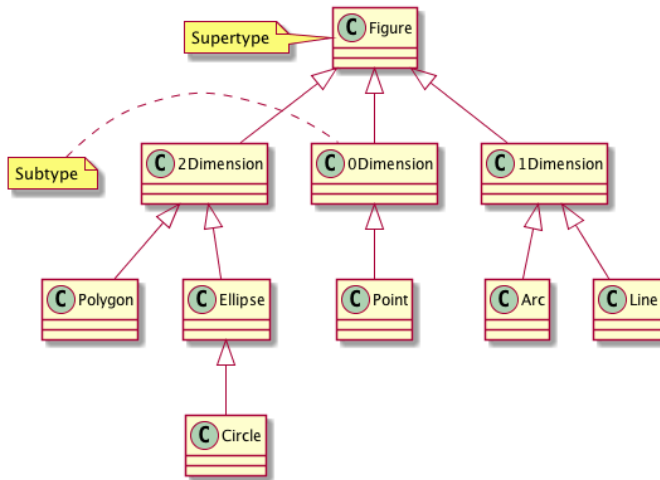
## Example

- Vector Graphics Drawing Programme
  - Point, Line, Arc, Polygon, Ellipse, Circle

# Generalisation: Hierarchy

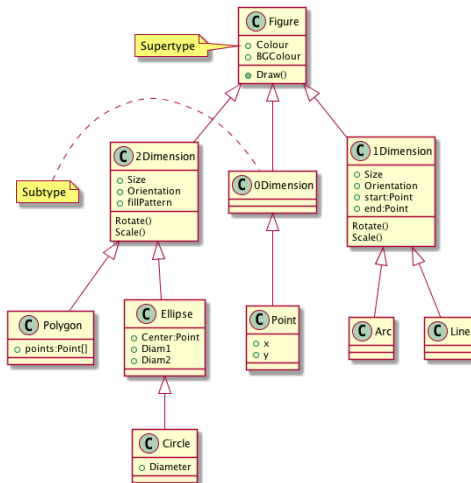


# Generalisation: Hierarchy II



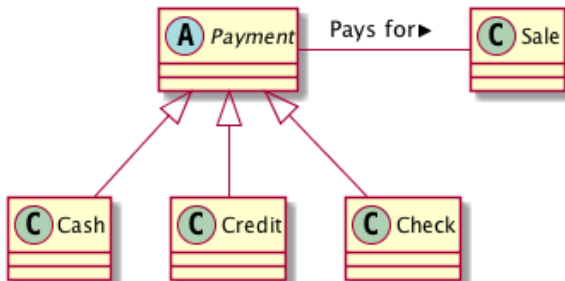


# Generalisation: Hierarchy III



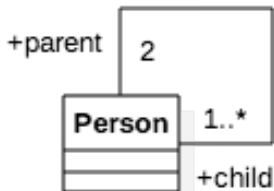
# Abstract Types

- When no instances of the base class are desirable.
- Example: There are no instances of the generic “Figure” base class.

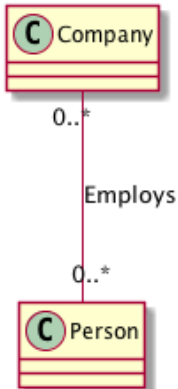




# Reflexive Associations



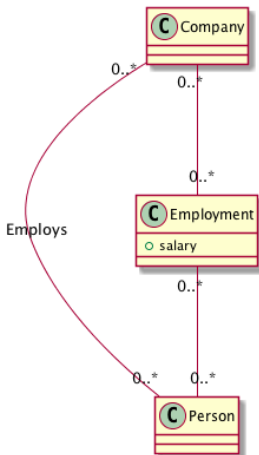
# Exotic UML: Association Attributes



Where do we put the attribute salary?  
in **Person**: implies you can only work in one place  
in **Company**: implies one salary for all

# Exotic UML: Association Attributes

One solution:





# Exotic UML: Association Attributes

Proper Solution:

