Design Defects and Restructuring

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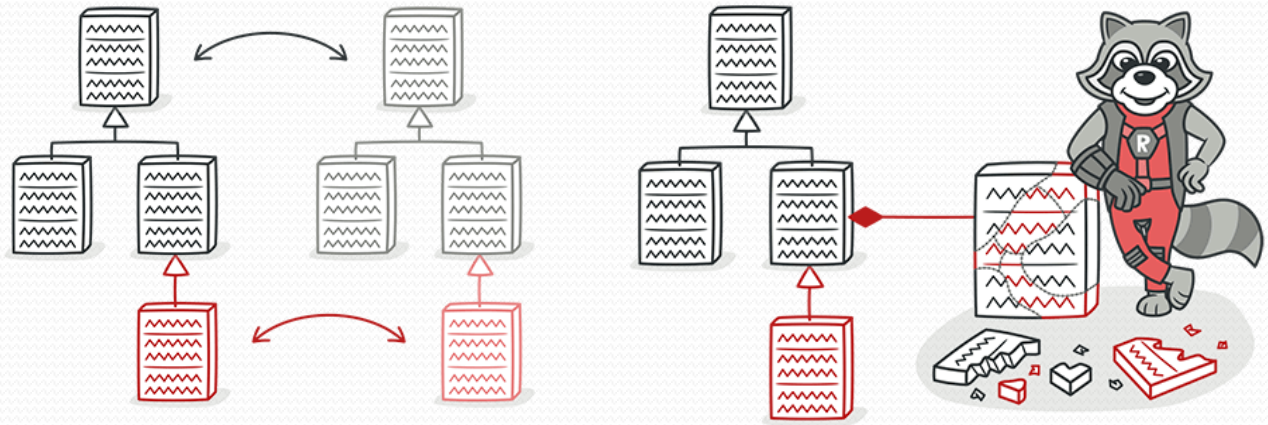
Refactoring-III

Bad Smells in Code

Parallel Inheritance Hierarchies

- **Signs and Symptoms**
- Whenever you create a subclass for a class, you find yourself needing to create a subclass for another class.



Treatment
Move Method and Move Field.

- **Reasons for the Problem**
- All was well as long as the hierarchy stayed small. But with new classes being added, making changes has become harder and harder.

Parallel Inheritance Hierarchies

- Think about engineers — just engineers in general. Computer engineers work on computers and deliver projects, whereas civil engineer work on structures. From a design perspective, there are two parallel hierarchies:
- Engineers
- Milestones
- The different engineers have different milestones, and each engineer has a specified milestone (special relation).
- The problem is that every time you add a new engineer in the Engineer inheritance, you have to introduce a new Milestone in Milestone hierarchy.

Parallel Inheritance Hierarchies

```
public interface Engineer {
String getType();
    void setType(String type);
    int getSalary();
    void setSalary(int salary);
    MileStone getMileStone();
    void setMileStone(MileStone
mileStone);
}

 public interface MileStone {
 public String work();
     public String target();
 }
```

Parallel Inheritance Hierarchies

```
public class ComputerEngineer implements Engineer {
private String type;
    private int salary;
    private MileStone mileStone;
    public void setType(String type) {
    this.type = type;
    }
    public void setSalary(int salary) {
        this.salary = salary;
    }
    public void setMileStone(MileStone mileStone) {
        this.mileStone = mileStone;
    }
    @Override
    public String getType() {
        // TODO Auto-generated method stub
        return type;
    }
    @Override
    public int getSalary() {
        // TODO Auto-generated method stub
        return salary;
    }
```

Parallel Inheritance Hierarchies

```
 @Override
    public MileStone getMileStone() {
        // TODO Auto-generated method stub
        return mileStone;
    }
    @Override
    public String toString() {
        return "ComputerEngineer [type=" + type + ", salary=" + salary
        + ", mileStone=" + mileStone + "]";
    }
}
```

