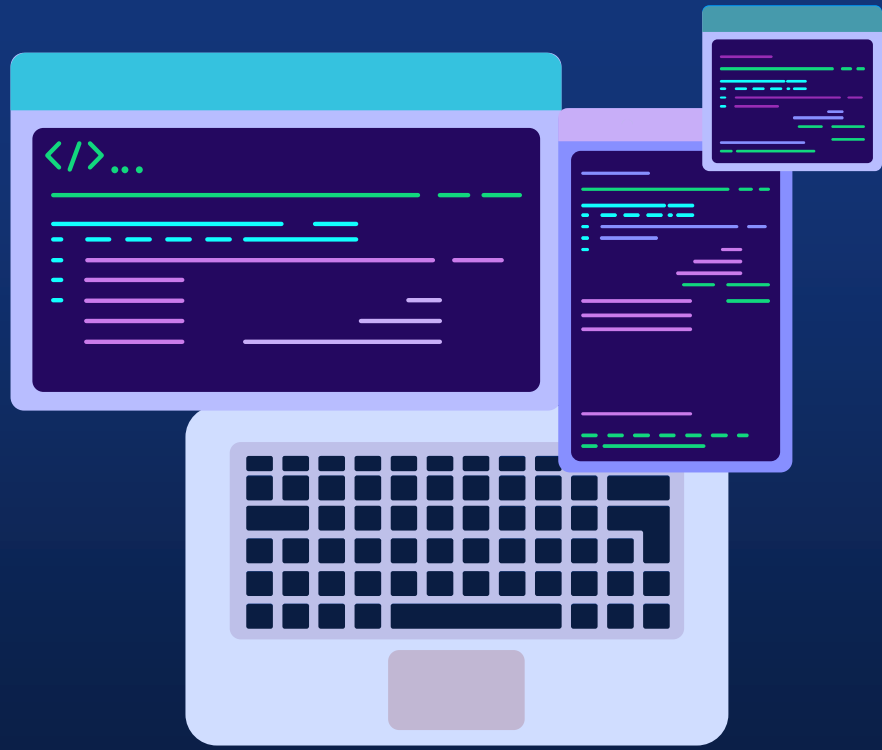
Software Design and Important concepts



Mentor: Einar Rocha

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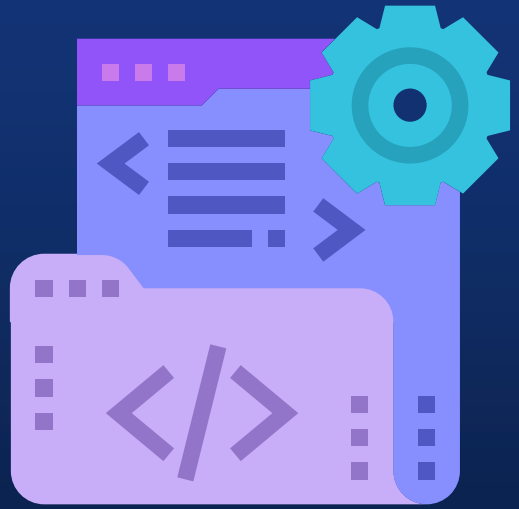
02

