

# Design Techniques

Ch 2.6-2.12

- 1) What technique can we use for initial design?
- 2) What technique can we use to document a design?

# Process

- Early Software Engineering Process Phases:



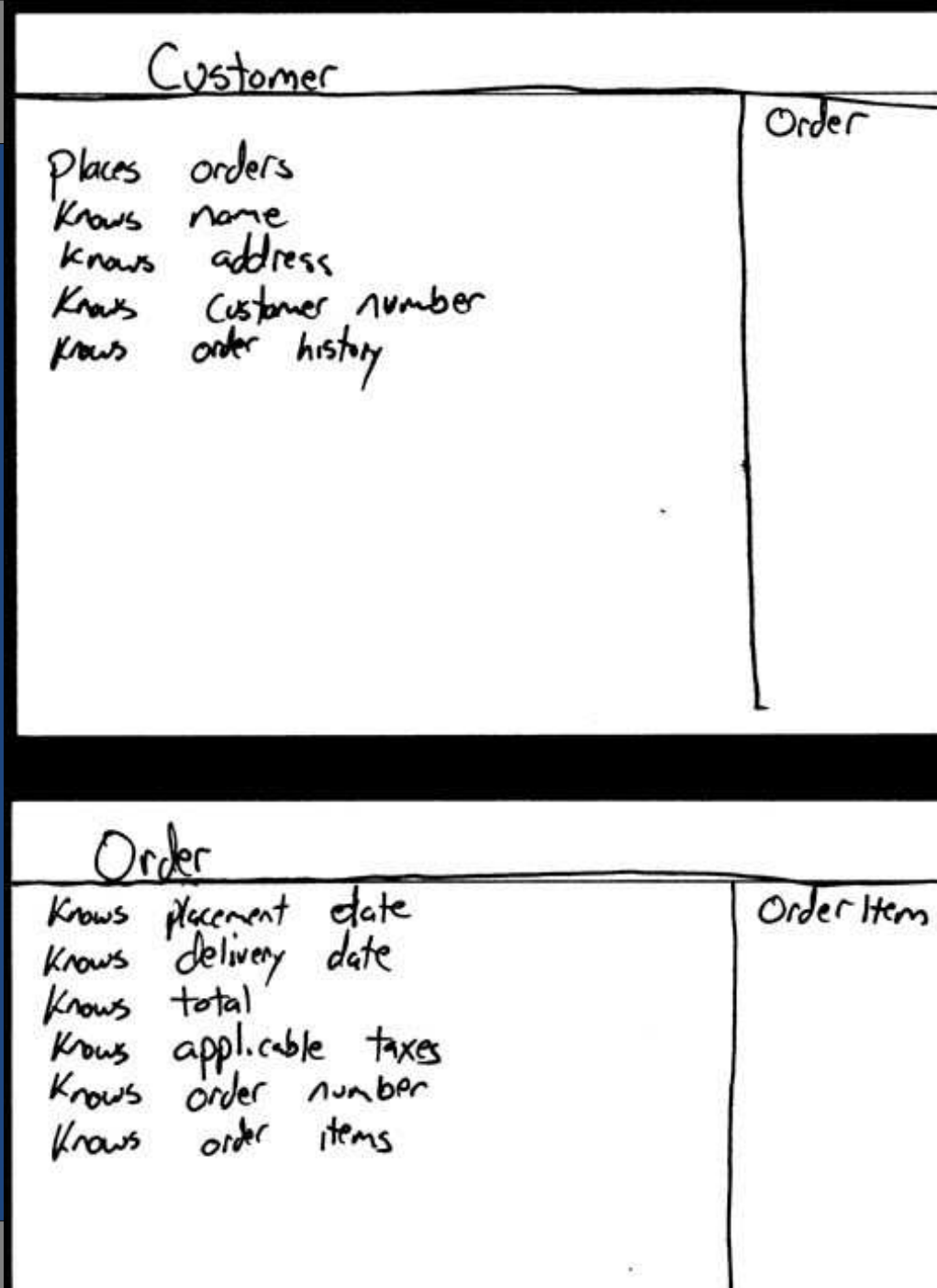
Software design techniques...

