

CSSE 220 Day 21

Object-Oriented Design

No SVN checkout today

In case you want to get an early start on Minesweeper project:

- ▶ Link to specs is on schedule page:
- ▶ Teams:
 - csse220-201210-ms-11,collinka,ryanlf,kleinerk
 - csse220-201210-ms-12,dooleykh,richarsm,mitchesm
 - csse220-201210-ms-13,huangz,dykestm
 - csse220-201210-ms-14,kowalsif,pfeiffkm,millerns
 - csse220-201210-ms-15,lius,yuhasmj,weil
 - csse220-201210-ms-16,stopkadj,niz

Contact each other if you want to start this weekend

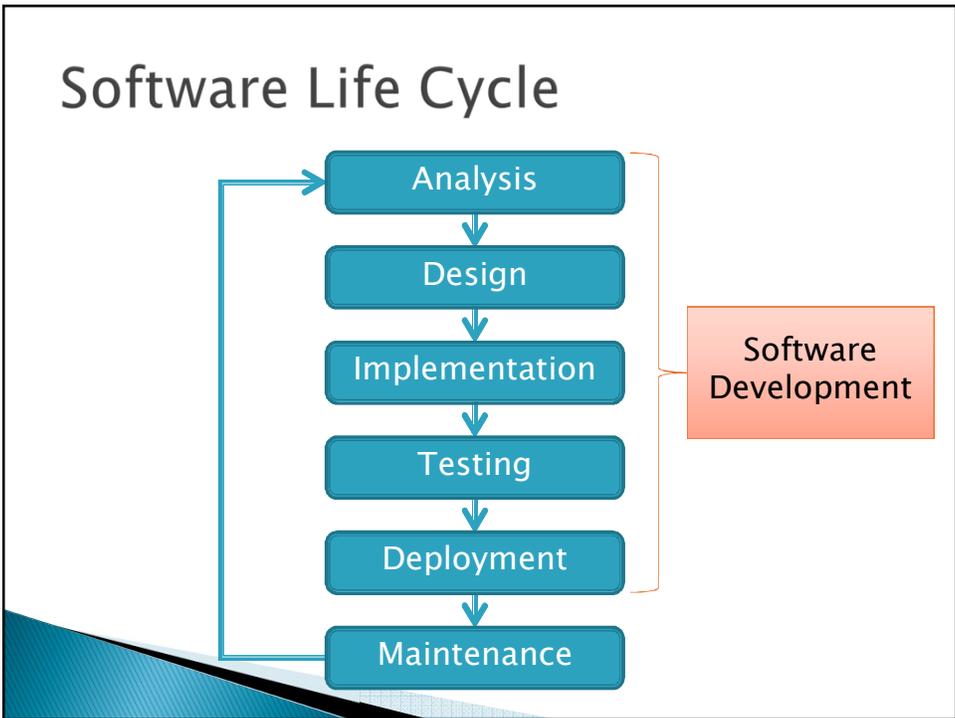
Everyone: Read the specification before Monday's class

Questions?

Today's Plan

- ▶ Software development methods
- ▶ Object-oriented design with CRC cards
- ▶ LayoutManagers for Java GUIs
- ▶ BallWorlds work time

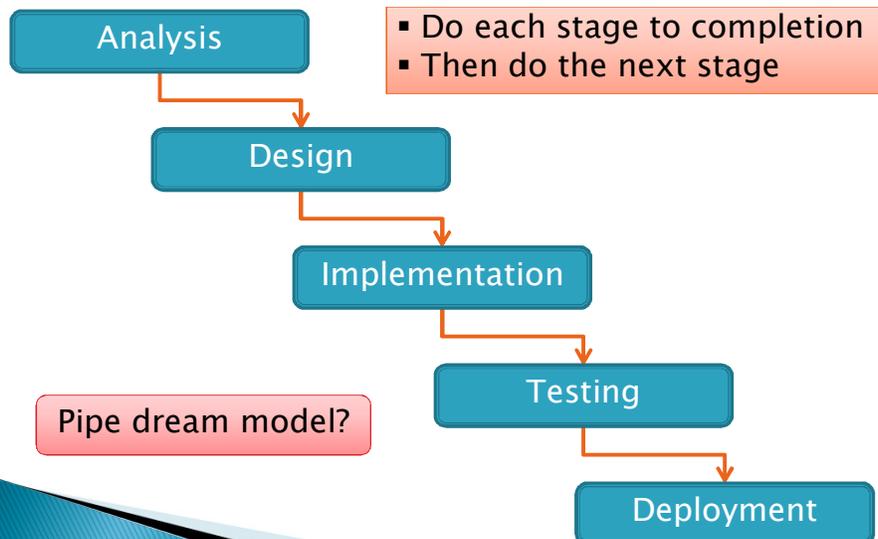
Software Development Methods



Formal Development Processes

- ▶ Standardized approaches intended to:
 - Reduce costs
 - Increase predictability of results
- ▶ Examples:
 - Waterfall model
 - Spiral model
 - “Rational Unified Process”

