Patterns

Anti-Patterns and Refactoring

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Lecture #6 out of 16
80 minutes

The slidedeck was presented by the author in this YouTube Video

“Experienced designers evidently know something inexperienced ones don’t. What is it? One thing expert designers know not to do is solve every problem from first principles. Rather, they reuse solutions that have worked for them in the past. When they find a good solution, they use it again and again. Such experience is part of what makes them experts.”

— Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. *Design Patterns: Elements of Reusable Object-Oriented Software.* Addison-Wesley, 1994

“When I see patterns in my programs, I consider it a sign of trouble. The shape of a program should reflect only the problem it needs to solve. Any other regularity in the code is a sign, to me at least, that I’m using abstractions that aren’t powerful enough—often that I’m generating by hand the expansions of some macro that I need to write.”

— *Revenge of the Nerds*, Paul Graham

- Some Patterns
- Some Anti-Patterns
- Anti-OOP Patterns
- Some Refactorings
- Books, Venues, Call-to-Action

Chapter #1:

Some Patterns

Design Patterns and Anti-Patterns, Love and Hate (2016)

36 patterns (22 anti-patterns)

[Decorator RAII]

Adapter, Facade, Proxy, Decorator, Bridge

```
class Database {
  String sql(String q);
}
void echo(Book b) {
  print(b.title());
  print(b.author());
}
class BookInDatabase implements Book {
  private Database d;
  private int id;
  String title() {
    return d.sql("SELECT title FROM book WHERE id=%1", id);
  }
}
```

https://www.yegor256.com/2015/02/26/composable-decorators.html →

[Decorator RAII]

Resource Acquisition Is Initialization (RAII)

```
class File {
  std::FILE* h;
public:
  File(const char* name) {
    h = std::fopen(name, "w+");
  }
  ~File() {
    std::fclose(h);
  }
}
void foo() {
  f File("foo.txt");
  // write to f
}
```

https://www.yegor256.com/2017/08/08/raii-in-java.html →

Chapter #2:

Some Anti-Patterns

[GOTO Numbers God Spaghetti Lasagna]

GOTO

```
1  void foo(int a) {
2    if (a % 2 == 0) {
3      printf("Even!");
4      goto exit;
5    }
6    printf("Odd!");
7    exit:
8  }
9  void foo(int a) {
10   if (a % 2 == 0) {
11     printf("Even!");
12   } else {
13     printf("Odd!");
14   }
15 }
```

[GOTO Numbers God Spaghetti Lasagna]

Magic Numbers

```
def points
  File.readlines("/data/users.csv") # why here?
    .map { |t| t.split(',', 11) } # what is 11?
    .map { a[7].to_i } # why 7?
    .inject(&:+)
end
```

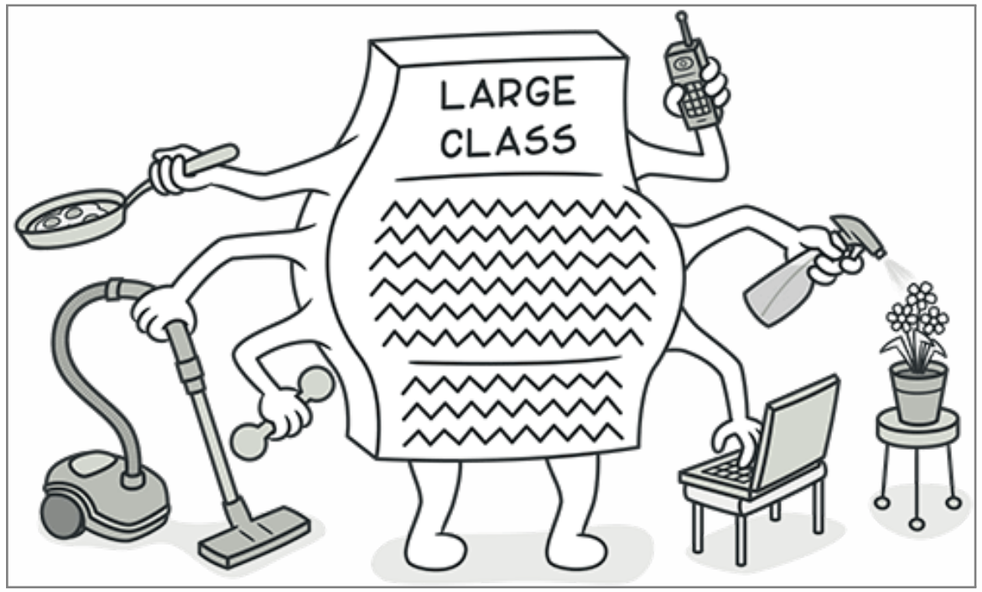
Magic Numbers ... Not!

```
def h2sec(h)
  return h * 60 * 60
end

def h2sec(h)
  seconds_in_minutes = 60
  minutes_in_hours = 60
  return h * seconds_in_minutes * minutes_in_hours
end
```

