

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...

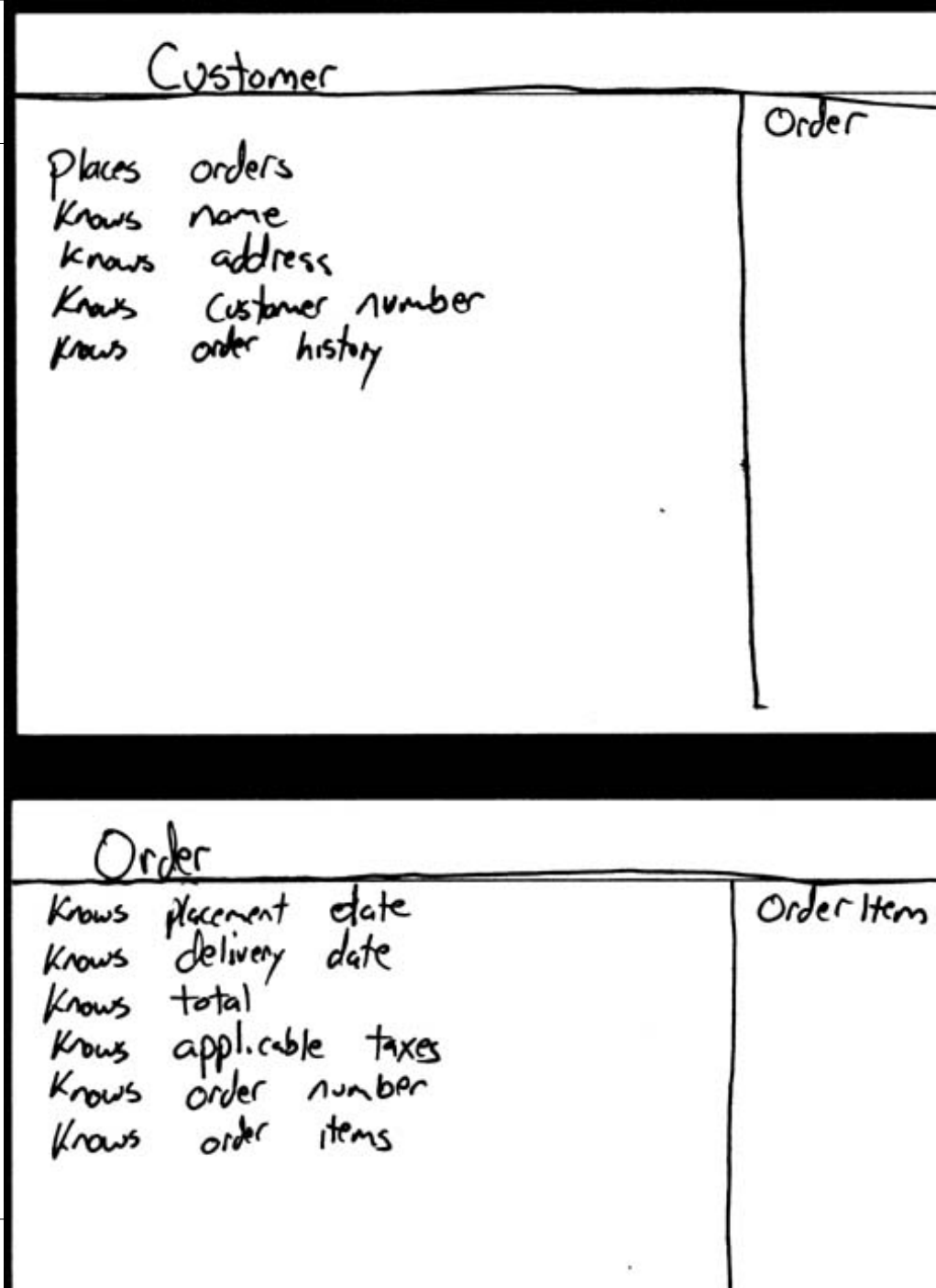
1. CRC Cards
2. UML Class Diagram

CRC Cards

a Design Technique

CRC Cards

- CRC Cards:
Class Responsibility &
Collaborator Cards
- It's an index card listing:
 - Class Name
 - Class Responsibilities
Ex: Manage messages
 - Class Collaborators
classes it depends on
Ex: Message class



