SOFTWARE TESTING

SOFTWARE REFACTORING

Mahdi Roozbahani

Slides are based on Alex Orso.

WHAT IS REFACTORING ?

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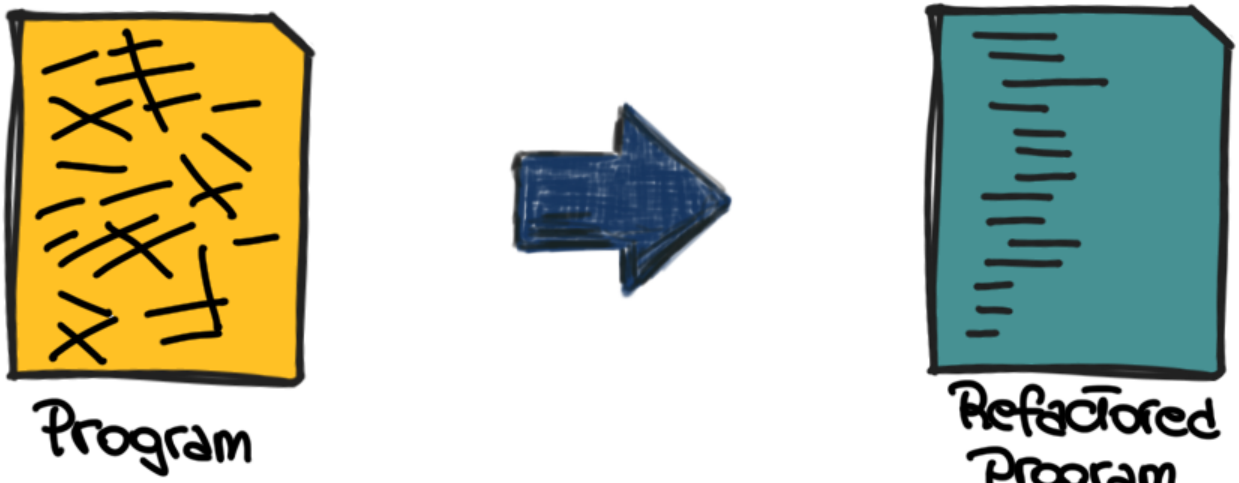

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WHAT IS REFACTORING?

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Key feature: behavior preserving.

BEHAVIOR PRESERVING

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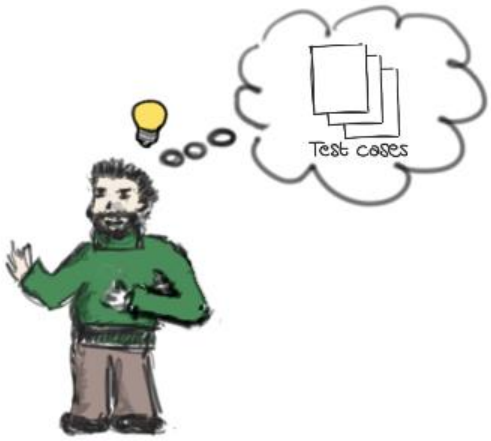
Test the code,
but beware:
no guarantees!



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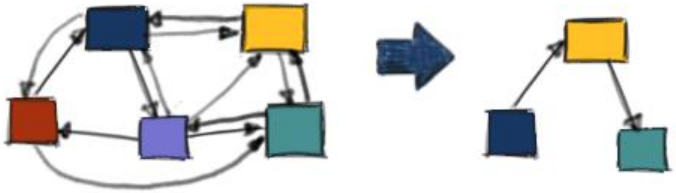

Design needs to be improved

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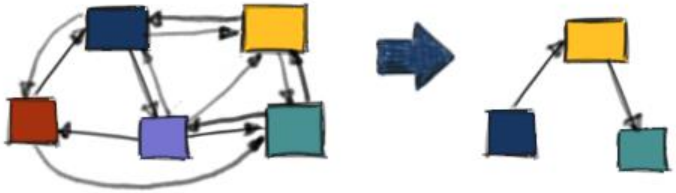

Design needs to be improved

Sloppiness / laziness

HOW YOU USED REFACTORING BEFORE?