Parallel Inheritance Hierarchies

```
public class ComputerMileStone implements MileStone {
@Override
    public String work() {
        return"Build a Billing CORBA Client Application";
    }
    @Override
    public String target() {
        return"Has to be finshed in 14 PD";
    }
    @Override
    public String toString() {
        return "ComputerMileStone [work()=" + work() + ", target()="
       + target() + "]";
    }

}
```

Parallel Inheritance Hierarchies

```
public class CivilEngineer implements Engineer{
private String type;
    private int salary;
    private MileStone mileStone;
    public void setType(String type) {
        this.type = type;
    }
    public void setSalary(int salary) {
        this.salary = salary;
    }
    public void setMileStone(MileStone mileStone) {
        this.mileStone = mileStone;
    }
    @Override
    public String getType() {
        // TODO Auto-generated method stub
        return type;
    }
    @Override
    public int getSalary() {
        // TODO Auto-generated method stub
        return salary;
    }
```

Parallel Inheritance Hierarchies

```
 @Override
    public MileStone getMileStone() {
        // TODO Auto-generated method stub
        return mileStone;
    }
    @Override
    public String toString() {
        return "CivilEngineer [type=" + type + ", salary=" + salary
        + ", mileStone=" + mileStone + "]";
    }
}
```

Parallel Inheritance Hierarchies

```
public class CivilMileStone implements MileStone {
@Override
    public String work() {
        // TODO Auto-generated method stub
        return "Creates  Habib Bank Plaza";
    }
    @Override
    public String target() {
        // TODO Auto-generated method stub
        return "Has to be completed in 3 years";
    }
    @Override
    public String toString() {
        return "CivilMileStone [work()=" + work() + ",
       target()=" + target() + "]";
    }
}
```

Parallel Inheritance Hierarchies

```
public class Manager {
public static void main(String[] args) {
// TODO Auto-generated method stub
Engineer comp = new ComputerEngineer();
comp.setType("Computer Engineer");
comp.setSalary(50000);
comp.setMileStone(new ComputerMileStone());
Engineer civil = new CivilEngineer();
civil.setType("Civil Engineer");
civil.setSalary(60000);
civil.setMileStone(new CivilMileStone());
System.out.println(comp);
System.out.println("********************");
System.out.println(civil);
}
}
```

Output:

```
ComputerEngineer [type=Computer Engineer, salary=50000,
mileStone=ComputerMileStone [work()=Build a Billing CORBA Client Application,
target()=Has to be finshed in 14 PD]]
********************
CivilEngineer [type=Civil Engineer, salary=60000, mileStone=CivilMileStone
[work()=Creates  Habib Bank Plaza, target()=Has to be completed in 3 years]]
```

Parallel Inheritance Hierarchies

- **Sol 1: Technique:** Make a common interface and move methods from another interface.

```
public interface EngineerMileStone {
String getType();
    void setType(String type);
    int getSalary();
    void setSalary(int salary);
    public String work();
    public String target();
}
```

Parallel Inheritance Hierarchies

```
public class ReFactorCivilEngineer implements EngineerMileStone {
private String type;
    private int salary;
    @Override
    public String getType() {
        return type;
    }
    @Override
    public void setType(String type) {
        this.type=type;
    }
    @Override
    public int getSalary() {
        return salary;
    }
    @Override
    public void setSalary(int salary) {
        this.salary=salary;
    }
    @Override
    public String work() {
        return "Creates  Habib Bank Plaza";
    }
```

Parallel Inheritance Hierarchies

```
 @Override
    public String target() {
        return "Has to be completed in 3 years";
    }
    @Override
    public String toString() {
        return "ReFactorCivilEngineer [type=" + type + ", salary=" +
salary
        + ", getType()=" + getType() + ", getSalary()=" + getSalary()
        + ", work()=" + work() + ", target()=" + target() + "]";
    }
}
```