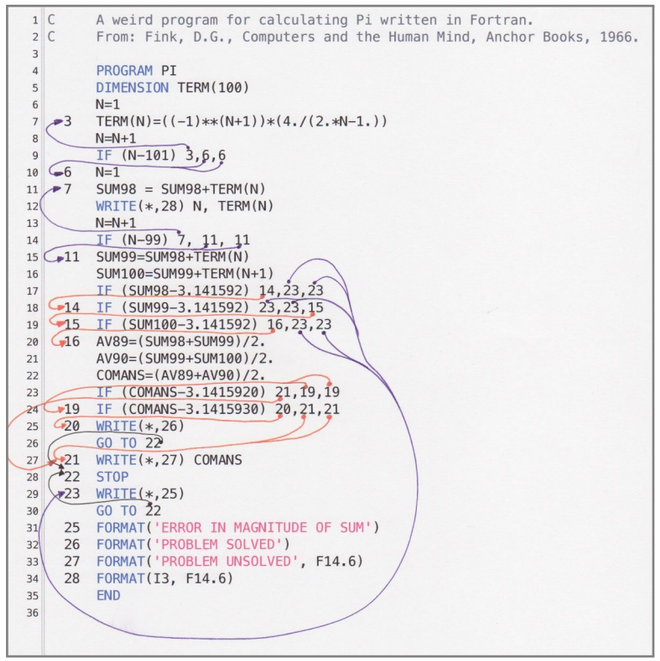
[GOTO Numbers God Spaghetti Lasagna]

God Class



[GOTO Numbers God Spaghetti Lasagna]

Spaghetti Code

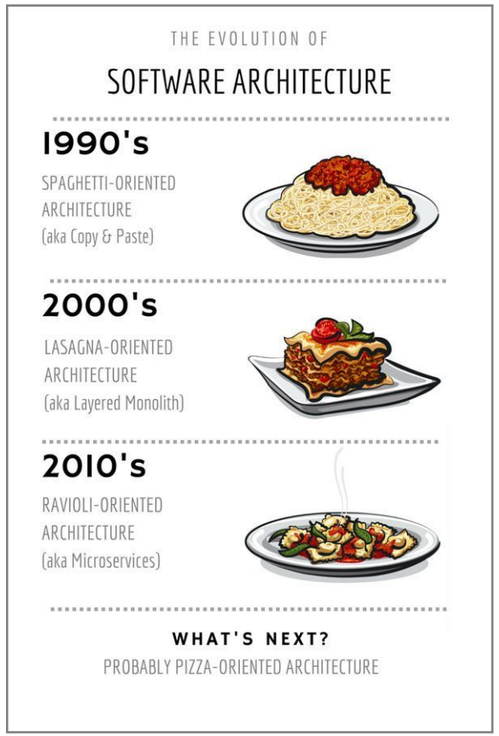


```
C     A weird program for calculating Pi written in Fortran.
C     From: Fink, D.G., Computers and the Human Mind, Anchor Books, 1966.

      PROGRAM PI
      DIMENSION TERM(100)
      N=1
    3 TERM(N)=((-1)**(N+1))*(4./(2.*N-1.))
      N=N+1
      IF (N-101) 3,6,6
    6 N=1
    7 SUM98 = SUM98+TERM(N)
      WRITE(*,28) N, TERM(N)
      N=N+1
      IF (N-99) 7, 11, 11
   11 SUM99=SUM98+TERM(N)
      SUM100=SUM99+TERM(N+1)
      IF (SUM98-3.141592) 14,23,23
   14 IF (SUM99-3.141592) 23,23,15
   15 IF (SUM100-3.141592) 16,23,23
   16 AV89=(SUM98+SUM99)/2.
      AV90=(SUM99+SUM100)/2.
      COMANS=(AV89+AV90)/2.
      IF (COMANS-3.1415920) 21,19,19
   19 IF (COMANS-3.1415930) 20,21,21
   20 WRITE(*,26)
      GO TO 22
   21 WRITE(*,27) COMANS
   22 STOP
   23 WRITE(*,25)
      GO TO 22
   25 FORMAT('ERROR IN MAGNITUDE OF SUM')
   26 FORMAT('PROBLEM SOLVED')
   27 FORMAT('PROBLEM UNSOLVED', F14.6)
   28 FORMAT(I3, F14.6)
      END
```

