Results of Code Smells Identification & Refactoring

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Tools Used

Smells(s)/Violation(s)/Bug(s)	Tool(s)	Type of Tool
Feature Envy	JDeodorant	Eclipse Plugin
God Class	JDeodorant	Eclipse Plugin
Switch Statement Smell	JDeodorant	Eclipse Plugin
Long Method	PMD	Eclipse Plugin
Short/Long variable	PMD	Eclipse Plugin
Data Flow Anomalies (DU)	PMD	Eclipse Plugin
Empty Catch	PMD	Eclipse Plugin
Dead Code	PMD Incode	Eclipse Plugin Standalone
Data Class	Incode	Standalone
Similar Code	Eclipse	Out of the Box
Thread declared without name	FindBugs	Eclipse Plugin
Naked Notify	FindBugs	Eclipse Plugin
Thread.sleep() with lock held	FindBugs	Eclipse Plugin
Unconditional Wait	FindBugs	Eclipse Plugin
Wait not in loop	FindBugs	Eclipse Plugin
Write to Static Field from Instance method	FindBugs	Eclipse Plugin
Long Parameter List	No tools used - Manual Review	None
Middle Man	No tools used - Manual Review	None

Location of Source Code Smells

Smells(s)/Violation(s)/Bug(s)	File Name(s)	Lines of Code
Feature Envy	ATM.java	266 - 271
Long Method	Transaction.java	94 - 205
Dead Code	ATM.java	226 – 233, 11
God Class	Simulation.java	76 – 113, 203 – 217
Data Class	Message.java	99 - 226
Long Parameter List	ATMPanel.java	29 - 36
Switch Statement Smell	SimKeyboard.java	174 - 218
Middle Man	Log.java	27 - 60
Short/Long variable	ATM.java	286, 369
Empty Catch	ATM.java	79 - 81
Thread declared without name	ATMMain.java	55
Similar Code	SimEnvelopeAcceptor.java	58 - 84
Naked Notify	SimEnvelopeAcceptor.java	99
Thread.sleep() with lock held	SimEnvelopeAcceptor.java	71
Unconditional Wait	ATM.java	77
Wait not in loop	ATM.java	77
Write to Static Field from Instance method	Simulation.java	55
Data Flow Anomalies (DU)	SimKeyboard.java	100

Mapping for Code Smells and Refactoring Techniques

Smells(s)/Violation(s)/Bug(s)	Refactoring Technique
Feature Envy	Move Method
Long Method	Extract Method
Dead Code	Code Removal
God Class	Extract Class
Data Class	Move Method
Long Parameter List	Pass Object
Switch Statement Smell	Replace Code by Type/Strategy
Middle Man	Move Method and Class Removal
Short/Long variable	Use proper naming conventions
Empty Catch	Remove catch block/Catch and re-throw
Thread declared without name	Give a meaningful name when declaring threads
Similar Code	Create one function containing similar code to reuse
Naked Notify	Make change to mutable state before notify
Thread.sleep() with lock held	Use wait() instead
Unconditional Wait	Introduce condition for wait
Wait not in loop	Modify to call wait in a while loop
Write to Static Field from Instance method	Use Singleton Design Pattern
Data Flow Anomalies (DD, DU)	Remove redefinition of variables (DD), place variables so that they are not undefined after defined recently (DU)

Metrics Improved in Refactored Code

Metric(s) Improved	Before Refactoring	After Refactoring
Abstractness	4.6%	5.7%
Average Cyclomatic Complexity	1.54 (maximum: 16)	1.45 (maximum: 9)
Average LOC per method	10.90	9.11
Average number of fields per type	1.44	1.38