Parallel Inheritance Hierarchies

```
public class RefactorComputerEngineer implements EngineerMileStone {
private String type;
private int salary;
@Override
public String getType() {
    return type;
}
@Override
public void setType(String type) {
    this.type=type;
}
@Override
public int getSalary() {
    return salary;
}
@Override
public void setSalary(int salary) {
    this.salary=salary;
}
@Override
public String work() {
    return"Build a Billing CORBA Client Application";
}
```

Parallel Inheritance Hierarchies

```
@Override
public String target() {
    return"Has to be finshed in 14 PD";
}
@Override
public String toString() {
    return "RefactorComputerEngineer [type=" + type + ", salary="
+ salary
    + ", getType()=" + getType() + ", getSalary()=" + getSalary()
    + ", work()=" + work() + ", target()=" + target() + "]";
}
}
```

Parallel Inheritance Hierarchies

```
public class Manager {
public static void main(String[] args) throws
InstantiationException, IllegalAccessException {
        EngineerMileStone comp = new RefactorComputerEngineer();
        comp.setType("Computer Engineer");
        comp.setSalary(50000);
        EngineerMileStone civil = new ReFactorCivilEngineer();
        civil.setType("Civil Engineer");
        civil.setSalary(60000);
        System.out.println(comp);
        System.out.println("********************");
        System.out.println(civil);
    }
}
```

Output:

```
RefactorComputerEngineer [type=Computer Engineer, salary=50000,
getType()=Computer Engineer, getSalary()=50000, work()=Build a Billing CORBA
Client Application, target()=Has to be finshed in 14 PD]
********************
ReFactorCivilEngineer [type=Civil Engineer, salary=60000, getType()=Civil
Engineer, getSalary()=60000, work()=Creates  Habib Bank Plaza, target()=Has
to be completed in 3 years]
```

Refactoring Demo

Eclipse

Refactor Navigate Search Project Run Window Help

Rename...	Alt+Shift+R
Move...	Alt+Shift+V
Change Method Signature...	Alt+Shift+C
Extract Method...	Alt+Shift+M
Extract Local Variable...	Alt+Shift+L
Extract Constant...	
Inline...	Alt+Shift+I
Convert Local Variable to Field...	
Convert Anonymous Class to Nested...	
Move Type to New File...	
Extract Interface...	
Extract Superclass...	
Use Supertype Where Possible...	
Pull Up...	
Push Down...	
Extract Class...	
Introduce Parameter Object...	
Introduce Indirection...	
Introduce Factory...	
Introduce Parameter...	
Encapsulate Field...	
Generalize Declared Type...	
Infer Generic Type Arguments...	
Migrate JAR File...	
Create Script...	
Apply Script...	
History...	

Eclipse - Extract Method

```
public class Test3 {
public static void main(String[] args) {
// corona registration
int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};

//Print cases **************
//Print Header
System.out.println("****Corona Cases Registered in Karachi****");

//Iterate
for (int cc:corons_cases_karachi) {
System.out.println(cc);
}

//Print Footer
System.out.println("****************************************");
}
```

Eclipse - Extract Method

- Select From Print Header to Print Footer code and Press: Alt+Shift+M

```
public class Test3 {
    public static void main(String[] args) {
        // corona registration
        int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};

        //Print cases **************
        //Print Header
        System.out.println("****Corona Cases Registered in Karachi****");

        //Iterate
        for (int cc:corons_cases_karachi) {
            System.out.println(cc);
        }

        //Print Footer
        System.out.println("*****************************************");
    }
}
```

Eclipse - Extract Method

Extract Method

Method name: print_cases

Access modifier: ○ public ○ protected ○ package ◉ private

Parameters:

Type	Name
int []	corons_cases_karachi

Edit...

