Effective Java Puzzlers

JSUG 9th Meeting
Vienna, 12.01.2009
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Agenda

i. The books
   - Effective Java & Java Puzzlers

ii. It’s your turn
   - Solve some puzzles at your own

iii. Solve’em together
   - Provide solutions and background infos

iv. Good advice
   - Some nuggets to be more effective

v. Summary

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The Books

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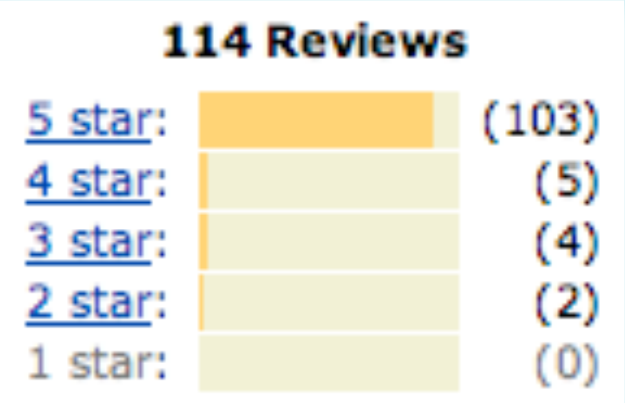
Effective Java

- by Joshua Bloch
  - designed/implemented many Java platform libraries
- 57 items on 252 pages
- program from an API designer's point of view



114 Reviews

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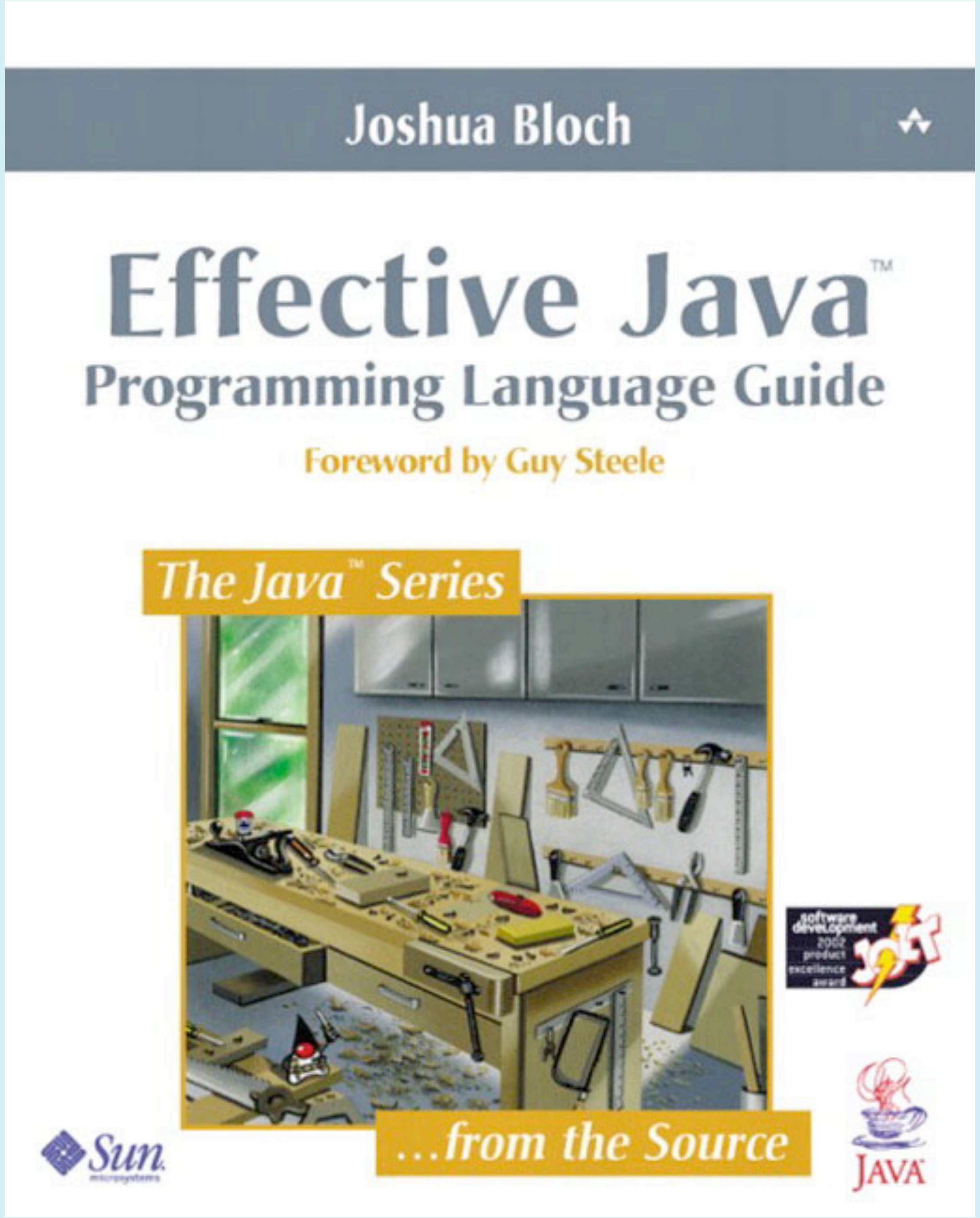
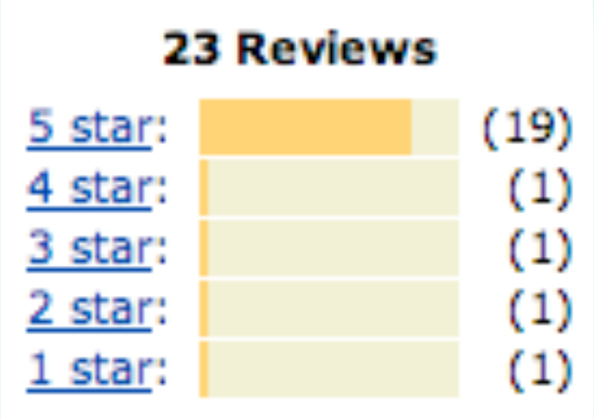