[GOTO Numbers God Spaghetti Lasagna]

Lasagna and Ravioli



Chapter #3:

Anti-OOP Patterns

Anti-Patterns in OOP (2014)

Eleven: NULL, Utility Classes, Mutable Objects, Getters and Setters, Data Transfer Object (DTO), Object-Relational Mapping (ORM), Singletons, Controllers/Managers/Validators, Public Static Methods, Class Casting, Traits and Mixins.

Data Transfer Object (DTO)

Getters and Setters

```
1 // Getters and Setters: WRONG!
2 Dog dog = new Dog();
3 dog.setWeight("23kg");
4 w = dog.getWeight();
5
6 // Smart objects: RIGHT!
7 Dog dog = new Dog("23kg");
8 int w = dog.weight();
```

https://www.yegor256.com/2014/09/16/getters-and-setters-are-evil.html →

Utility Class

```
1  public class NumberUtils {
2    public static int max(int a, int b) {
3      return a > b ? a : b;
4    }
5  }
6  public class Max implements Number {
7    private final int a;
8    private final int b;
9    public Max(int x, int y) { this.a = x; this.b = y; }
10   public int intValue() {
11     return this.a > this.b ? this.a : this.b;
12   }
13 }
```

https://www.yegor256.com/2014/05/05/oop-alternative-to-utility-classes.html →

Singleton

```
1  class Database {
2    public static Database INSTANCE = new Database();
3    private Database() { /* start */ }
4    public java.sql.Connection connect() { /* fetch */ }
5  }
6  c = Database.INSTANCE.connect();
7  class Foo {
8    private final Database d;
9    void foo() {
10     this.d.connect();
11   }
12 }
```

https://www.yegor256.com/2016/06/27/singletons-must-die.html →

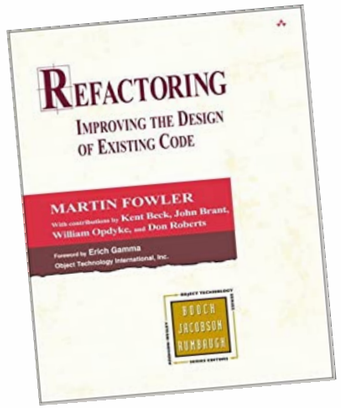
Object-Relational Mapping (ORM)

```
1 // ORM: Wrong!
2 Post post = new Post();
3 post.setDate(new Date());
4 post.setTitle("How to cook an omelette");
5 session.save(post);
6
7 // Objects: RIGHT!
8 Post post = new Post();
9 post.setDate(new Date());
```

https://www.yegor256.com/2014/12/01/orm-offensive-anti-pattern.html →

Chapter #4:

Some Refactorings



“Whenever I do refactoring, the first step is always the same. I need to build a solid set of tests for that section of code. The tests are essential because even though I follow refactorings structured to avoid most of the opportunities for introducing bugs, I’m still human and still make mistakes. Thus I need solid tests.”