Up

Down

☐ Declare thrown runtime exceptions

☑ Generate method comment

☐ Replace additional occurrences of statements with method

Method signature preview:

```
private static void print_cases(int []
corons_cases_karachi)
```

Preview >

OK

Cancel

```
public class Test3 {
public static void main(String[] args) {
// corona registration
int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};

//Print cases **************
print_cases(corons_cases_karachi);
}

/**
 * @param corons_cases_karachi
 */
private static void print_cases(int[] corons_cases_karachi) {
//Print Header
System.out.println("****Corona Cases Registered in Karachi****");

//Iterate
for (int cc:corons_cases_karachi) {
System.out.println(cc);
}

//Print Footer
System.out.prinatln("****************************************")
;
}
```

output

```
****Corona Cases Registered in Karachi****
11
34
0
45
21
33
20
11
2
1
12
*****************************************
```

- Output will be same before Refactoring and After Refactoring

Eclipse - Inline Method

```
public class Test3 {
public static void main(String[] args) {
// corona registration
int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};
//Print cases **************
print_cases(corons_cases_karachi);
}
private static void print_cases(int[] corons_cases_karachi) {
//Print Header
System.out.println("****Corona Cases Registered in Karachi****");
//Iterate
for (int cc:corons_cases_karachi) {
System.out.println(cc);
}
//Print Footer
System.out.prinatln("*****************************************")
;
}
}
```

C

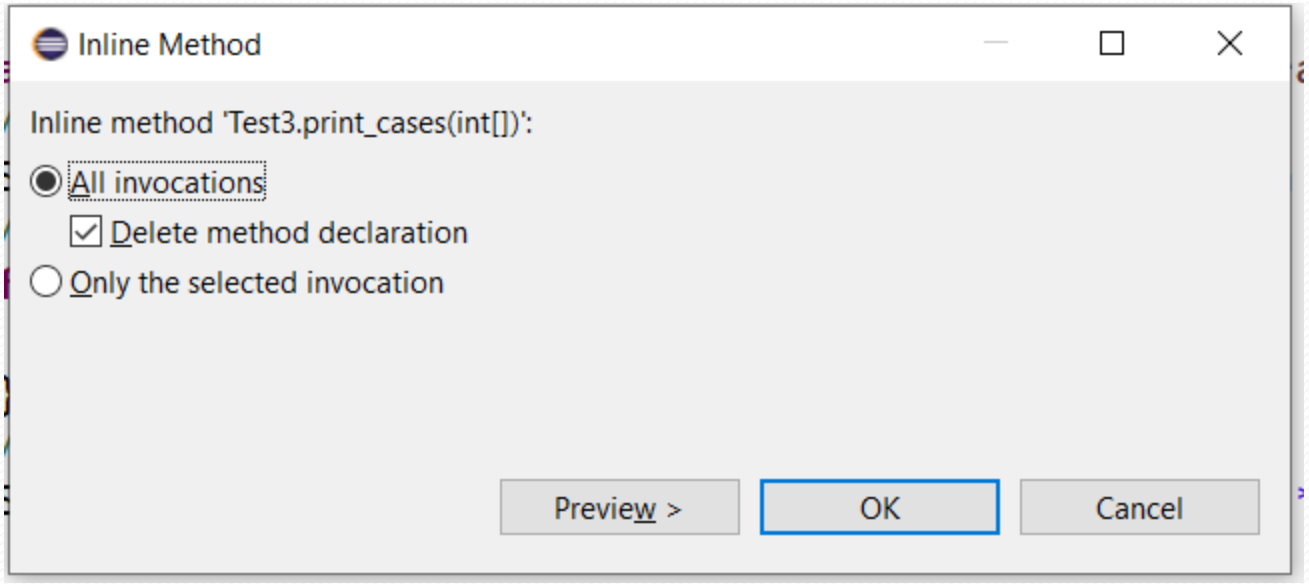
- Select the method to perform Inline method refactoring and press Alt+Shift+I

```
public class Test3 {
    public static void main(String[] args) {
        // corona registration
        int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};

        //Print cases **************
        print_cases(corons_cases_karachi);
    }
    private static void print_cases(int[] corons_cases_karachi) {
        //Print Header
        System.out.println("****Corona Cases Registered in Karachi****");
        //Iterate
        for (int cc:corons_cases_karachi) {
            System.out.println(cc);
        }
        //Print Footer
        System.out.println("****************************************");
    }
}
```