Clean Code



The Goals of Software Design

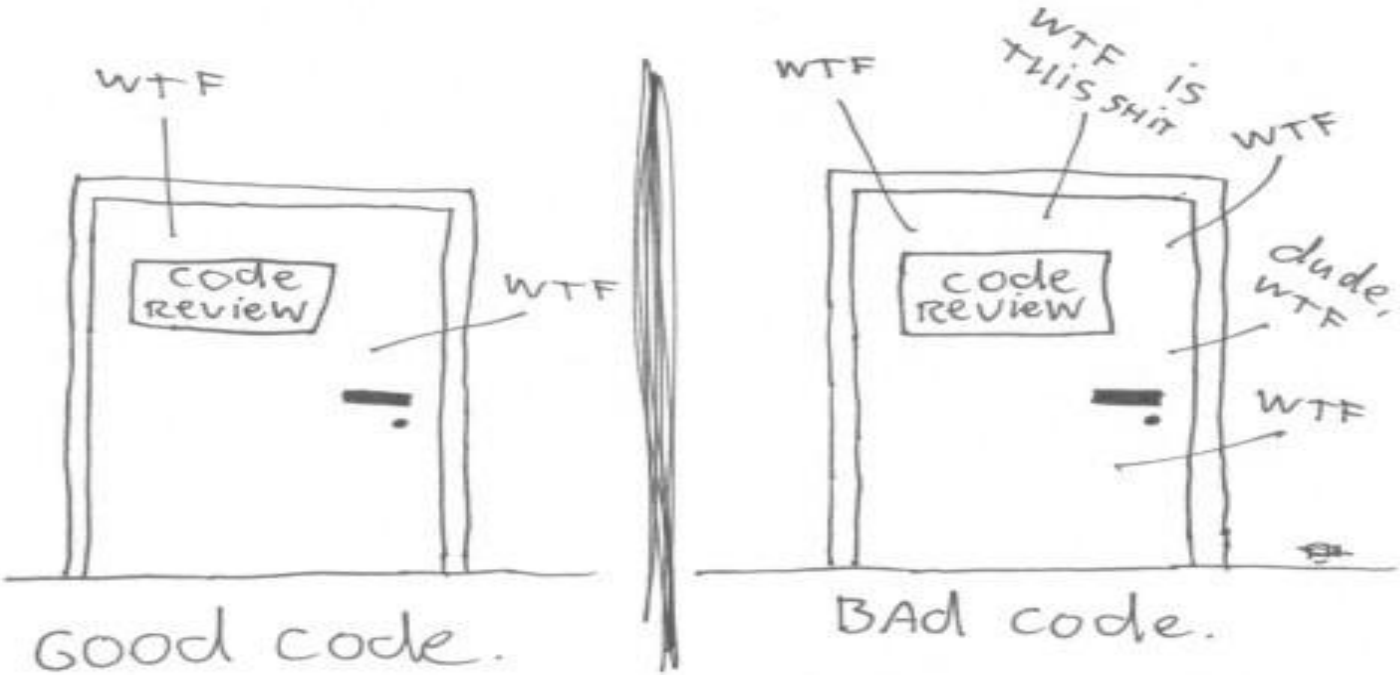
- To allow us to write software that is as helpful as possible.
- To allow our software to continue to be as helpful as possible.
- To design systems that can be created and maintained as easily as possible by their programmers

Agenda

Functions — Small, Do One thing, Descriptive names, arguments, side effects...

Comments — Explain yourself in code, Good comments, Bad comments...