Java Puzzlers

- by Joshua Bloch and Neal Gafter
- 95 puzzles on 282 pages
- Covers different topics
  - Expressions, Strings, Loops, Exceptions, Classes, Threads, Java Library, Serialization



23 Reviews

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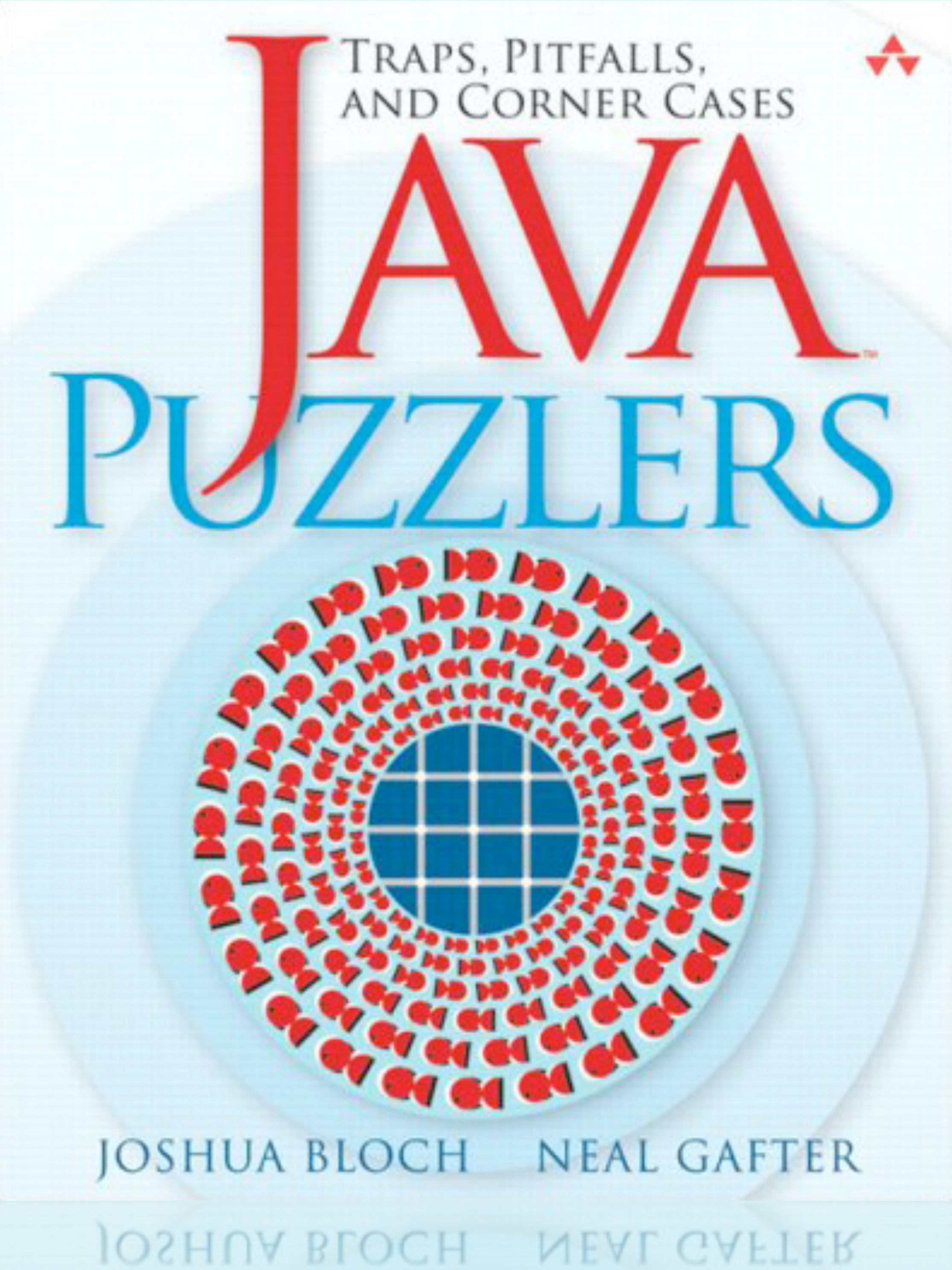

