Interface Quality
Ch 3.5

http://jeffreysambells.com/media/2010/09/photo.jpg

Topics

1) Who cares about the quality of an interface?
2) How can we analyze the quality of a class's interface?

2 Points Of View

- Can view a class interface from 2 points of view:
  1. class's user/client
     - Goals:
       - Easy to understand, clear abstraction
       - Easy to use
  2. class's designer/programmer
     - Goals:
       - Easy to design
       - Easy to implement

Interface Design Challenge

- Challenge
  The easiest way to implement a feature may not be..
  the easiest way to understand & use it
- Example
  - Getting MP3 song's info:

Option 1:

```
/**
 * Pass the ID number:
 * 1 = artist
 * 2 = song title
 * 3 = recording year
 *  ...
 */
String getSongInfo(int id);
```

...

Option 2:

```
String getArtist();
String getSongTitle();
int getYearRecorded();
```

..

Interface Quality

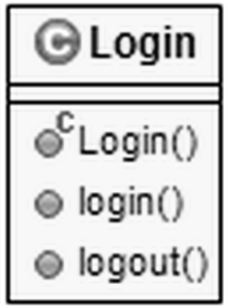
- Analyze the interface checking for:

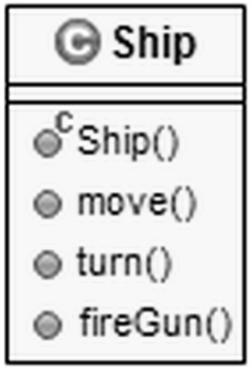
    1. Cohesion
    2. Completeness / Convenience
    3. Clarity
    4. Consistency

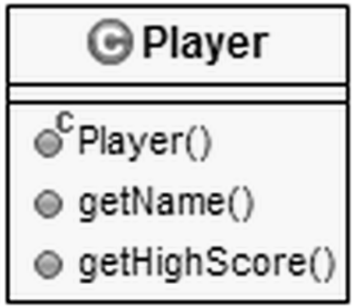
Cohesion

- Cohesion
  - Are all interface methods.. related to a single abstraction?
- Single Responsibility Principle:
  - A class should have.. only one reason to change
  - i.e., all its code should deal with one responsibility.

- Example:
  - All relates to a "game"; cohesion?
  - break into sub-classes
    each handling one responsibility







*classes grow -> cohesion decreases

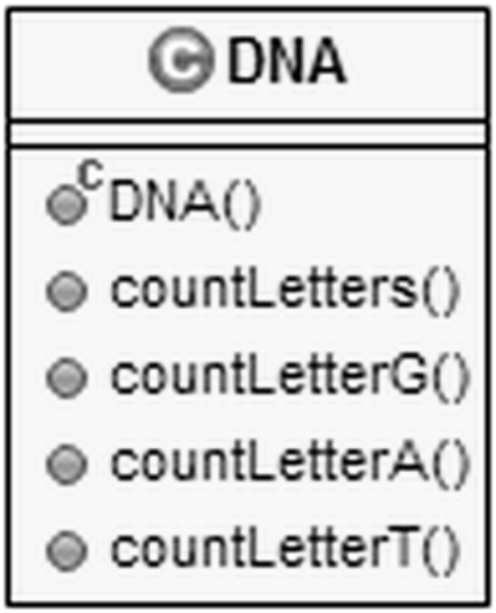
Completeness & Convenience

- Completness / Convenience
  - Interface should have the... features client code needs
- Example: Reading a line from System.in

```
BufferedReader reader = new BufferedReader(new InputStreamReader(System.in));
String line1 = reader.readLine();

Scanner scanner = new Scanner(System.in);
String line2 = scanner.nextLine();
```

Before Java 5.0



- DNA Example:
  - DNA made up of G, A, T, and C nucleotides.
  - Missing... countLetterC()
    Client could write it, but class incomplete!

```
int numC = myDna.countLetters() - myDna. countLettersG()
        - myDna.countLettersA() - myDna.countLettersT();
```

Clarity

- Clarity
  - The interface should be clear to the programmer.
  - Use well named classes, methods and variables to be.. intention revealing
  - Use.. meaningful abstractions
- Example: Compare these Stack methods
  - getTop(), setTop()
  - push(), pop()
- Example: Consider these ListIterator methods
  - next(), hasNext(), previous(), hasPrevious(), add(), remove()
  - Which element does.. remove() delete? -> not clear

Consistency

- Consistency:
  - be consistent!

```
public class GameBoard {
    // row: 0-indexed row.
    // col: 1-indexed column.
    Piece getPiece(int row, int col) { ... }

    void setPieceOnBoard(
            int col, int row, Piece element) { ... }

    boolean positionHasPiece(int x, int y) { ... }
}
```

- Consistency Problems:
  - indices:
    0 indexed for Java
  - naming: x vs col
  - argument order:
    (row, col) vs (col, row)

Additional Class/Interface Quality Checks

- 4C's
  - Cohesion
  - Completeness
  - Clarity
  - Consistency
- Some other ways to review quality
  - Constructor create fully formed objects
  - One name for each idea
  - Command-query
  - Implementing Iterable/Comparable/... when appropriate
  - Breaking encapsulation

-maintainability
-simplicity
-repetitive code
-scalability (not taught in this course)
-mutability: is this class need to be changed?

Analysis Exercise

- Analyze the quality of the following interface:

```
/**
 * Represent a point in 2D space.
 */
interface Point2D {

    void setLocation(int x, int y);
    void setHeight(int height);

    int getX();
    int getYValue();

    double getDistanceTo(int y, int x);

    void drawStarAtPoint();
    void drawCircleAtPoint(int radius);
    double computeTriangle(Point2D p1, Point2D p2);
}
```

completeness: can only set Y, not X

clarity: need one name for same property. unclear

mutability: do we need setHeight here? or do we want point not be changed

consistency: x y then y x

cohesion: computeTriangle shouldn't be here

drawStarAtPoint and drawCircleAtPoint as well

might want getDistanceTo that can accept a Point

Summary: “4C's” Analysis Process

1. Check..cohesion
   - Interface relate to a single abstraction?
   - If not, split into multiple classes.
2. Check..completeness
   - All required methods provided?
   - Client code have functions which should be in the class?
3. Check..clarity
   - All classes, methods, variables have the best names?
   - Is the abstraction clear?
4. Check..consistency
   - All names, numbering, and ordering consistent?

- Goals often conflict; strike the best balance you can.