The ONLY VALID MEASUREMENT OF CODE QUALITY: WTFs/MINUTE



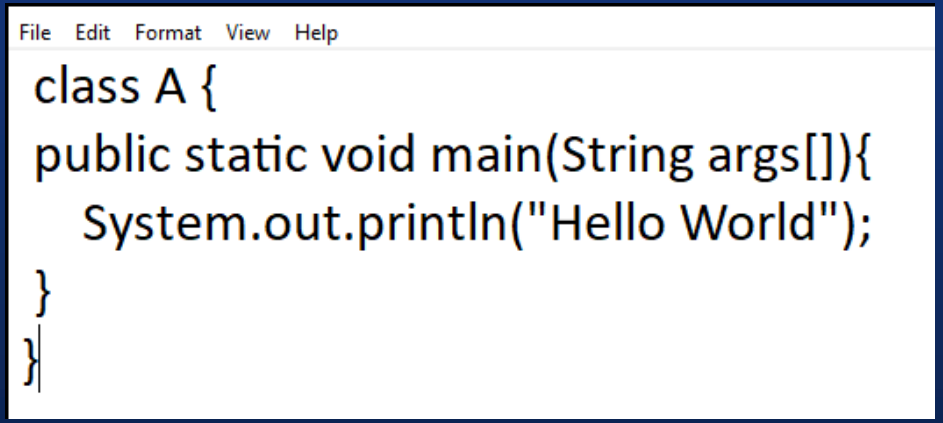
HtmlUtil.java

```
package com.clean;

public class TestHtml {
  public static String testableHtml(
      PageData pageData,
      boolean includeSuiteSetup
  ) throws Exception {
    WikiPage wikiPage = pageData.getWikiPage();
    StringBuffer buffer = new StringBuffer();
    if (pageData.hasAttribute("Test")) {
      if (includeSuiteSetup) {
        WikiPage suiteSetup =
            PageCrawlerImpl.getInheritedPage(
                SuiteResponder.SUITE_SETUP_NAME, wikiPage
            );
        if (suiteSetup != null) {
          WikiPagePath pagePath =
              suiteSetup.getPageCrawler().getFullPath(suiteSetup);
          String pagePathName = PathParser.render(pagePath);
          buffer.append("!include -setup .")
              .append(pagePathName)
              .append("\n");
        }
      }
      WikiPage setup =
          PageCrawlerImpl.getInheritedPage("SetUp", wikiPage);
      if (setup != null) {
        WikiPagePath setupPath =
            wikiPage.getPageCrawler().getFullPath(setup);
        String setupPathName = PathParser.render(setupPath);
        buffer.append("!include -setup .")
            .append(setupPathName)
            .append("\n");
      }
    }
    buffer.append(pageData.getContent());
    if (pageData.hasAttribute("Test")) {
      WikiPage teardown =
          PageCrawlerImpl.getInheritedPage("TearDown", wikiPage);
      if (teardown != null) {
        WikiPagePath tearDownPath =
            wikiPage.getPageCrawler().getFullPath(teardown);
        String tearDownPathName = PathParser.render(tearDownPath);
        buffer.append("\n")
            .append("!include -teardown .")
            .append(tearDownPathName)
            .append("\n");
      }
    }
    if (includeSuiteSetup) {
      WikiPage suiteTeardown =
          PageCrawlerImpl.getInheritedPage(
              SuiteResponder.SUITE_TEARDOWN_NAME,
              wikiPage
          );
      if (suiteTeardown != null) {
        WikiPagePath pagePath =
            suiteTeardown.getPageCrawler().getFullPath(suiteTeardown);
        String pagePathName = PathParser.render(pagePath);
        buffer.append("!include -teardown .")
            .append(pagePathName)
            .append("\n");
      }
    }
    pageData.setContent(buffer.toString());
    return pageData.getHtml();
  }

}
```

HtmlUtil.java

```
public static String renderPageWithSetupsAndTeardowns(
        PageData pageData, boolean isSuite
) throws Exception {
    boolean isTestPage = pageData.hasAttribute("Test");
    if (isTestPage) {
        WikiPage testPage = pageData.getWikiPage();
        StringBuffer newPageContent = new StringBuffer();
        includeSetupPages(testPage, newPageContent, isSuite);
        newPageContent.append(pageData.getContent());
        includeTeardownPages(testPage, newPageContent, isSuite);
        pageData.setContent(newPageContent.toString());
    }
    return pageData.getHtml();
}
```

Small


File Edit Format View Help
class A {
public static void main(String args[]){
System.out.println("Hello World");
}
}

HtmlUtil.java

```
public static String renderPageWithSetupsAndTeardowns(
      PageData pageData, boolean isSuite) throws Exception {
   if (isTestPage(pageData))
      includeSetupAndTeardownPages(pageData, isSuite);
   return pageData.getHtml();
}
```

Do One Thing

HtmlUtil.java

```
public static String renderPageWithSetupsAndTeardowns(
        PageData pageData, boolean isSuite) throws Exception {
    if (isTestPage(pageData))1
        includeSetupAndTeardownPages(pageData, isSuite);2
    return pageData.getHtml(); 3
}
```

HtmlUtil.java

```
public static String renderPageWithSetupsAndTeardowns(
        //Initialize
        ..................

        //Do something
        ..................

        //Validate
        ..............
}
```

Use Descriptive Names

```
public static String testHtml(
....
}


//To


public static String renderPageWithSetupsAndTeardowns(
....
}
```

Function Arguments

```
.....
public static String getHtml()


//AVOID
public static String get(String arg1, String, arg2, String arg3, String arg4)
```

Flag Arguments

```
.....
includeSetupAndTeardownPages(pageData, isSuite);


//To

includeSetupAndTeardownPagesForSuite(pageData);

includeSetupAndTeardownPagesForReport(pageData);
```