# CRC Cards

## a Design Technique

# CRC Cards

- CRC Cards:...
- It's an index card listing:
  - Class Name
  - Class Responsibilities  
Ex: Manage messages
  - Class Collaborators  
..  
Ex: Message class



# CRC Cards

- Purpose
  - Support an..
- Physical card support
  - Walk-through a use-case deciding..
  - Lay cards out on table and re-arrange them as needed.
- Small, so limit responsibility of the class
  - No "God" object (knows everything)
  - If too much on a card,..

# CRC Process

- 1) For each discovered class, write its name on the top.
  - Look for.. nouns in the use-cases.
- 2) Left side: Responsibilities
  - Not method names, but.. high-level responsibilities
  - Message class example:
    - Good: manage message content
    - Bad: `getContent()`, `getContentLength()`, `setContent()`
- 3) Right side: Collaborators
  - no particular order; which classes does this one use
  - does not line-up with responsibilities
- 4) Don't list all details; just enough to show.. it

# CRC Example

Mailbox	
<i>manage passcode</i>	MessageQueue
<i>manage greeting</i>	
<i>manage new and saved messages</i>	

MailSystem	
<i>manage mailboxes</i>	Mailbox

# CRC Use

- CRC Cards are good for
  - discussions and collaboration
  - eliciting design ideas and starting design
- But they are messy
  - Not good for recording design decisions.  
UML Diagrams do this!



# In-class exercise: Pledge Tracker Description

- Participants gather pledges from friends and neighbours for completing a charity walk-athon
  - Pledge lists donor's name and billing info.
- App reads pledge data from file (.csv) and:
  - Generates invoices for pledge (.pdf's)
  - Allow entry of payments received (saves to file)
  - Display summary of unpaid pledges (names, \$)
  - Display summary of total pledge amounts:  
total \$ pledged, \$ paid, \$ unpaid

# CRC Example

- What classes would be in charity pledge tracker?
- Draw a CRC card for a class or two.