CRC Cards

- Purpose
 - Support an [informal design process](#)
- Physical card support
 - Walk-through a use-case deciding..
[which classes do which tasks](#)
 - 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, [split into two classes](#)

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 can do its job*

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

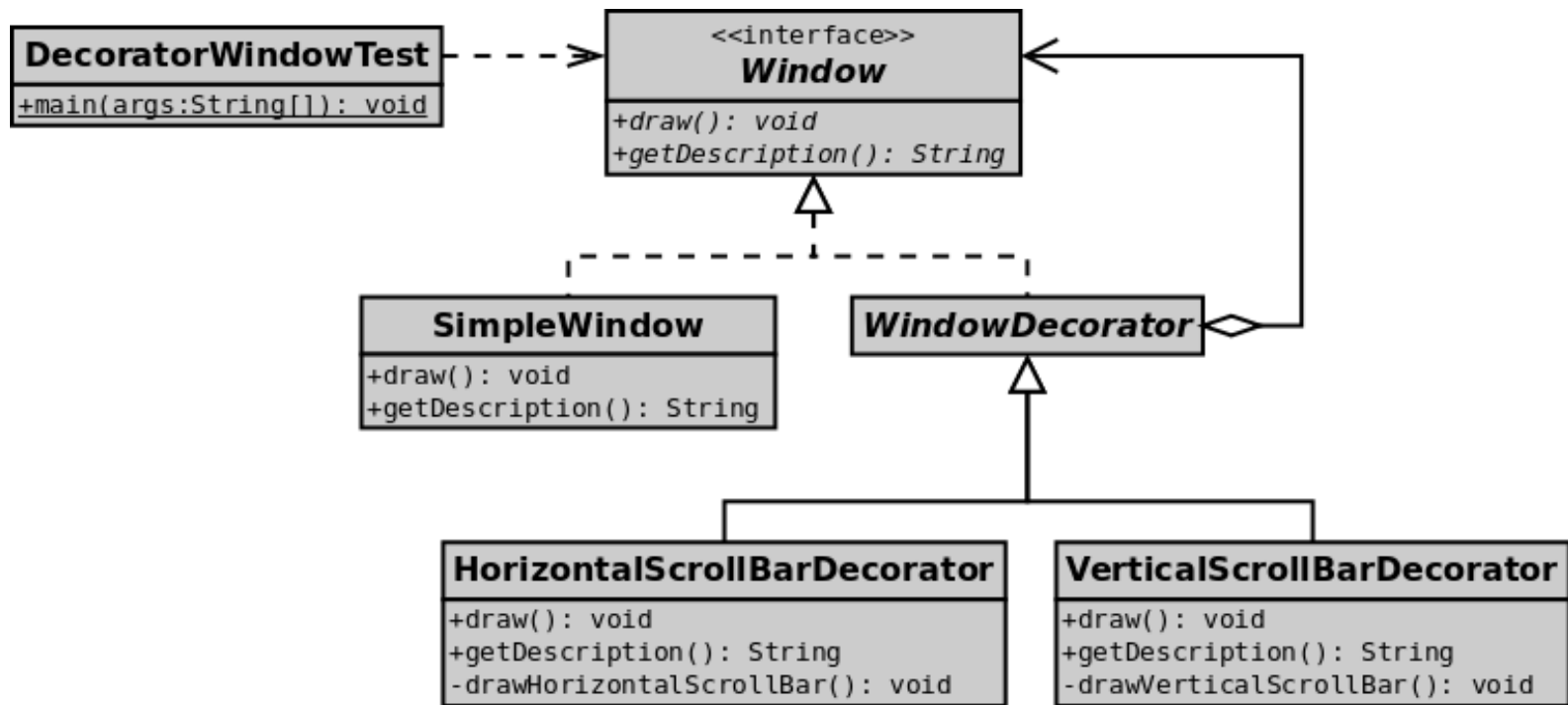
- What classes would be in charity pledge tracker?
- Draw a CRC card for a class or two.