Dyadic Functions

```
.....
writeField(output-Stream, name);
```

```
writeField(name);
Point p = new Point(0,0);
assertEquals(expected, actual);
```

Triads Functions

```
.....
assertEquals(message, expected, actual)
```

Triads Functions

```
Circle makeCircle(double x, double y, double radius);
Circle makeCircle(Point center, double radius);
```

Side effects

```
public boolean checkPassword(String userName, String password) {
    User user = UserGateway.findByName(userName);
    if (user != User.NULL) {
        String codedPhrase = user.getPhraseEncodedByPassword();
        String phrase = cryptographer.decrypt(codedPhrase, password);
        if ("Valid Password".equals(phrase)) {
            Session.initialize();
            return true;
        }
    }
    return false;
}
```

Command Query Separation

```
public boolean set(String attribute, String value);

.....
if (set("username", "unclebob"))
```

```
if (attributeExists("username")) {
      setAttribute("username", "unclebob");
      ...
   }
```

Prefer Exceptions to Returning Error Codes

```
if (deletePage(page) == E_OK) {
    if (registry.deleteReference(page.name) == E_OK) {
        if (configKeys.deleteKey(page.name.makeKey()) == E_OK){
            logger.log("page deleted");
        } else {
            logger.log("configKey not deleted");
        }
    } else {
        logger.log("deleteReference from registry failed");
    }
} else {
    logger.log("delete failed");
    return E_ERROR;
}
```

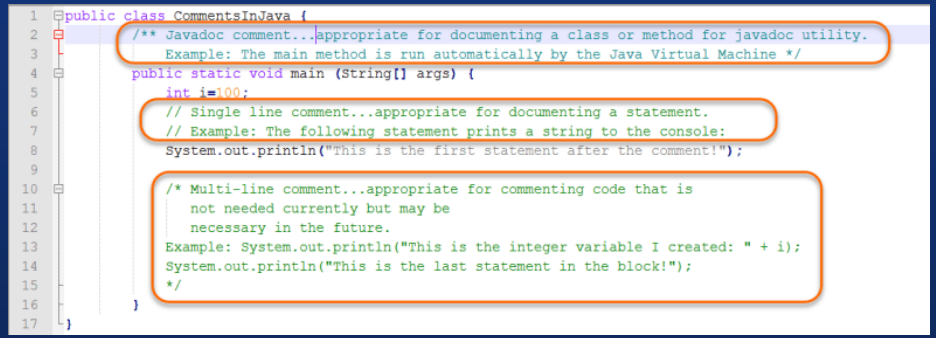
Prefer Exceptions to Returning Error Codes

```
try {
    deletePage(page);
    registry.deleteReference(page.name);
    configKeys.deleteKey(page.name.makeKey());
}
catch (Exception e) {
    logger.log(e.getMessage());
}
```

Extract Try/Catch Blocks

```
public void delete(Page page) {
    try {
        deletePageAndAllReferences(page);
    }
    catch (Exception e) {
        logError(e);
    }
}
private void deletePageAndAllReferences(Page page) throws Exception {
    deletePage(page);
    registry.deleteReference(page.name);
    configKeys.deleteKey(page.name.makeKey());
}
```

Comments



```
1  public class CommentsInJava {
2      /** Javadoc comment...appropriate for documenting a class or method for javadoc utility.
3          Example: The main method is run automatically by the Java Virtual Machine */
4      public static void main (String[] args) {
5          int i=100;
6          // Single line comment...appropriate for documenting a statement.
7          // Example: The following statement prints a string to the console:
8          System.out.println("This is the first statement after the comment!");
9
10         /* Multi-line comment...appropriate for commenting code that is
11            not needed currently but may be
12            necessary in the future.
13         Example: System.out.println("This is the integer variable I created: " + i);
14         System.out.println("This is the last statement in the block!");
15         */
16     }
17 }
```