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Even renaming a class is a refactoring!
(albeit a trivial one)

A LITTLE BIT OF HISTORY

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- Especially important for object-oriented languages
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- Increasingly popular due to agile development

FOWLER'S BOOK

Catalog of refectorings

List of bad smells

Guidelines on when applying refactoring

Example of code before and after

COMING UP NEXT

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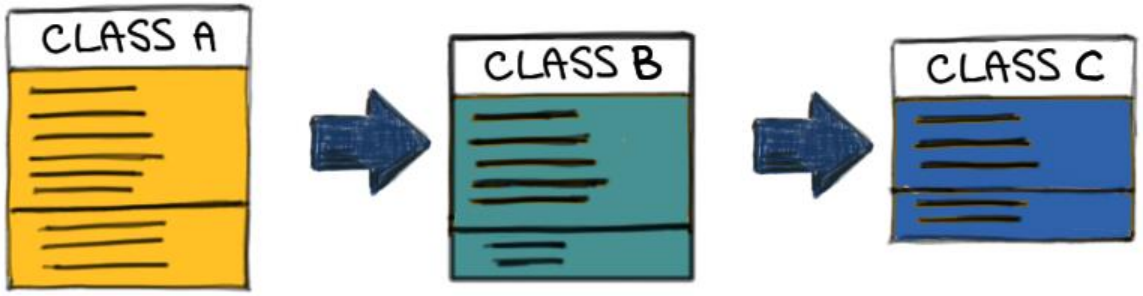

Some examples of refactoring

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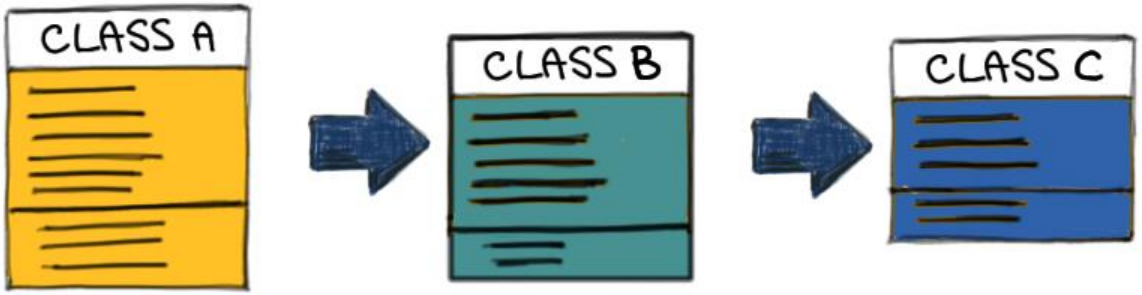

Some examples of refactoring

Some examples of "bad smells" in code

THERE ARE MANY REFACTORINGS

Add parameter
Change association
Reference to value
Value to reference
Collapse hierarchy
Consolidate conditionals
Procedures to objects
Decompose conditionals
Encapsulate collection

Encapsulate downcast
Encapsulate field
Extract method
Extact class
Inline class
Form template method
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A superclass and a subclass are too similar

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CONSOLIDATE CONDITIONAL EXPRESSION

Set of conditionals with the same results
=> combine and extract them

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double disabilityAmount(){
    if (seniority<2)
        return 0;
    if (monthsDisabled>12)
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    if (isPartTime)
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    // compute disability amount
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```
double disabilityAmount(){
    if (notEligibleForDisability())
        return 0;
    // compute disability amount
}
```

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⇒ extract methods from conditions
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```
if (not Summer(date))
    charge = winterCharge(quantity)
else
    charge = summerCharge(quantity)
```

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A class is doing the work of two classes

