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
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,..
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

- manage passcode
- manage greeting
- manage new and saved messages

MessageQueue

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](Image from Wikipedia: UML2 Decorator Pattern)
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..
Class Connections

![Class Connections Diagram]

- **Food**
  - **Pizza**
    - + getRadius()
  - **PizzaOrder**
    - Association with **Pizza** with multiplicity `0:*
  - **Address**
  - **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 (+, -, #).
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.**