UML Class Diagrams

a Design Communication Technique

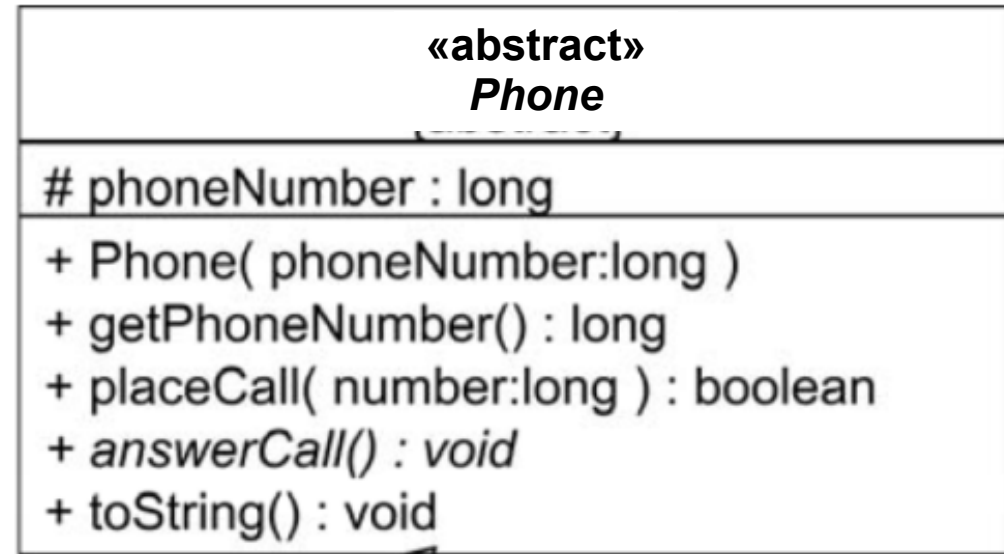
UML Class Diagram

- UML Class Diagram
 - A diagram showing [classes](#), and [relationship between them](#)



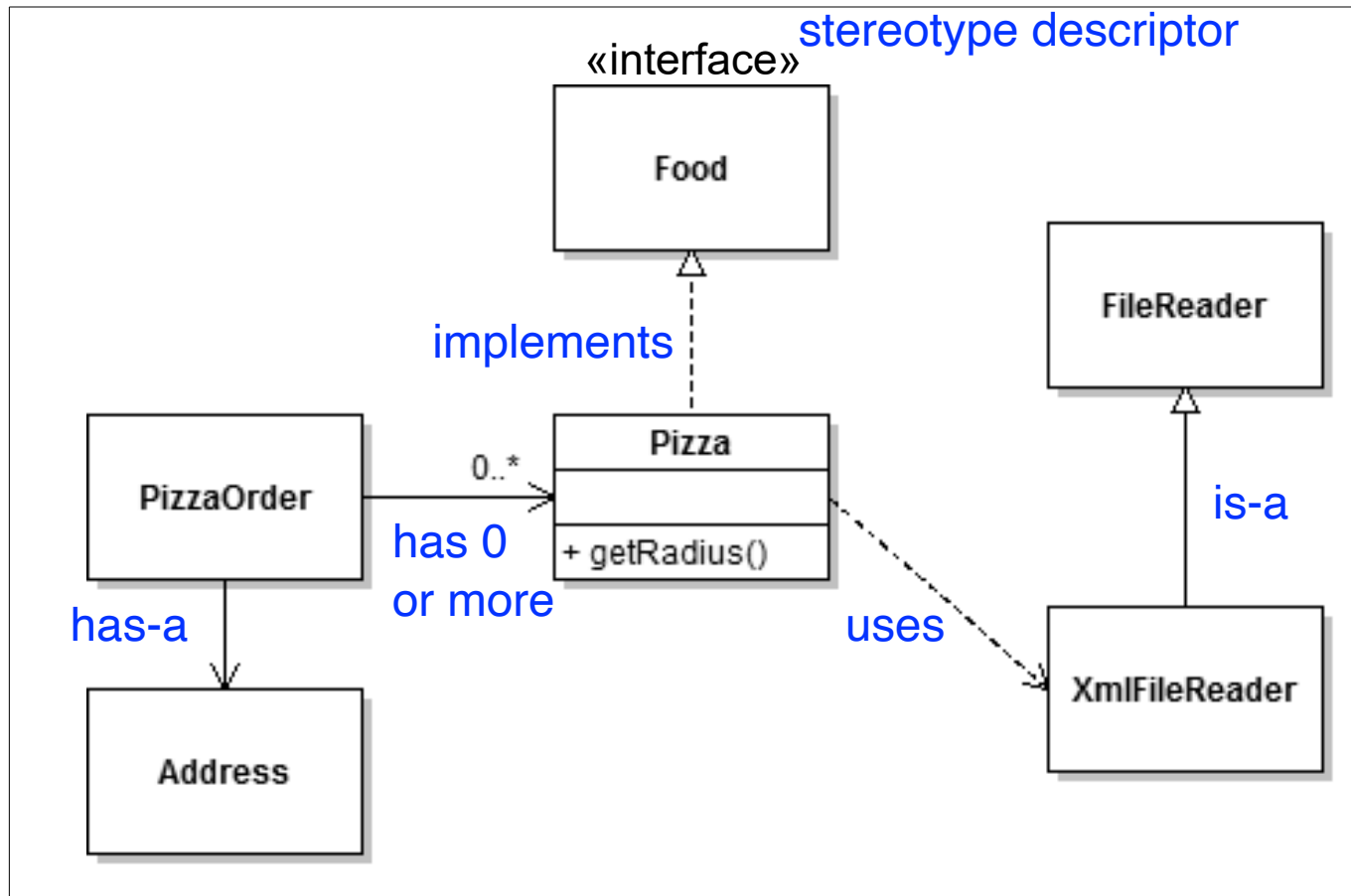
UML Class diagram implementation details