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A class is not doing much

⇒ move its features into another class and delete this one

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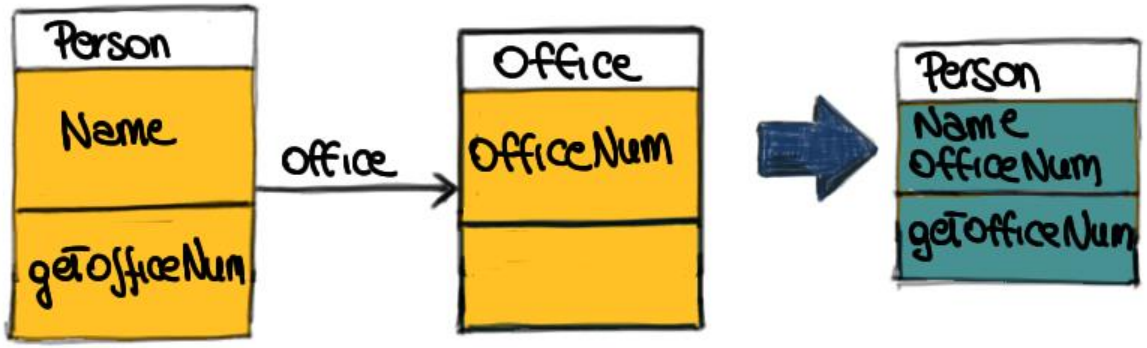

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Cohesive code fragment in a large method