Old Comments

```
MockRequest request;
// Example: "Tue, 02 Apr 2003 22:18:49 GMT"
private Response response;
private FitNesseContext context;
private FileResponder responder;
private Locale saveLocale;
private final String HTTP_DATE_REGEXP =
      "[SMTWF][a-z]{2}\\,\\s[0-9]{2}\\s[JFMASOND][a-z]{2}\\s"+
           "[0-9]{4}\\s[0-9]{2}\\:[0-9]{2}\\:[0-9]{2}\\sGMT";
```

Extract Try/Catch Blocks

```
// Check to see if the employee is eligible for full benefits
if ((employee.flags & HOURLY_FLAG) &&
        (employee.age > 65))

// To
if (employee.isEligibleForFullBenefits())
```

Good Comments - Legal

```
// Copyright (C) 2003,2004,2005 by Object Mentor, Inc. All rights reserved.
// Released under the terms of the GNU General Public License version 2 or later.
package com.clean;
```

Good Comments - Informative

```
// Returns an instance of the Responder being tested.
protected abstract Responder responderInstance();

//maybe?


protected abstract Responder responderBeingTested();
```

Good Comments - Explanation of Intent

```
public int compareTo(Object o)
{
   if(o instanceof WikiPagePath)
   {
      WikiPagePath p = (WikiPagePath) o;
      String compressedName = StringUtil.join(names, "");
      String compressedArgumentName = StringUtil.join(p.names, "");
      return compressedName.compareTo(compressedArgumentName);
   }
   return 1; // we are greater because we are the right type.
}
```

Good Comments - Clarification

```
public void testCompareTo() throws Exception
{
   WikiPagePath a = PathParser.parse("PageA");
   WikiPagePath ab = PathParser.parse("PageA.PageB");
   WikiPagePath b = PathParser.parse("PageB");
   WikiPagePath aa = PathParser.parse("PageA.PageA");
   assertTrue(a.compareTo(a) == 0); // a == a
   assertTrue(a.compareTo(b) != 0); // a != b
   assertTrue(ab.compareTo(ab) == 0); // ab == ab
   assertTrue(a.compareTo(b) == -1); // a < b
   assertTrue(aa.compareTo(ab) == -1); // aa < ab
   assertTrue(b.compareTo(a) == 1); // b > a
   assertTrue(ab.compareTo(aa) == 1); // ab > aa
}
```

Good Comments - Warning of Consequences

```
// Don't run unless you
// have some time to kill.
public void _testWithReallyBigFile()
{
    writeLinesToFile(10000000);
    response.setBody(testFile);
    response.readyToSend(this);
    String responseString = output.toString();
    assertSubString("Content-Length: 1000000000", responseString);
    assertTrue(bytesSent > 1000000000);
}
```

Good Comments - ToDo

```
// TODO-MdM these are not needed
// We expect this to go away when we do the checkout model
protected versionInfo makeVersion() throws Exception
{
   return null;
}
```

Good Comments - Amplification

```
String listItemContent = match.group(3).trim();
// the trim is real important. It removes the starting
// spaces that could cause the item to be recognized
// as another list.
new ListItemWidget(this, listItemContent, this.level + 1);
return buildList(text.substring(match.end()));
```

Good Comments - Javadocs in Public APIs

```java
/**
 * <p>This is a simple description of the method. . .
 * <a href="http://www.supermanisthegreatest.com">Superman!</a>
 * </p>
 * @param incomingDamage the amount of incoming damage
 * @return the amount of health hero has after attack
 * @see <a href="http://www.link_to_jira/HERO-402">HERO-402</a>
 * @since 1.0
 */
public int successfullyAttacked(int incomingDamage) {
   // do things
   return 0;
}
```

Bad Comments - Mumbling

```
public void loadProperties()
{
   try
   {
      String propertiesPath = propertiesLocation + "/" + PROPERTIES_FILE;
      FileInputStream propertiesStream = new FileInputStream(propertiesPath);
      loadedProperties.load(propertiesStream);
   }
   catch(IOException e)
   {
      // No properties files means all defaults are loaded
   }
}
```

Bad Comments - Redundant Comments

```
// Utility method that returns when this.closed is true. Throws an exception
// if the timeout is reached.
public synchronized void waitForClose(final long timeoutMillis)
        throws Exception
{
    if(!closed)
    {
        wait(timeoutMillis);
        if(!closed)
            throw new Exception("MockResponseSender could not be closed");
    }
}
```