- 3 Sections
 - Class name
 - Attributes (fields)
 - Operations (methods)
- Types (Optional)
 - `fieldName: type`
 - `methodName() : returnType`
- Visibility: Can precede attributes and methods
 - + for `public`
 - # for `protected`
 - for `private`



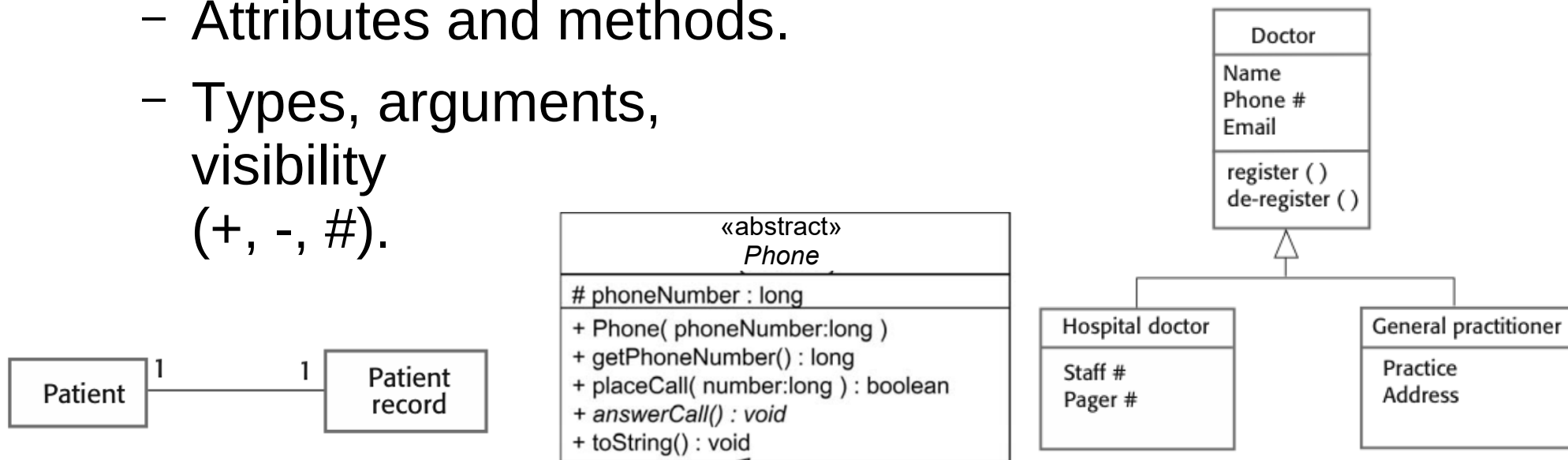
Class Connections

watch this part again! Mon Feb 5 (the end)