Puzzle Alone

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Puzzle alone

- hand out questionnaires and pencils
  - **18 puzzles**
- **45 minutes** time (max!)
- providing name is **optionally**
  - results will be **evaluated**
  - best result will be placed in “hall of fame”
- most of them are multiple choice
  - make use of “Other...” option
- no talking, no cheating, no use of internet :)

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Puzzle Together

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#1 Simple Subtraction

```
public class SimpleSubtraction {
  public static void main(String[] args) {
    System.out.println(2.00 - 1.10);
  }
}

// solution #1: poor - still uses binary floating-point!
System.out.printf(“%.2f%n”, 2.00 - 1.10);

// solution #2: use integral types
System.out.println((200 - 110) + “ cents”);

// solution #3: use BigDecimal(String)
System.out.println(new BigDecimal(“2.00”).
                       subtract(new BigDecimal(“1.10”)));
```

avoid `float` and `double` where exact answers are required;
for monetary calculations, use `int`, `long` or `BigDecimal`

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2# Simple Addition

```
public class SimpleAddition {
  public static void main(String[] args) {
    System.out.println(12345 + 5432l);
  }
}
```

```
List<String> l = new ArrayList<String>();
l.add("Foo");
System.out.println(1);
```

```
System.out.println(12345 + 5432L);
```

always use a capitel L in `long` literals, never a lowercase l

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#3 Simple Division

```
public class SimpleDivision {
  public static void main(String[] args) {
    final long MICROS_PER_DAY = 24 * 60 * 60 * 1000 * 1000;
    final long MILLIS_PER_DAY = 24 * 60 * 60 * 1000;
    System.out.println(MICROS_PER_DAY / MILLIS_PER_DAY);
  }
}

// computation of constant overflows!
long MICROS_PER_DAY = ((int) (24 * 60 * 60 * 1000 * 1000));
// afterwards widening primitive conversion [JLS 5.1.2]

final long MICROS_PER_DAY = 24L * 60 * 60 * 1000 * 1000;
final long MILLIS_PER_DAY = 24L * 60 * 60 * 1000;
System.out.println(MICROS_PER_DAY / MILLIS_PER_DAY);
```

when working with large numbers,
watch out for **overflow** - it’s a silent killer

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#4 Compound Legal

```
_________ x = _________;
_________ i = _________;
x += i;    // first statement legal
x = x + i; // second statement illegal


short x = 0;
int i = 123456;
x += i;    // narrowing primitive conversion [JLS 5.1.3]
x = x + i; // won’t compile: “possible loss of precision”


// [JLS 15.26.2] says about compound assignment operator:
// E1 op= E2 <==> E1 = (T) ((E1) op (E2))
```

do not use compound assignment operators
on variables of type `byte`, `short` or `char`