Bad Comments - Redundant Comments

```
public abstract class ContainerBase
      implements Container, Lifecycle, Pipeline,
      MBeanRegistration, Serializable {
   /**
    * The processor delay for this component.
    */
   protected int backgroundProcessorDelay = -1;
   /**
    * The lifecycle event support for this component.
    */
   protected LifecycleSupport lifecycle =
         new LifecycleSupport(this);
   /**
    * The container event listeners for this Container.
    */
   protected ArrayList listeners = new ArrayList();
   /**
    * The Loader implementation with which this Container is
    * associated.
    */
   protected Loader loader = null;
   /**
    * The Logger implementation with which this Container is
    * associated.
    */
   protected Log logger = null;
   /**
    * Associated logger name.
    */
   protected String logName = null;
.....................
```

Bad Comments - Misleading Comments

```
// Utility method that returns when this.closed is true. Throws an exception
// if the timeout is reached.
public synchronized void waitForClose(final long timeoutMillis)
        throws Exception
{
    if(!closed)
    {
        wait(timeoutMillis);
        if(!closed)
            throw new Exception("MockResponseSender could not be closed");
    }
}
```

Bad Comments - Mandated Comments

```
/**
 *
 * @param title The title of the CD
 * @param author The author of the CD
 * @param tracks The number of tracks on the CD
 * @param durationInMinutes The duration of the CD in minutes
 */
public void addCD(String title, String author,
                  int tracks, int durationInMinutes) {
    CD cd = new CD();
    cd.title = title;
    cd.author = author;
    cd.tracks = tracks;
    cd.duration = duration;
    cdList.add(cd);
}
```

Bad Comments - Journal Comments

```
/**
 * Changes (from 11-Oct-2001)
 * --------------------------
 * 11-Oct-2001 : Re-organised the class and moved it to new package
 * com.jrefinery.date (DG);
 * 05-Nov-2001 : Added a getDescription() method, and eliminated NotableDate
 * class (DG);
 * 12-Nov-2001 : IBD requires setDescription() method, now that NotableDate
 * class is gone (DG); Changed getPreviousDayOfWeek(),
 * getFollowingDayOfWeek() and getNearestDayOfWeek() to correct
 * bugs (DG);
 * 05-Dec-2001 : Fixed bug in SpreadsheetDate class (DG);
 * 29-May-2002 : Moved the month constants into a separate interface
 * (MonthConstants) (DG);
 * 27-Aug-2002 : Fixed bug in addMonths() method, thanks to N???levka Petr (DG);
 * 03-Oct-2002 : Fixed errors reported by Checkstyle (DG);
 * 13-Mar-2003 : Implemented Serializable (DG);
 * 29-May-2003 : Fixed bug in addMonths method (DG);
 * 04-Sep-2003 : Implemented Comparable. Updated the isInRange javadocs (DG);
 * 05-Jan-2005 : Fixed bug in addYears() method (1096282) (DG);
 */
```

Bad Comments - Noise Comments

```java
/**
 * Returns the day of the month.
 *
 * @return the day of the month.
 */
public int getDayOfMonth() {
   return dayOfMonth;
}
```

Bad Comments - Scary Noise

```
/** The name. */
private String name;
/** The version. */
private String version;
/** The licenceName. */
private String licenceName;
/** The version. */
private String info;
```

Don’t Use a Comment When You Can Use a Function or a Variable

```
// does the module from the global list <mod> depend on the
// subsystem we are part of?
if (smodule.getDependSubsystems().contains(subSysMod.getSubSystem()))



ArrayList moduleDependees = smodule.getDependSubsystems();
String ourSubSystem = subSysMod.getSubSystem();
if (moduleDependees.contains(ourSubSystem))
```

Bad Comments - Scary Noise

```
// Initializers ////////////////////////////////

.............

// Actions ////////////////////////////////

.............

// Functions ////////////////////////////////

.............
```