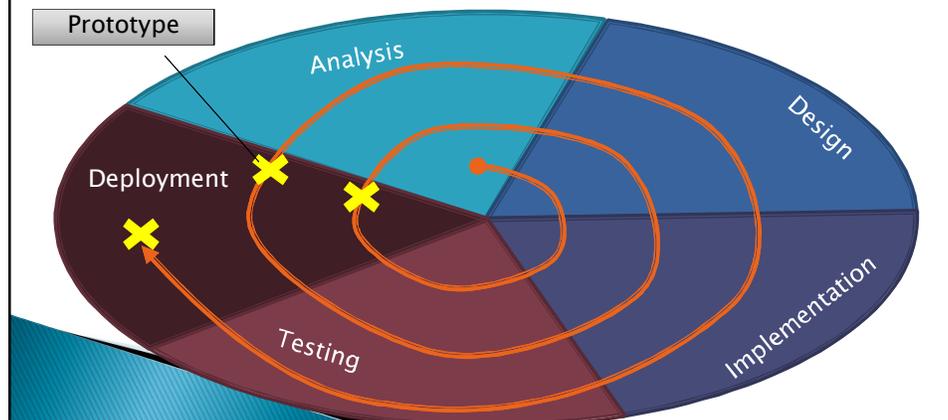
Waterfall Model



Spiral Model

- Schedule overruns
- Scope creep

- ▶ Repeat phases in a cycle
- ▶ Produce a prototype at end of each cycle
- ▶ Get early feedback, incorporate changes



Extreme Programming—XP

- ▶ Like the spiral model with **very** short cycles
- ▶ Pioneered by Kent Beck
- ▶ One of several “agile” methodologies, focused on building high quality software quickly
- ▶ Rather than focus on rigid process, XP espouses 12 key practices...

The XP Practices

- Realistic planning
- Small releases
- Shared metaphors
- Simplicity
- **Testing**
- **Refactoring**
- **Pair programming**
- Collective ownership
- Continuous integration
- 40-hour week
- On-site customer
- **Coding standards**

When you see opportunity to make code better, do it

Use descriptive names

Q1

Object-Oriented Design

»» A practical technique

Object-Oriented Design

- ▶ We won't use full-scale, formal methodologies
 - Those are in later SE courses
- ▶ We will practice a common object-oriented design technique using **CRC Cards**
- ▶ Like any design technique, **the key to success is practice**

Key Steps in Our Design Process

1. **Discover classes** based on requirements
2. **Determine responsibilities** of each class
3. **Describe relationships** between classes

Q2

Discover Classes Based on Requirements

- ▶ Brainstorm a list of possible classes
 - Anything that might work
 - No squashing

Discover Classes Based on Requirements

- ▶ Prompts:
 - Look for **nouns**
 - Multiple objects are often created from each class
 - So look for **plural concepts**
 - Consider how much detail a concept requires:
 - A lot? Probably a class
 - Not much? Perhaps a primitive type
- ▶ Don't expect to find them all → add as needed

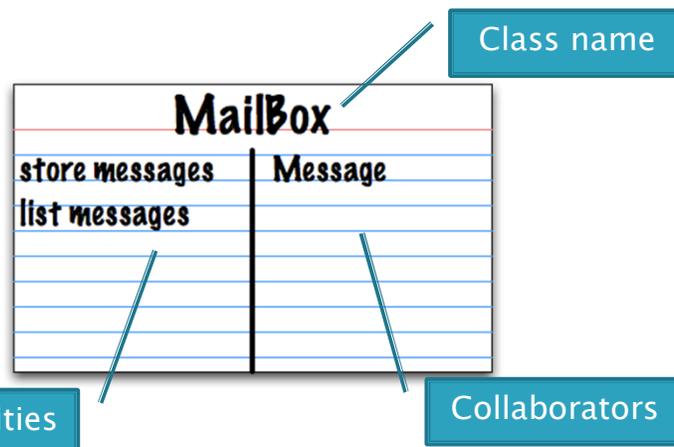
Tired of hearing this yet?