#5 Compound Illegal

```
________ x = ________;
________ i = ________;
x += i;    // first statement illegal
x = x + i; // second statement legal




Object x = “object string ”;
String i = “real string”;
x += i;    // left-hand side object reference type != String
x = x + i; // is assignment compatible [JLS 5.2]
           // string concatenation is performed [JLS 15.26.2]
```

#6 Unicode Escapes

```
public class UnicodeEscapes {
  public static void main(String[] args) {
    // \u0022 is the unicode escape for double quote (")
    System.out.println("a\u0022.length() + \u0022b".length());
  }
}

public class LinePrinter {
  public static void printLine() {
    // Note: \u000A is Unicode representation of linefeed (LF)
    char c = 0x000A;
    System.out.print(c);
  }
}
```

do not use Unicode escapes to represent **ASCII** characters;
avoid Unicode escapes except where they are **truly necessary**

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#7 Classify Characters

```
public class Classifier {
  public static void main(String[] args) {
    System.out.println(classify('n') +
                       classify('+') + classify('2'));
  }
  public static String classify(char c) {
    if("0123456789".indexOf(c) >= 0)
      return "NUMERAL ";
    if("abcdefghijklmnopqrstuvwxyz".indexOf(c) >= 0)
      return "LETTER ";
//  TODO finish implementation of operator classification
//  if("+-*/&|!=".indexOf(c) >= 0)
//    return "OPERATOR ";
//
    return "UNKOWN ";
  }
}
```

comment out a section of code by make use of
a sequence of **single-line comments**

#8 Count Loops

```
public class InTheLoop {
 public static final int END = Integer.MAX_VALUE;
 public static final int START = END - 100;
 public static void main(String[] args) {
  int count = 0;
  for (int i = START; i <= END; i++)
   count++;
  System.out.println(count);
 }
}


for (long i = START; i <= END; i++)
 count++;
```

whenever using an integral type, be aware of the boundary conditions;
and again: watch out for **overflow** - it’s a silent killer

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#9 Never Ending Story

```
int start = Integer.MAX_VALUE - 1;
for (int i = start; i <= start + 1; i++) { }

double i = Double.POSITIVE_INFINITY; // see [IEEE-754]
while (i == i + 1) { }

double i = Double.NaN; // see [JLS 15.21.1]
while (i != i) { }

String i = “foobar”; // see [JLS 15.18.1]
while(i != i + 0) { }

Integer i = new Integer(0);
Integer j = new Integer(0);
while(i <= j && j <= i && i != j) { }
```

binary floating-point arithmetic is only an approximation to real arithmetic;
operator overloading can be very misleading

#10 Overloaded Constructors

```
public class Confusing {
  public Confusing(Object o) {
    System.out.println("Object");
  }
  public Confusing(double[] d) {
    System.out.println("double array");
  }
  public static void main(String[] args) {
    new Confusing(null);
  }
}
```

```
// overloading process operates in two phases [JLS 15.12.2.5]

new Confusing((Object) null);
```

avoid **overloading**; use different names for different methods
(not possible for constructors, therefore use **static factory methods**)

#11 Which Instance

```
public class Type1 {
  public static void main(String[] args) {
    String s = null;
    System.out.println(s instanceof String);
  }
}

public class Type2 {
  public static void main(String[] args) {
    System.out.println(new Type2() instanceof String);
  } // compile time error!!! [JLS 15.20.2, 15.16, 5.5]
}

public class Type3 {
  public static void main(String[] args) {
    Type3 t = (Type3) new Object();
  } // runtime exception!!!
}
```

#12 What’s the Point?

```
class Point {
 final int x, y;
 final String name;
 Point (int X, int Y) {
  x=X;y=Y;
  name = makeN(); 3
 }
 String makeN() {
  return "["+x+","+y+"]";
 }
 final String toString() {
  return name; 6
 }
}
```

```
class Point2 extends Point {
  final String c;
  Point2(int x,int y,String C) {
    super(x, y); 2
    c = C; 5
  }
  String makeN() {
    return super.makeN()+":"+c; 4
  }
  public static void main (..) {
    System.out.println(
      new Point2(4,2,"purple")); 1
  } // prints "[4,2]:purple"
}   // prints "[4,2]:null"
```