Bad Comments - Closing Brace Comments

```
BufferedReader in = new BufferedReader(new InputStreamReader(System.in));
String line;
int lineCount = 0;
int charCount = 0;
int wordCount = 0;
try {
   while ((line = in.readLine()) != null) {
      lineCount++;
      charCount += line.length();
      String words[] = line.split("\\W");
      wordCount += words.length;
   } //while
   System.out.println("wordCount = " + wordCount);
   System.out.println("lineCount = " + lineCount);
   System.out.println("charCount = " + charCount);
} // try
catch (IOException e) {
   System.err.println("Error:" + e.getMessage());
} //catch
```

Bad Comments - Commented-Out Code

```
InputStreamResponse response = new InputStreamResponse();
response.setBody(formatter.getResultStream(), formatter.getByteCount());
// InputStream resultsStream = formatter.getResultStream();
// StreamReader reader = new StreamReader(resultsStream);
// response.setContent(reader.read(formatter.getByteCount()));
```

Bad Comments - HTML Comments

```
/**
 * Task to run fit tests.
 * This task runs fitnesse tests and publishes the results.
 * <p/>
 * <pre>
 * Usage:
 * &lt;taskdef name=&quot;execute-fitnesse-tests&quot;
 * classname=&quot;fitnesse.ant.ExecuteFitnesseTestsTask&quot;
 * classpathref=&quot;classpath&quot; /&gt;
 * OR
 * &lt;taskdef classpathref=&quot;classpath&quot;
 * resource=&quot;tasks.properties&quot; /&gt;
 * <p/>
 * &lt;execute-fitnesse-tests
 * suitepage=&quot;FitNesse.SuiteAcceptanceTests&quot;
 * fitnesseport=&quot;8082&quot;
 * resultsdir=&quot;${results.dir}&quot;
 * resultshtmlpage=&quot;fit-results.html&quot;
 * classpathref=&quot;classpath&quot; /&gt;
 * </pre>
 */
```

Bad Comments - Nonlocal Information

```
/**
 * Port on which fitnesse would run. Defaults to <b>8082</b>.
 *
 * @param fitnessePort
 */
public void setFitnessePort(int fitnessePort)
{
   this.fitnessePort = fitnessePort;
}
```

Bad Comments - Too Much Information

```
/**
 * RFC 2045 - Multipurpose Internet Mail Extensions (MIME)
 *       Part One: Format of Internet Message Bodies
 *       section 6.8. Base64 Content-Transfer-Encoding
 *       The encoding process represents 24-bit groups of input bits as output
 *       strings of 4 encoded characters. Proceeding from left to right, a
 *       24-bit input group is formed by concatenating 3 8-bit input groups.
 *       These 24 bits are then treated as 4 concatenated 6-bit groups, each
 *       of which is translated into a single digit in the base64 alphabet.
 *       When encoding a bit stream via the base64 encoding, the bit stream
 *       must be presumed to be ordered with the most-significant-bit first.
 *       That is, the first bit in the stream will be the high-order bit in
 *       the first 8-bit byte, and the eighth bit will be the low-order bit in
 *       the first 8-bit byte, and so on.
 */
```

Bad Comments - Inobvious Connection

```
/**
 * start with an array that is big enough to hold all the pixels
 * (plus filter bytes), and an extra 200 bytes for header info
 */
this.pngBytes = new byte[((this.width + 1) * this.height * 3) + 200];
```

Bad Comments - Javadocs in Nonpublic Code

```
/**
 * This class Generates prime numbers up to a user specified
 * maximum. The algorithm used is the Sieve of Eratosthenes.
 * <p>
 * Eratosthenes of Cyrene, b. c. 276 BC, Cyrene, Libya --
 * d. c. 194, Alexandria. The first man to calculate the
 * circumference of the Earth. Also known for working on
 * calendars with leap years and ran the library at Alexandria.
 * <p>
 * The algorithm is quite simple. Given an array of integers
 * starting at 2. Cross out all multiples of 2. Find the next
 * uncrossed integer, and cross out all of its multiples.
 * Repeat untilyou have passed the square root of the maximum
 * value.
 *
 * @author Alphonse
 * @version 13 Feb 2002 atp
 */
import java.util.*;
public class GeneratePrimes
{
  /**
   * @param maxValue is the generation limit.
   */
  public static int[] generatePrimes(int maxValue)
  {
```