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void printOwing(){
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   System.out.println("name:"+ name+
                      "address:"+address);
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   System.out.println("amount owned "+
                      amount)
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```
void printOwing(){
...
   printDetails();
...
}
void printDetails(){
   System.out.println("name"+...);
   ...
   System.out.println("amount...);
}
```

HOW CAN WE ACTUALLY PERFORM REFACTORING ?

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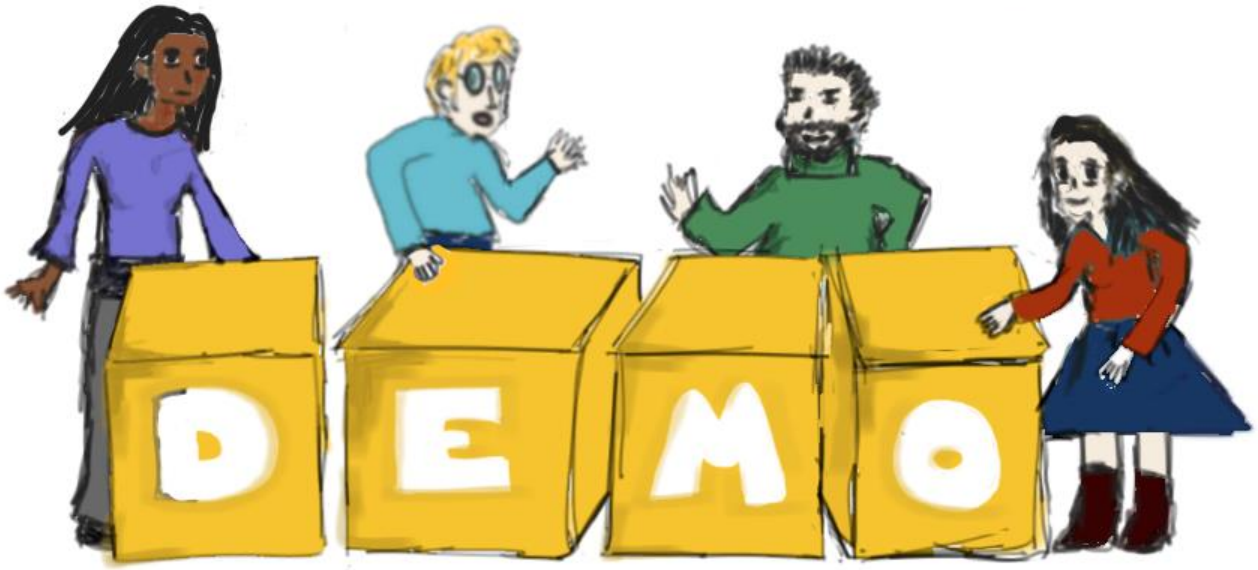


When is it appropriate to apply refactoring "extract method"?

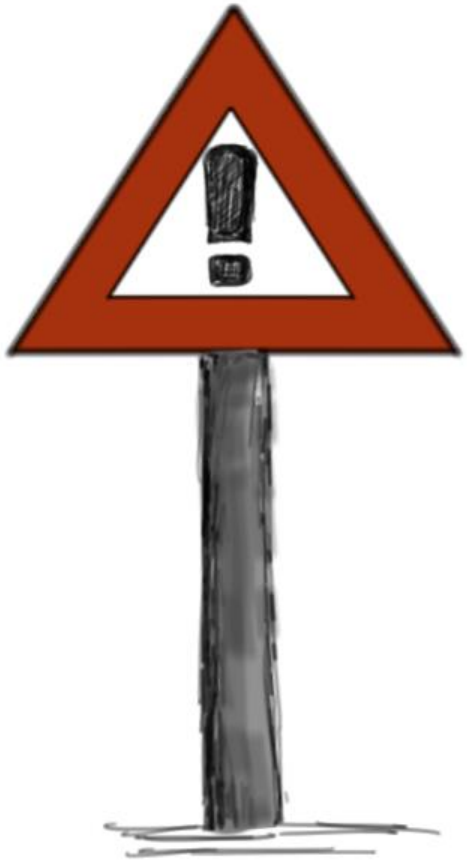
[ ] When there is duplicated code in two or more methods

[ ] When a class is too large

[ ] When the names of two classes are too similar

[ ] When a method is highly coupled with a class other than the one where it is defined

REFACTORING RISKS



Powerful tool, but ...

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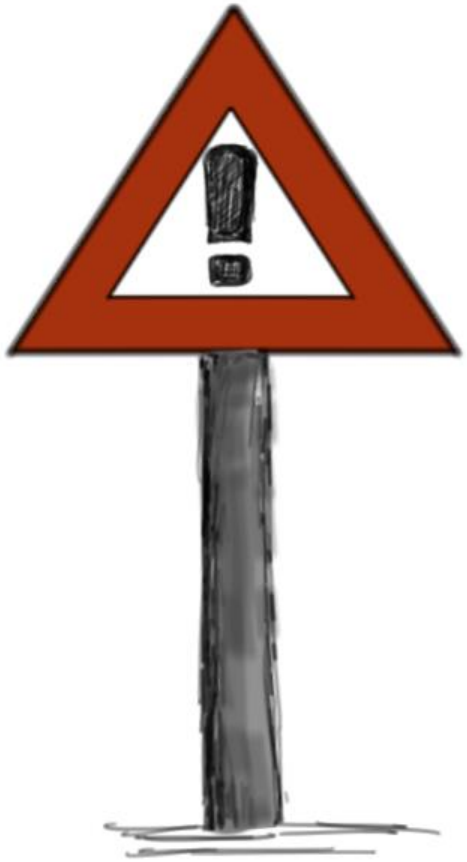

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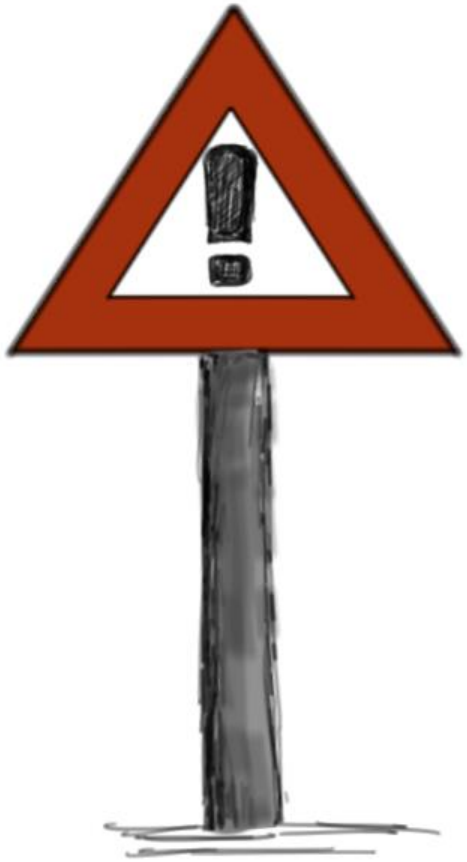

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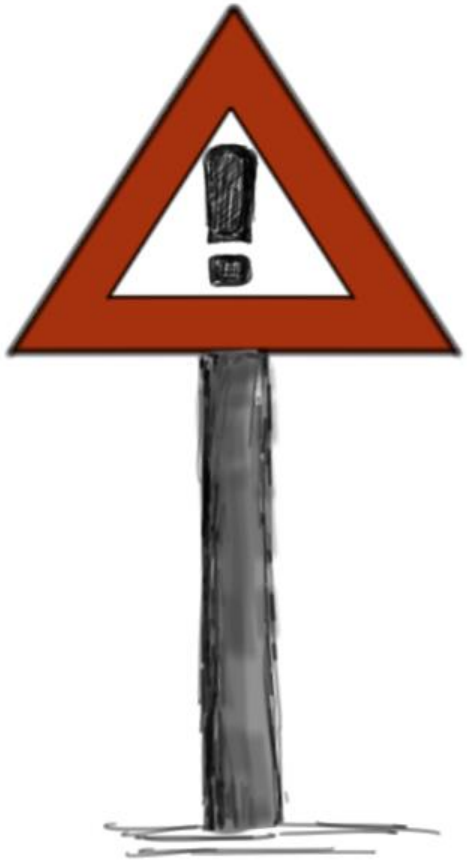

