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Agile Software Development

Refactoring

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Motivation

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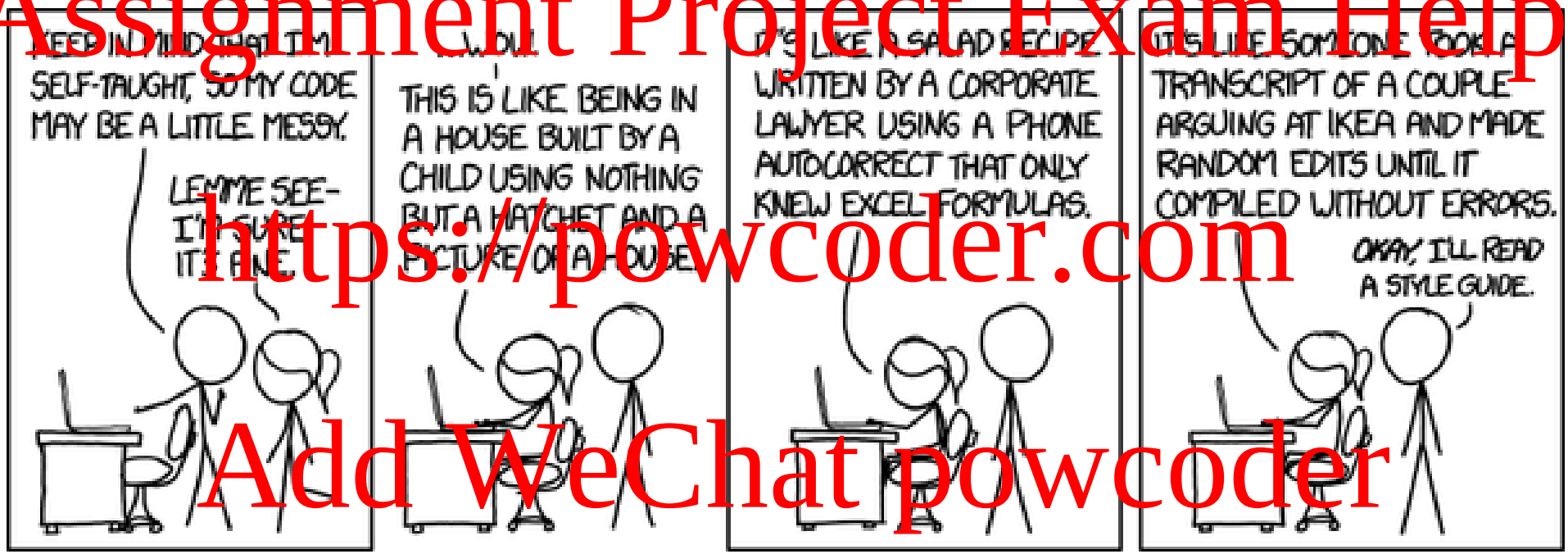

Noun

"A change made to the internal structure of software to make it easier to understand and cheaper to modify without changing its observable behavior." [1]

Verb

"To restructure software by applying a series of refactorings without changing its observable behavior." [1]

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DRY: Don't Repeat Yourself

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SOLID

Software Development is not a Jenga game

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Bad Smells

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Find ways to avoid duplicate code. This is the principle behind DRY (Don't Repeat Yourself).

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The general approach is to move the common code into its own method or class and reuse it.

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Long Method

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Long methods are hard to:

- Test.
- Understand.

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It's often possible to extract components of large methods into smaller ones that are simpler to test, understand and maintain.

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Long Parameter List

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Long parameter lists are often hard to understand and maintain.

In general it's better practice to pass objects that contain the data rather than the data itself.

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Be careful about following this guidance on remote methods. Object serialization may introduce unacceptable performance and network overhead.

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Divergent Change

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Occurs when a single class is changed in common ways for different reasons. For example, changing some methods of a class to support new databases and other methods in the same class to support integration to a new service provider. This is a good indicator that this single class should really be two classes.

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Some code quality metrics, like LCOM, can help identify this kind of problem since such classes will typically not be cohesive.

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Each time you want to make a change, you need to make lots of smaller changes in many different classes.

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This is a good sign that all of those smaller methods can be aggregated into a single class.

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A method of one class requires lots of data from another class in order to perform its job.

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Usually a sign that the method is in the wrong class.

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Data clumps are pieces of discrete data that are commonly found together.

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It may make sense to aggregate such data elements into a new class.

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Primitive Obsession

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The use of (multiple) primitive values rather than using a class-based representation.

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The best solution for this smell is to transform those small, primitive fields into classes where any useful, specialized functionality can be incorporated.

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Switch statements often lead to duplicate logic scattered around the code.

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A better approach would be to define an appropriate class hierarchy and rely on polymorphism to handle the different cases.

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Parallel Inheritance Hierarchies

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Each time you create a new subclass in one hierarchy you have to create a new subclass in another.

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Sometimes this is desirable, for instance to support various design patterns. In other cases, collapsing the two hierarchies into a single one might make more sense.

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A class isn't responsible for very much.

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Subclasses can be merged into super classes or inlined into their client classes.

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Speculative Generality

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A class shouldn't have lots of hooks and logic for dealing with speculative future requirements.

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Get rid of all such functionality since it makes things harder to understand.

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One or more fields are used only during certain processing steps and are unused otherwise.

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Move those fields into a new class.

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One object must traverse a long chain of accessor methods to get at the data it really needs. This tightly couples the client object to the structure of hierarchy and the organization of the objects.

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It may be possible to move the method closer to the caller by either physically moving it or by providing a delegate method.

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Too many delegating methods are located in a single class.

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It may be worthwhile to get rid of the middle-man class and have the caller interact with the real objects.

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Two classes know to much about one another's inner workings.

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Rework the code to enforce stricter encapsulation. Possibly replace inheritance with delegation.

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Alternative Classes with Different Interfaces

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Multiple methods on the same class that do the same thing have different signatures.

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Consolidate the methods. Possibly construct new superclasses to inherit shared functionality.

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Incomplete Library Class

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Libraries may not provide all of the features or capabilities that we need.

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Introducing new methods or classes to an external library isn't a good idea. We instead use inheritance and the constructive use of local methods to extend the library's behavior.

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This is the classic “Value Object” structure where a class has data members and associated accessors and mutators.

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The class needs more responsibility ensure that other classes are not performing tasks this class should be doing for itself.

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Refused Bequest

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A subclass doesn't want the implementation of its parent.

This may be a sign that the hierarchy is wrong. If it's causing confusion, address the issue. If not, it may be easier to do nothing.

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It's a different issue if the subclass doesn't want the parent's interface. Then you're likely looking at a case of bad inheritance that should be replaced by delegation.

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[1] Martin Fowler.
Refactoring.
Addison Wesley, 2002.

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