#12 What’s the Point?

```
class Point {
 final int x, y;
 ~~final~~ String name;
 Point (int X, int Y) {
  x=X;y=Y;
  // lazy initializing
 }
 String makeN() {
  return "["+x+","+y+"]";
 }
 String toString() {
  if(name == null) {
    name = makeN();
  }
  return name;
 }
}
```

```
class Point2 extends Point {
  final String c;
  Point2(int x,int y,String C) {
    super(x, y);
    c = C;
  }
  String makeN() {
    return super.makeN()+":"+c;
  }
  public static void main (..) {
    System.out.println(
      new Point2(4,2,"purple"));
  }
}
```

it’s possible observing final instance field before its value has been assigned; never call **overridable methods** from constructors

#13 Null and Void

```
public class Null {
  public static void greet() {
    System.out.println("Hello world!");
  }
  public static void main(String[] args) {
    System.out.println(((Null) null).greet());
  }
}
```

```
System.out.println(Null.greet();
```

invoke static methods in a **static** way

#14 Name It

```java
public class Name {
  private final String first, last;
  public Name(String first, String last) {
    this.first = first; this.last = last;
  }
  public boolean equals(Object o) {
    if(!(o instanceof Name)) return false;
    Name n = (Name) o;
    return n.first.equals(first) && n.last.equals(last);
  }

  public static void main(String[] args) {
    Set<Name> set = new HashSet<Name>();
    set.add(new Name("Spar", "Dat"));
    System.out.println(set.contains(new Name("Spar", "Dat")));
  }
}
```

#14 Name It

```java
public class Name {
  private final String first, last;
  public Name(String first, String last) {
    this.first = first; this.last = last;
  }
  public boolean equals(Object o) {
    if(!(o instanceof Name)) return false;
    Name n = (Name) o;
    return n.first.equals(first) && n.last.equals(last);
  }
  public int hashCode() {
    return 37 * first.hashCode() + last.hashCode();
  }
}
```

you MUST override `hashCode` whenever you override `equals`

#15 Shades of Gray

```
public class ShadesOfGray {
  public static void main(String[] args) {
    System.out.println(X.Y.Z);
  }
}
class X {
  static class Y {
    static String Z = "Black";
  }
  static C Y = new C();
}
class C {
  static String Z = "White";
}


// when a variable and a type have the same name and
// both are in scope, the variable takes precedence [JLS 6.5.2]
```

#15 Shades of Gray

```java
public class ShadesOfGray {
  public static void main(String[] args) {
    System.out.println(Ex.Why.z);
  }
}
class Ex {
  static class Why {
    static String z = "Black";
  }
  static See y = new See();
}
class See {
  String z = "White";
}
```

always obey the standard Java **naming conventions**

A Glossary of Name Reuse

- Overriding
  - method overrides other superclass’ instance methods with the same signature (enabling *dynamic dispatch*)
- Hiding
  - field/static method/member type hides other with same name (signature) of supertypes
- Overloading
  - method with the same name but with another signature
- Shadowing
  - variable/method/type shadows other with same name&scope
- Obscuring
  - variable obscures a type with the same name