— Martin Fowler, Kent Beck, John Brant, William Opdyke, and Don Roberts. *Refactoring: Improving the Design of Existing Code.* Addison-Wesley, 1999. doi:10.5555/311424

Extract Method

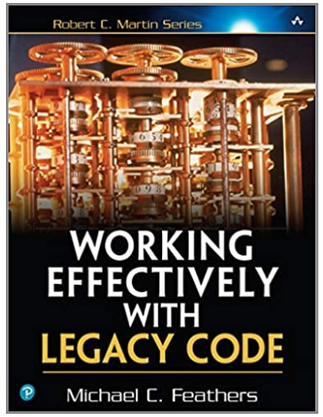
```
def root(a, b, c)
  d = Math.sqrt(b * b - 4 * a * c)
  r1 = (-b + d) / (2 * a)
  r2 = (-b - d) / (2 * a)
  [r1, r2]
end

def root(a, b, c)
  d = Math.sqrt(b * b - 4 * a * c)
  [r(a, b, d, 1), r(a, b, d, -1)]
end
def r(a, b, d, m)
  (-b + d * m) / (2 * a)
end
```

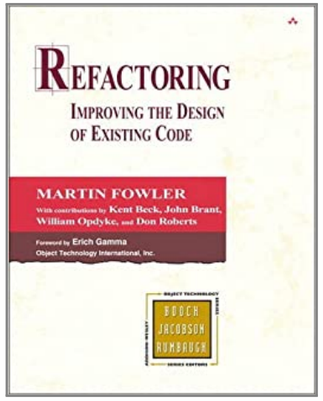
$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Chapter #5:

Books, Venues, Call-to-Action



Michael Feathers. *Working Effectively With Legacy Code.* Prentice Hall, 2004. doi:10.5555/1050933



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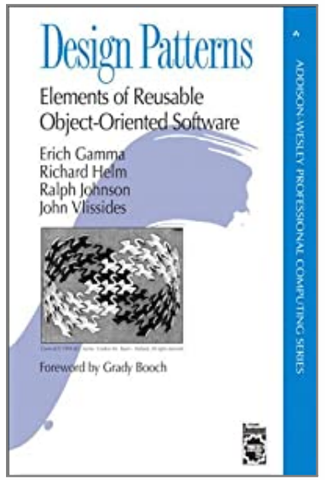
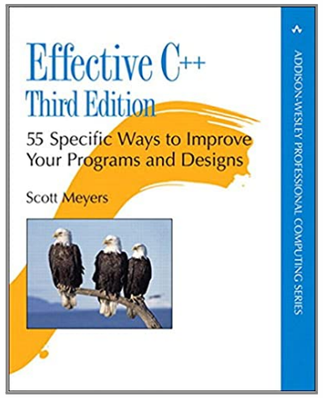


Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. *Design Patterns: Elements of Reusable Object-Oriented Software.* Addison-Wesley, 1994



Scott Meyers. *Effective C++: 55 Specific Ways to Improve Your Programs and Designs.* Addison-Wesley, 3 edition, 2005

Where to publish:

SPLASH: ACM SIGPLAN conference on Systems, Programming, Languages, and Applications

International Conference on Code Quality (ICCQ), in cooperation with ACM SIGPLAN/SIGSOFT and IEEE

Call to Action:

In your application demonstrate the usage of 4+ design patterns. Also, perform 4+ refactorings, each one in its own pull request.

Still unresolved issues:

- How to prove certain patterns are anti-patterns?
- How to find methods for automated refactoring?
- How to guarantee validity during refactoring?
- How to mine patterns from code?

Bibliography

Michael Feathers. *Working Effectively With Legacy Code*. Prentice Hall, 2004. doi:10.5555/1050933.

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