Powerful tool, but ...

- May introduce subtle faults
- Should not be abused
- Should be used carefully on systems in production

COST OF REFACTORING

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Manual work

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Test development and maintenance

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Manual work

Test development and maintenance

Documentation maintenance

WHEN NOT TO REFACTOR?

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When code is broken

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When a deadline is close

WHEN NOT TO REFACTOR?

When code is broken

When a deadline is close

When there is no reason to!


BAD SMELLS

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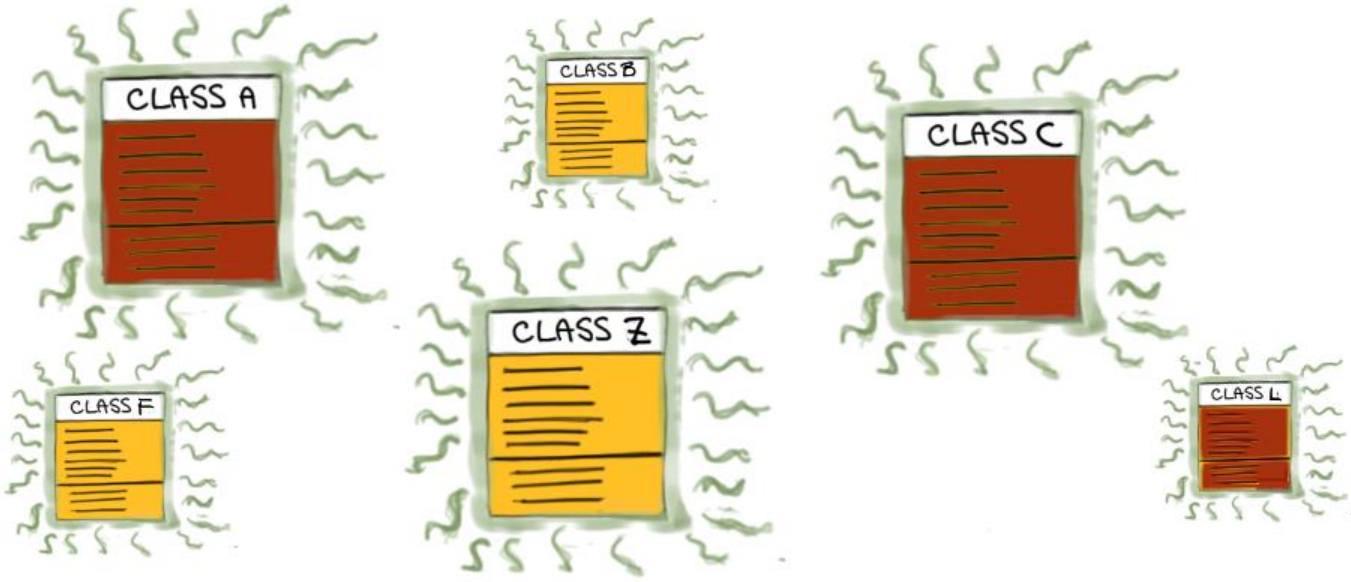

A CATALOGUE OF BAD SMELLS

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- Duplicated code
- Long method
- Large class
- Long parameter list
- Divergent change
- Shotgun surgery
- Feature envy
- Data clumps
- Primitive obsession
- Switch statements
- Parallel inheritance hierarchy
- Lazy class
- Speculative generality
- Temporary field
- Message chains
- Middle man
- Inappropriate intimacy
- Incomplete library class
- Data class