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#16 Reflection Infection

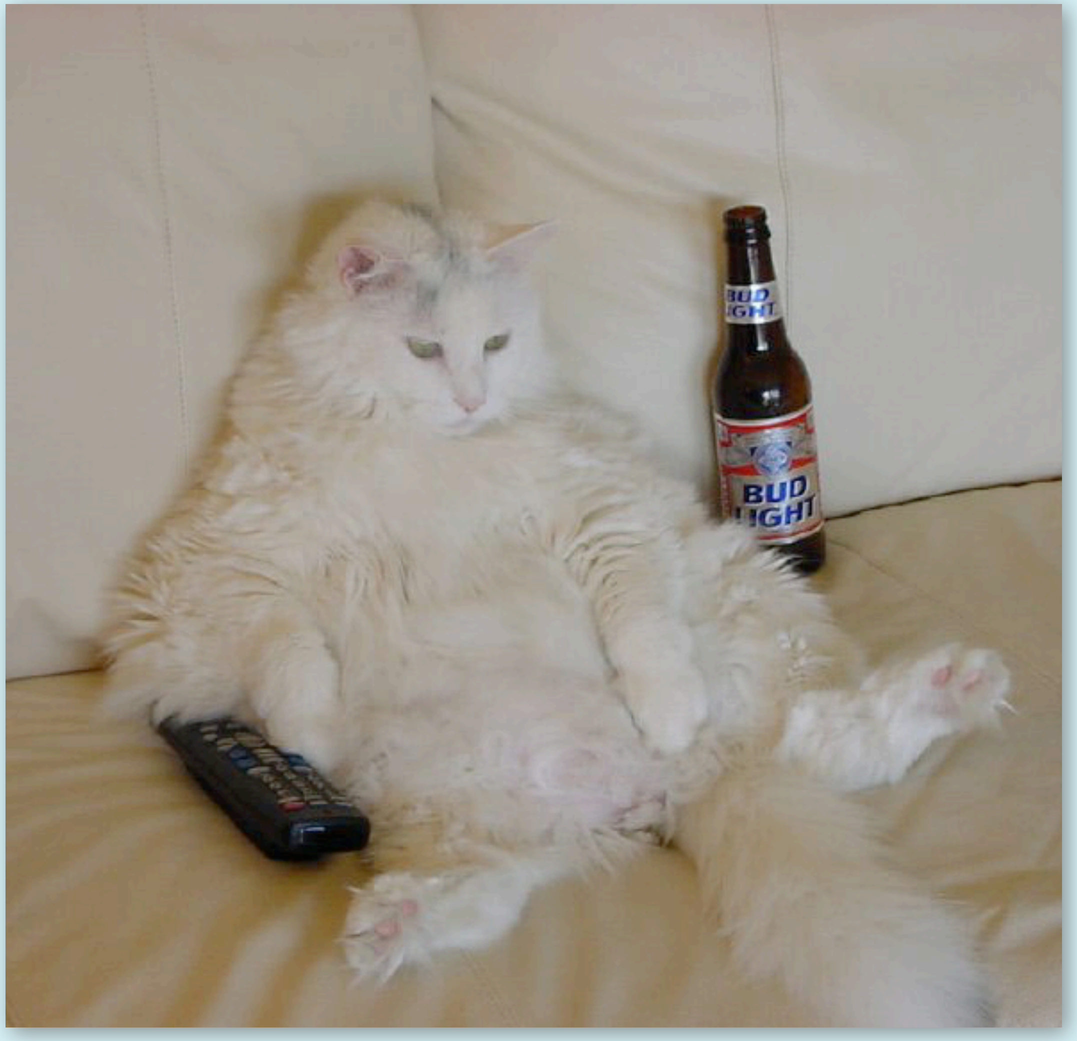
```
public class Reflector {
  public static void main(String[] args) {
    Set<String> set = new HashSet<String>();
    set.add("foo");
    Iterator it = set.iterator();
    Method m = it.getClass().getMethod("hasNext");
    System.out.println(m.invoke(it));
  }
}
Exception in thread "main" IllegalAccessException:
  Class Reflector can not access a member of a class HashMap
  $HashIterator with modifiers "public"
// you cannot legally access a member of
// a nonpublic type from another package [JLS 6.6.1]
Method m = Iterator.class.getMethod("hasNext");
```

when accessing a type reflectively,
use a `Class` object that represents an accessible type

#17 Lazy Initialization

Class initialization [JLS 12.4.2]

- The class is **not yet** initialized.
- The class is **being** initialized by the **current** thread: a recursive request for initialization.
- The class is **being** initialized by some thread **other** than the current thread.
- The class is **already** initialized



#17 Lazy Initialization

```
public class Lazy {
  private static boolean initialized = false;
  static {
    Thread thread = new Thread(new Runnable() {
      public void run() {
        initialized = true;
      }});
    thread.start();
    try {
      thread.join();
    } catch(InterruptedException e) {
      throw new AssertionError(e);
    }
  }
  public static void main(String[] args) {
    System.out.println(initialized);
  }
}
```

#18 Class Warfare

```
at.spardat.puzzler.client;
public class PrintWords {
  public static void main(String[] args) {
    System.out.println(
        Words.FIRST + " " + Words.SECOND + " " + Words.THIRD);
  }
}

at.spardat.puzzler.library;
public class Words {
  private Words() { }
  public static final String FIRST  = "the";
  public static final String SECOND = null;
  public static final String THIRD  = "set";
}
```

API designers should **think** long and hard
before exporting a **constant field**

Effective Nuggets

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Effective Java

- always override `toString`
- static factory methods instead constructors
- favor immutability
- favor composition over inheritance
- prefer interfaces to abstract classes
- use overloading rarely
- string concatenation’s performance
- favor static over nonstatic member classes
- minimize accessibility