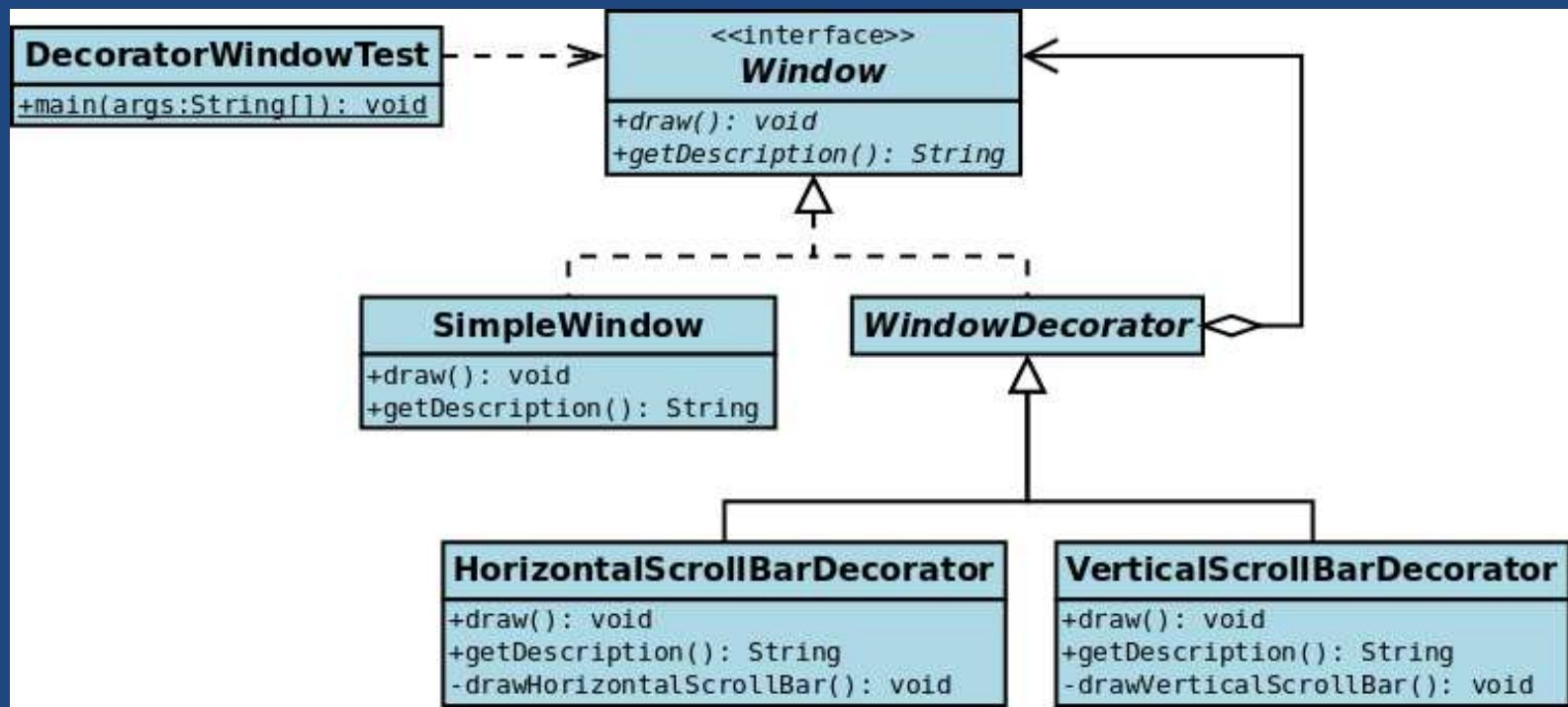


# UML Class Diagrams

## a Design Communication Technique

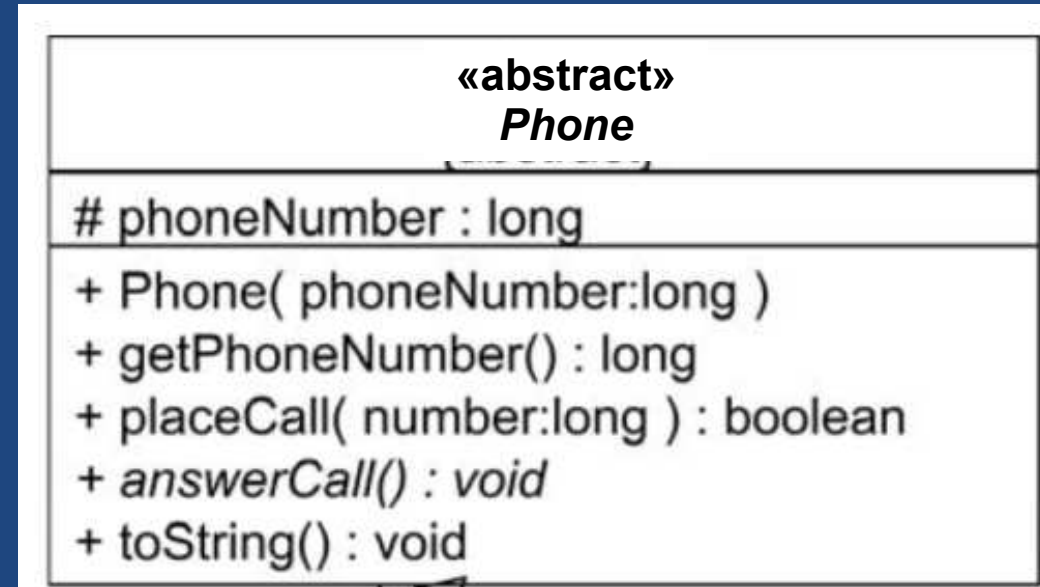
# UML Class Diagram

- UML Class Diagram
  - A diagram showing..

