Code smell
What are code smells?

• Fowler: “... certain structures in the code that suggest (sometimes they scream for) the possibility of refactoring.”

• Wikipedia: “... symptom[s] in the source code of a program that possibly indicate a deeper problem. ... usually not bugs... not technically incorrect and don't currently prevent the program from functioning. Instead, they indicate weaknesses in design that may be slowing down development or increasing the risk of bugs or failures in the future.”
Why are code smells bad?

• They are clear signs that your design is starting to decay
• Long term decay leads to “software rot”
Example code smells

• Duplicated code
• Long method
• Large class
• Long parameter list
• Message chain

• Switch statements
• Data class
• Speculative generality
• Temporary field
• Refused bequest
Duplicated code

• Duplicate methods in subclasses
  • ??

• Duplicate expressions in same class
  • ??

• Duplicate expressions in different classes
  • ??
Duplicated code

- Duplicate methods in subclasses
  - Lift to super class
- Duplicate expressions in same class
  - Create new member method (maybe private method)
- Duplicate expressions in different classes
  - Maybe create another class to offer the common computation
Long method

• Won’t fit on a page
• Can’t think of whole thing at once

• Extract function
  • Where to extract?
Long method

• Won’t fit on a page
• Can’t think of whole thing at once

• Extract function
  • Loop body
  • Places where there is (or should be) a comment
Large class

• More than a couple dozen methods, or half a dozen variables

• How to make the class small?
Large class

• More than a couple dozen methods, or half a dozen variables

• Split into component classes

• Create superclass
  • If using switch statement, split into subclasses
Long parameter list

• Introduce parameter object
• Only worthwhile if there are several methods with same parameter list, and they call each other
Message chain

• Long list of method calls:
  customer.getAddress().getState()
  window.getBoundingbox().getOrigin().getX()

• How to change this?
Message chain

• Long list of method calls:
  customer.getAddress().getState()
  window.getBoundingbox().getOrigin().getX()

• Replace with shorter calls:
  customer.getState()
  window.leftBoundary()
Data class

• Class has no methods except for getter and setters
• What to do:
  • ??
Data class

• Class has no methods except for getter and setters

• What to do:
  • Look for missing methods and move them to the class
  • Merge with another class
Switch statement

• (Long) if-else
• Switch case case case case

• How to change?
class Book : Element ...

class Collection : Element ...

int computeWords(Element e) {
    if (!e.hasChildren()) {
        // e instanceof Book
        return ((Book)e).getBookWords();
    } else {
        return ((Collection)e).getTotalWords();
    }
}
Library example

```java
int computeWords(Element e) {
    if (!e.hasChildren()) {  // e instanceof Book
        return ((Book)e).getBookWords();
    } else {
        return ((Collection)e).getTotalWords();
    }
}

• Replace with a new method:

int computeWord(Element e) {
    return e.getWord();
}
```
Speculative generality

• What are the examples?
Speculative generality

• Interfaces/abstract classes that are implemented only one class
• Unused parameters
Temporary field

• Instance variable is only used during part of the lifetime of an object

• Move variable into another object (perhaps a new class)
Refused bequest

• A is a subclass of B

• A
  • Overrides inherited methods of B
  • Does not use some variables of B
  • Does not use some methods of B
Refused bequest

• A is a subclass of B

• A
  • Overrides inherited methods of B
  • Does not use some variables of B
  • Does not use some methods of B

• Give A and B a common superclass and move common code into it
Other smells

• Non-localized plans
• Too many bugs
• Too hard to understand
• Too hard to change
Too many bugs

• If one part of the system has more than its share of the bugs, there is probably a good reason
• Redesign, rewrite, refactor
Too hard to understand

• Hard to fix bugs because you don’t understand
• Hard to change because you don’t understand
Too hard to change

• Because of lack of tests

• Because of dependencies
  • Global variables
  • Very large modules
  • Importing too many classes

• Because of duplication or non-localized plans
Summary

• Code smells are code pieces with potentially bad design
• Fairly subjective
  • Fowler: “You will have to develop your own sense of how many instance variables are too many instance variables and how many lines of code in a method are too many lines.”