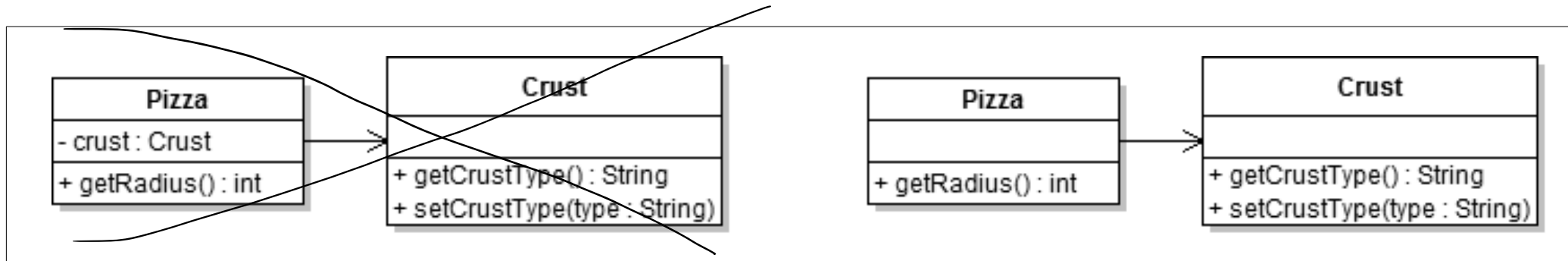
Level of Detail

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

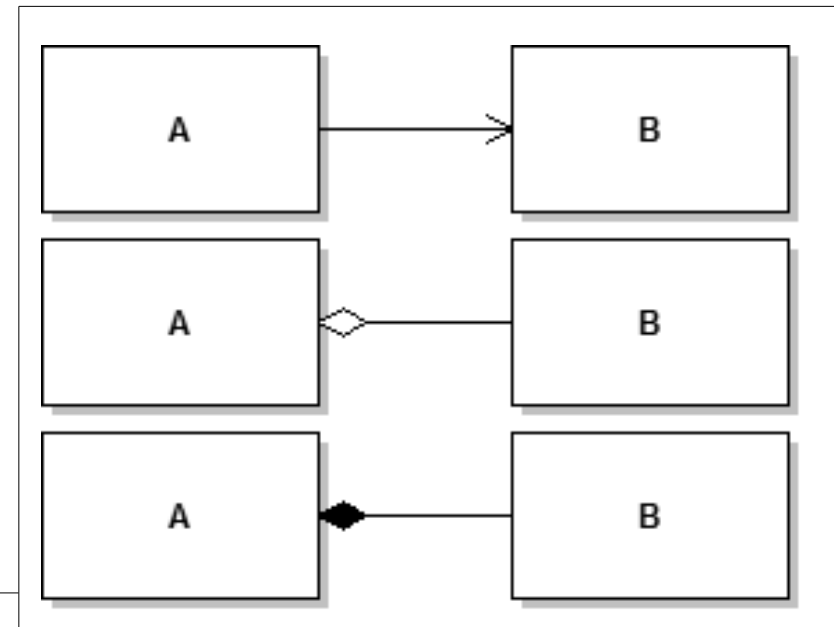


Class Diagram Notes

- If Pizza “has-a” Crust, don't list it as a field as well. [list it as a field as well](#)

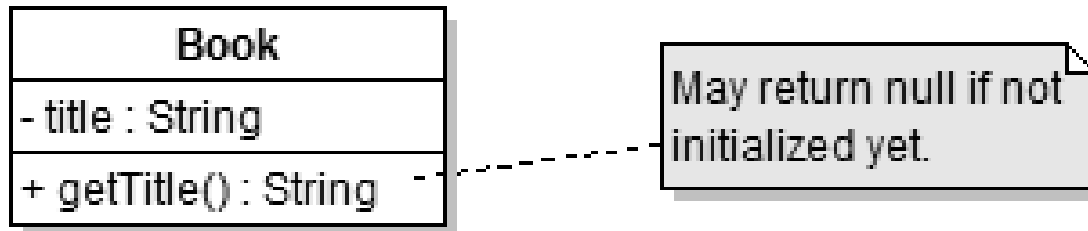


- A “has-a” B can be shown as any of the following:
 - Directed association (we'll use this; simplest)
 - Aggregation
 - Composition



More Notation

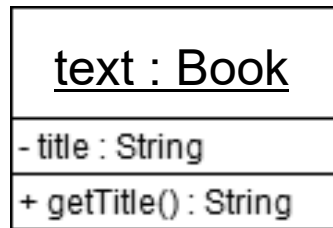
- **add comments:**



- **Show objects:**

A class but with a ':' (and underlined)

.. myCar: Car



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.