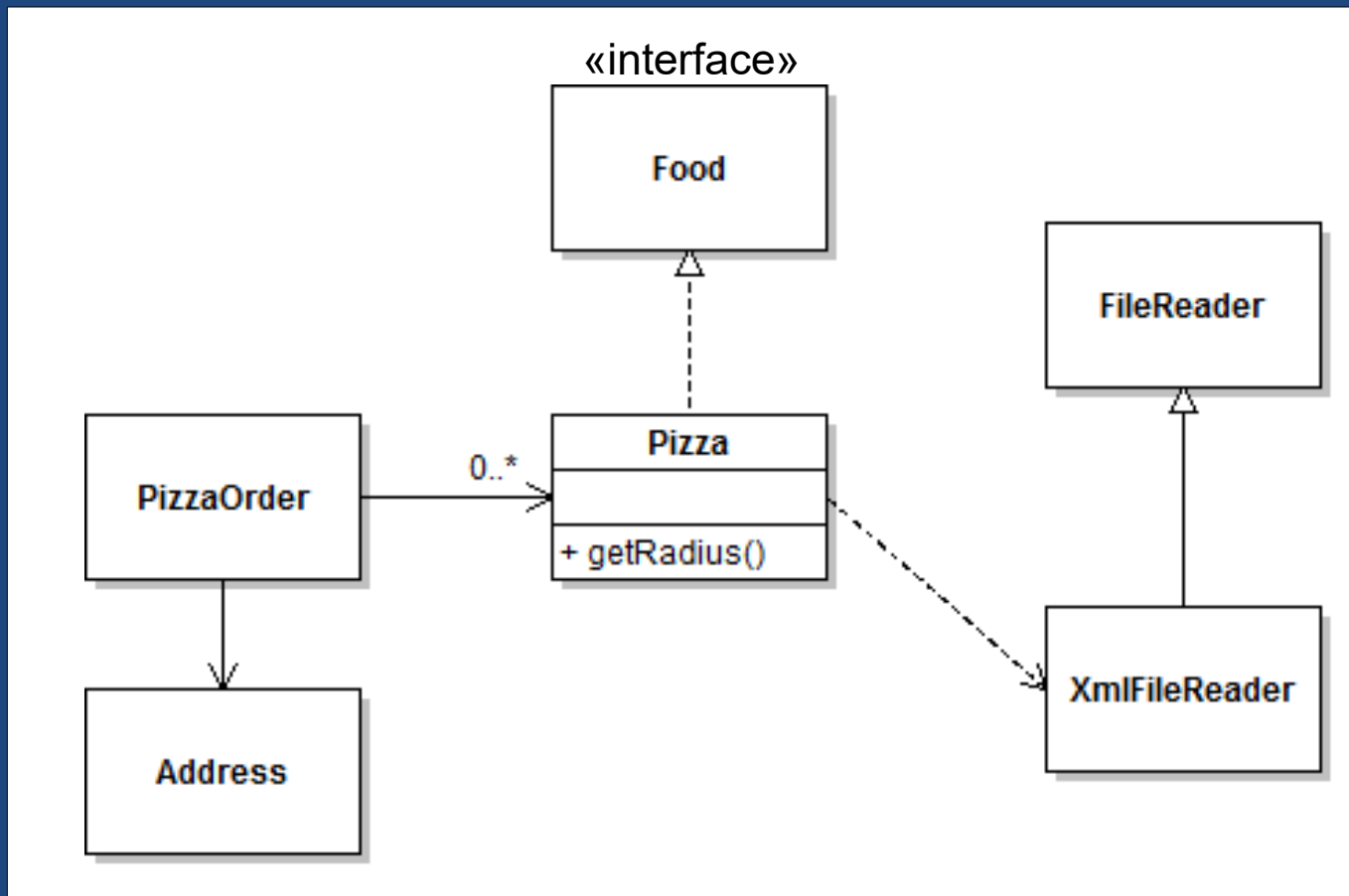


# UML Class diagram implementation details

- **3 Sections**
  - Class name
  - Attributes (fields)
  - Operations (methods)
- **Types (Optional)**
  - 
  - **methodName() : returnType**
- **Visibility:** Can preceded attributes and methods
  - + for..
  - # for..
  - for..

