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:

  Requirements  →  Design  →  Implementation

  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

Image Source: http://www.agilemodeling.com
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..

2) Left side: Responsibilities
   - Not method names, but..
   - 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..
CRC Example

Mailbox

<table>
<thead>
<tr>
<th>manage passcode</th>
<th>MessageQueue</th>
</tr>
</thead>
<tbody>
<tr>
<td>manage greeting</td>
<td></td>
</tr>
<tr>
<td>manage new and saved messages</td>
<td></td>
</tr>
</tbody>
</table>

MailSystem

| manage mailboxes | Mailbox |
CRC Use

- CRC Cards are good for
  - discussions and collaboration
  -

- 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

![Class Connections Diagram]

- PizzaOrder
- Address
- Pizza (with `getRadius()`)
- Food
- FileReader
- XmlFileReader

`<interface>`
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 (+, -, #).

![UML Diagram]

```
```

```
Phone

# phoneNumber : long
+ phone( phoneNumber: long )
+ getPhoneNumber() : long
+ placeCall( number: long ) : boolean
+ answerCall() : void
+ toString() : void
```
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:

  ![Diagram of Book class]

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

  ![Diagram of text: Book class]
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.