- Refused bequest

A FEW EXAMPLES

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Duplicated code

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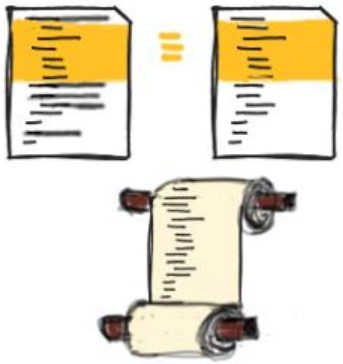

Duplicated code ➡ extract method

Long method

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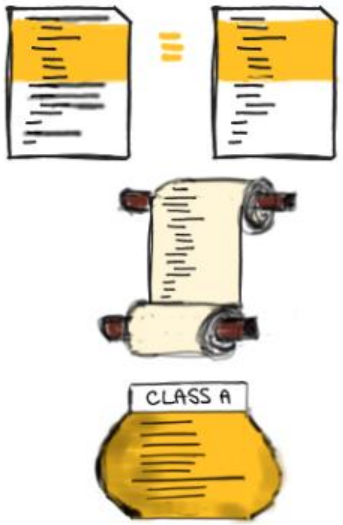

Duplicated code ➡ extract method

Long method ➡ extract method, decompose conditionals, ...

Large class

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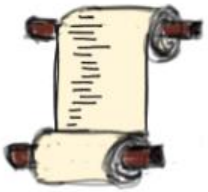

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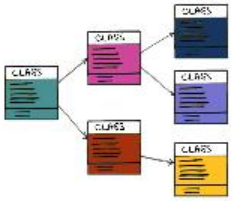
Large class ➡ extract class (or subclass)



Shotgun surgery ➡ move method / field, inline class, ...

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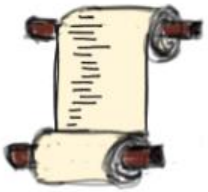

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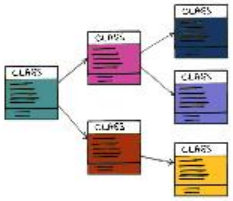

Shotgun surgery ➡ move method / field, inline class, ...

Feature envy

Which of the following can be considered to be "bad smells" in the context of refactoring?

[ ] The program takes too long to execute

[ ] Method m() in class C is very long

[ ] Classes Cat and Dog are subclasses of class Animal

[ ] Every time we modify method m1(), we also need to modify method m2()