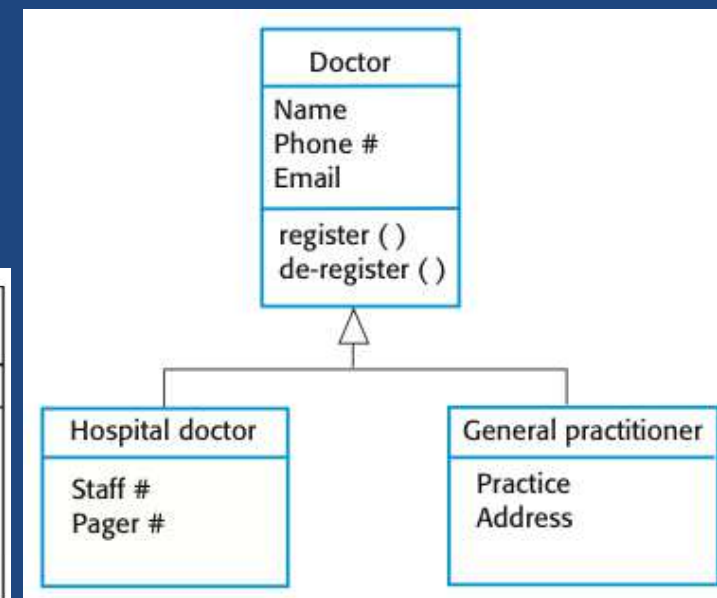
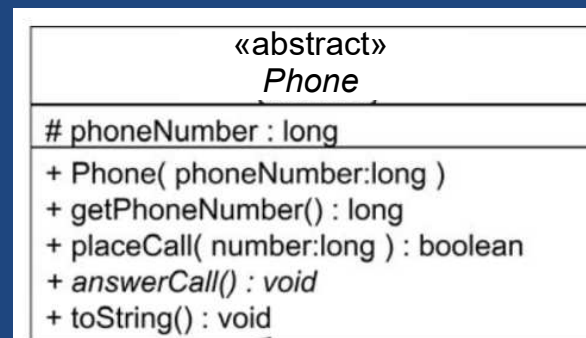
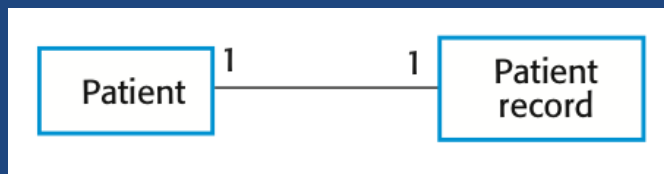


# Class Connections



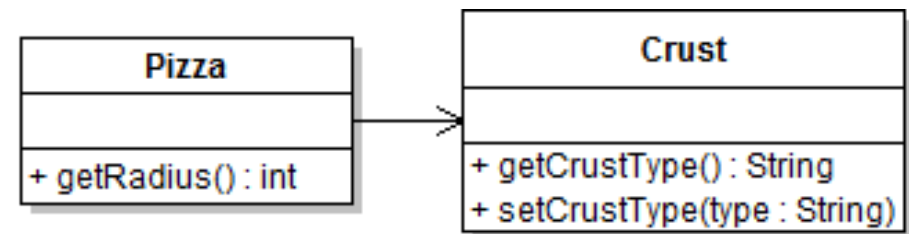
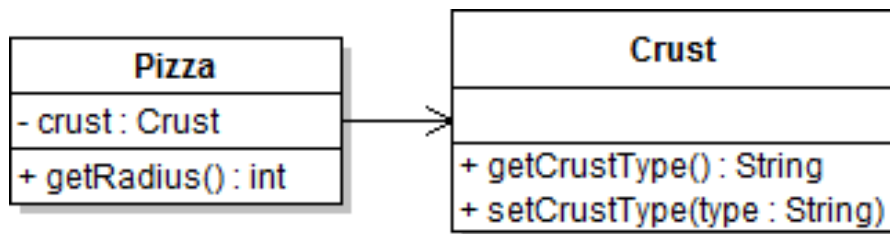
# Level of Detail

- Choose required level of detail
  - What are you trying to show in your diagram?
  - Who is the..
- Some Options
  - Classes & relationships.
  - Attributes and methods.
  - Types, arguments, visibility  
(+, -, #).