Determine Responsibilities

- ▶ Look for **verbs** in the requirements to identify **responsibilities** of your system
- ▶ Which class handles the responsibility?
- ▶ Can use **CRC Cards** to discover this:
 - **Classes**
 - **Responsibilities**
 - **Collaborators**

CRC Cards

- ▶ Use one index card per class



Q3

CRC Card Technique

1. Pick a **responsibility** of the program
2. Pick a **class** to carry out that responsibility
 - Add that responsibility to the class's card
3. Can that class carry out the responsibility by itself?
 - Yes → Return to step 1
 - No →
 - Decide which classes should help
 - List them as **collaborators** on the first card
 - Add additional responsibilities to the collaborators' cards

CRC Card Tips

- ▶ **Spread the cards out** on a table
 - Or sticky notes on a whiteboard instead of cards
- ▶ **Use a "token"** to keep your place
 - A quarter or a magnet
- ▶ **Focus on high-level responsibilities**
 - Some say < 3 per card
- ▶ **Keep it informal**
 - Rewrite cards if they get too sloppy
 - Tear up mistakes
 - Shuffle cards around to keep "friends" together

Break

» These go to 11

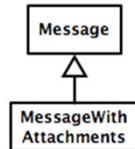
Describe the Relationships

- ▶ Classes usually are related to their collaborators
- ▶ Draw a UML class diagram showing how
- ▶ Common relationships:
 - **Inheritance**: only when subclass **is a** special case
 - **Aggregation**: when one class **has a field** that references another class
 - **Dependency**: like aggregation but transient, usually for method parameters, **“has a” temporarily**
 - **Association**: any other relationship, can label the arrow, e.g., **constructs**

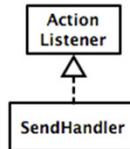
NEW!

Summary of UML Class Diagram Arrows

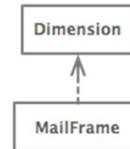
Inheritance
(is a)



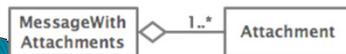
Interface
Implementation
(is a)



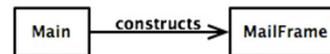
Dependency
(depends on)



Aggregation
(has a)



Association



Q4

Object-Oriented Design



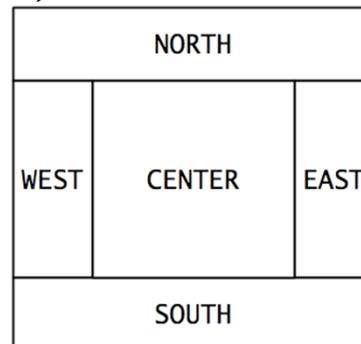
- Draw UML class diagrams based on your CRC cards
- Initially just show classes (not insides of each)
- Add insides for two classes

Some Notes on Layout Managers

- »» When JFrame's and JPanel's defaults just don't cut it.

Recall: How many components can a JFrame show by default?

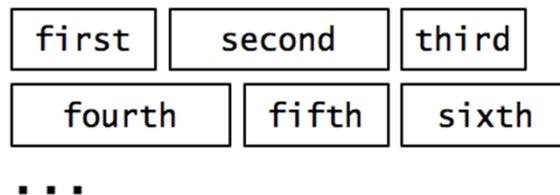
- ▶ Answer: 5
- ▶ We use the two-argument version of `add`:
- ▶ `JPanel p = new JPanel ();`
`frame.add(p, BorderLayout.SOUTH);`
- ▶ JFrame's default `LayoutManager` is a `BorderLayout`
- ▶ `LayoutManager` instances tell the Java library how to arrange components
- ▶ `BorderLayout` uses up to five components



Q5

Recall: How many components can a JPanel show by default?

- ▶ Answer: arbitrarily many
- ▶ Additional components are added in a line
- ▶ JPanel's default LayoutManager is a FlowLayout



Setting the Layout Manager

- ▶ We can set the layout manager of a JPanel manually if we don't like the default:

```

JPanel panel = new JPanel ();
panel.setLayout(new GridLayout(4, 3));
panel.add(new JButton("1"));
panel.add(new JButton("2"));
panel.add(new JButton("3"));
panel.add(new JButton("4"));
// ...
panel.add(new JButton("0"));
panel.add(new JButton("#"));
frame.add(panel);

```



Lots of Layout Managers

- ▶ A **LayoutManager** determines how components are laid out within a container
 - **BorderLayout**. When adding a component, you specify center, north, south, east, or west for its location. (Default for a JFrame.)
 - **FlowLayout**: Components are placed left to right. When a row is filled, start a new one. (Default for a JPanel.)
 - **GridLayout**. All components same size, placed into a 2D grid.
 - Many others are available, including **BoxLayout**, **CardLayout**, **GridBagLayout**, **GroupLayout**
 - If you use **null** for the LayoutManager, then you must specify every location using coordinates
 - More control, but it doesn't resize automatically

Q6

Additional Resources on Layout Managers

- ▶ Chapter 18 of Big Java
- ▶ Swing Tutorial
 - <http://java.sun.com/docs/books/tutorial/ui/index.html>
 - Also linked from schedule

Work Time

»» BallWorlds

Q7-Q8