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Summary

- binary floating-point arithmetic is inexact
- be aware of silent overflows
- obey general naming conventions
- overriding `equals` => overriding `hashCode`
- carefully read API documentation

if you are not shure what a piece of code does,
it’s very likely that it doesn’t do what you want it to do

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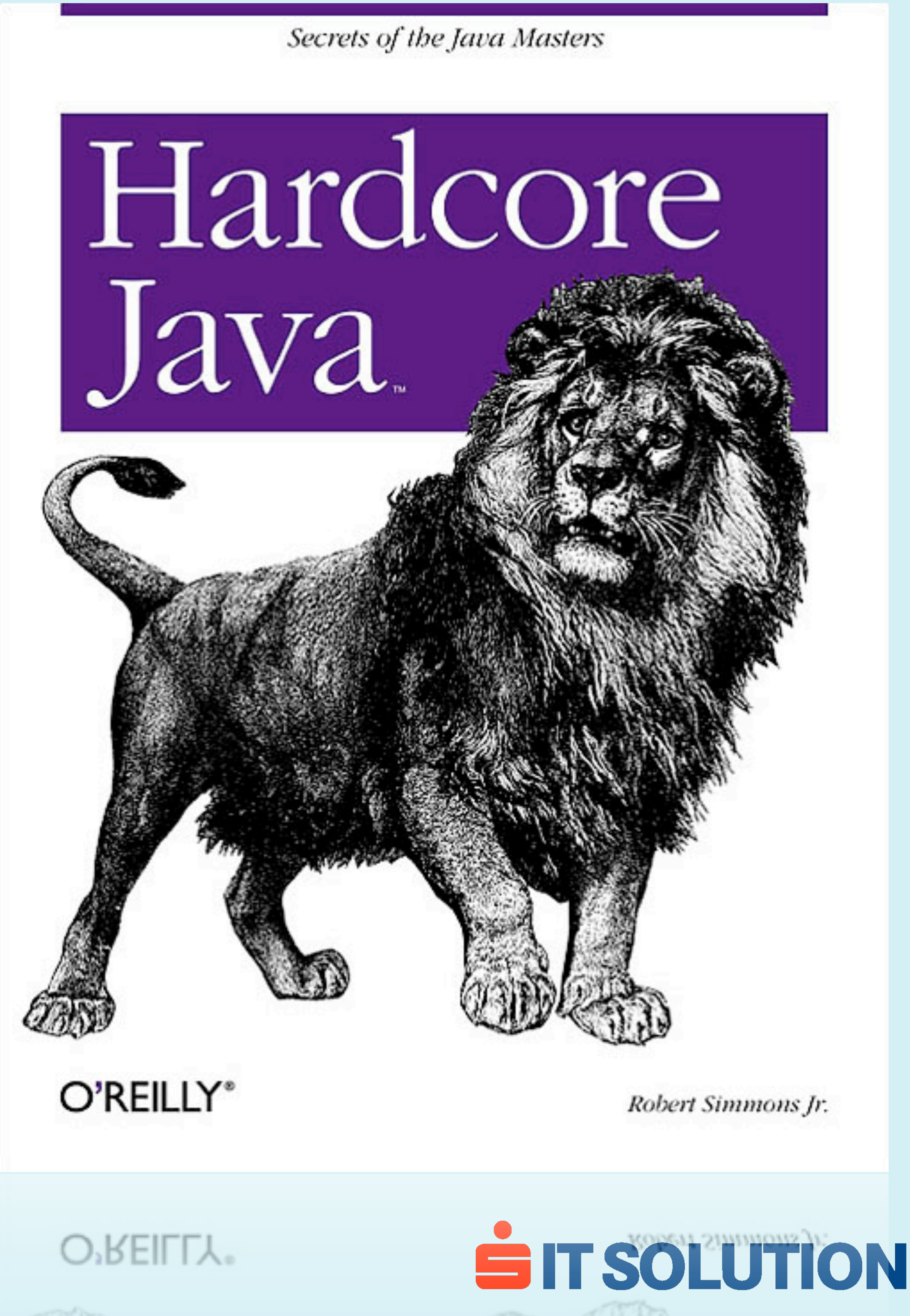
Hardcore Java

- by Robert Simmons
- 344 pages full of *hardcore* stuff
- Covers:
    - Final (!), Immutable Types, Collections, Exceptions, Constants, Nested Classes, Reflection, References



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That's it

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