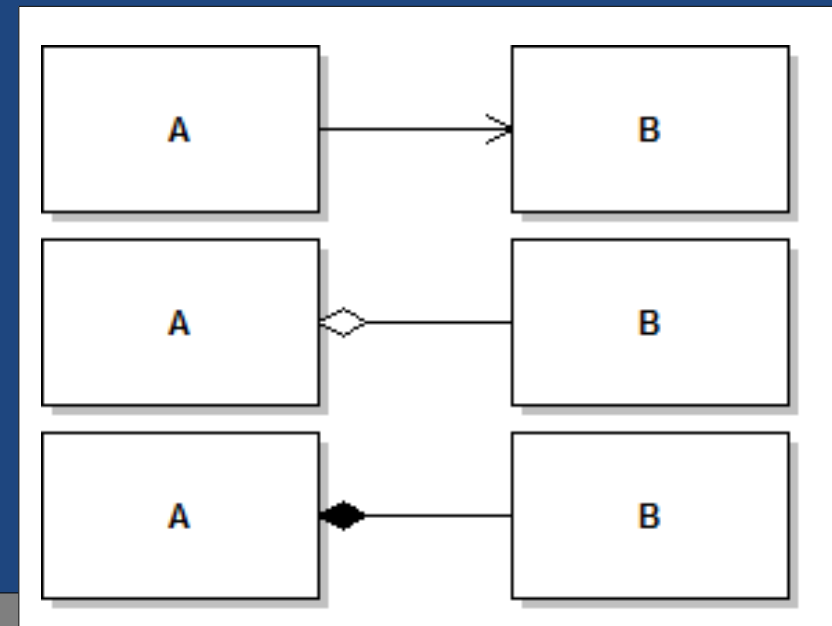


# Class Diagram Notes

- If **Pizza** “has-a” **Crust**, don't..



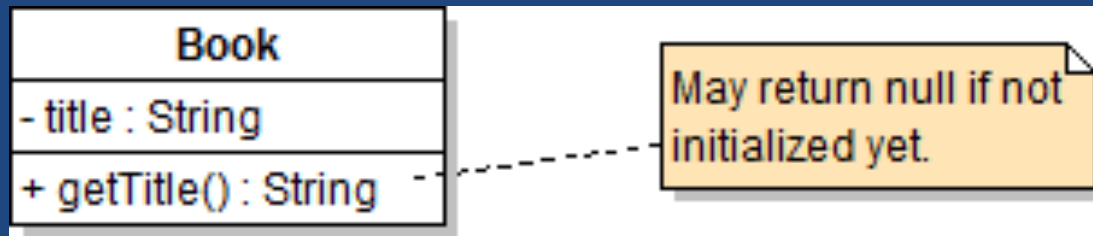
- **A** “has-a” **B** can be shown as any of the following:
  - Directed association (we'll use this; simplest)
  - Aggregation
  - Composition





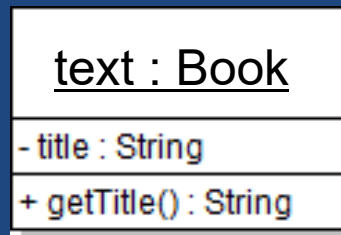
# More Notation

- add comments:



- Show objects:  
A class but with a ':' (and underlined)

..



# UML Class Diagram Example

- Draw a **UML class diagram** for the classes from the CRC cards for the pledge tracker.
  - Show just class names and relationships.

# Summary

- CRC: Early design process.
  - Index card listing class name, responsibilities, and collaborators.
  - High-level and informal description.
- UML Class Diagrams: Formalize design.
  - Draw classes and class relationships.