Eclipse - Inline Method

- After pressing Alt+Shift+I you will see this dialog:



Eclipse - Inline Method

- Here is the result of refactoring:

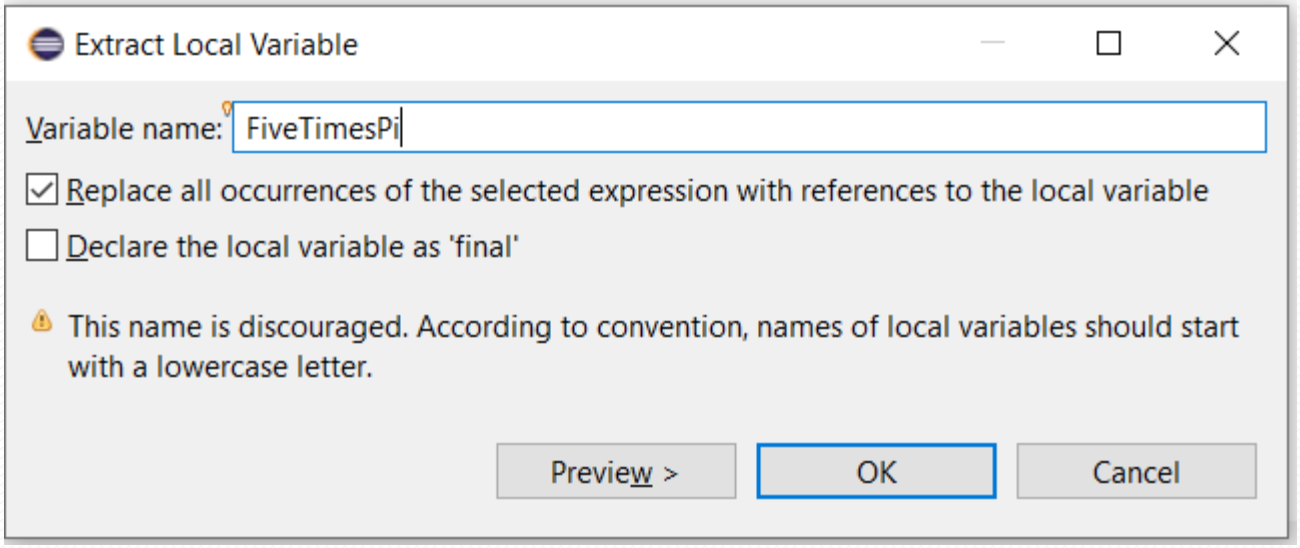
```
public class Test3 {
public static void main(String[] args) {
// corona registration
int[] corons_cases_karachi = {11,34,0,45,21,33,20,11,2,1,12};

//Print cases **************
//Print Header
System.out.println("****Corona Cases Registered in Karachi****");
//Iterate
for (int cc:corons_cases_karachi) {
System.out.println(cc);
}
//Print Footer
System.out.println("****************************************");
}
}
```

Eclipse - Extract Local Variable

```
public class ExtractLocalVar {
public static void main(String[] args) {
double pi = 3.14159265359;
System.out.println(pi*5);
System.out.println((pi*5)/7);
System.out.println((pi*5)+4);
}
}
```

Select ***pi*5*** and press Alt+Shift+L



Eclipse - Extract Local Variable

```
public class ExtractLocalVar {
public static void main(String[] args) {
double pi = 3.14159265359;
double FiveTimesPi = pi*5;
System.out.println(FiveTimesPi);
System.out.println(FiveTimesPi/7);
System.out.println(FiveTimesPi+4);
}
}
```

Output:

```
15.70796326795
2.243994752564286
19.70796326795
```

- Output will be same before Refactoring and After Refactoring

Change Method signature

```
 public class Test5{
 public Test5() {
}

public void Fun1(int i, double d) {
System.out.println("i = "+ i);
System.out.println("d = "+ d);
}

public static void main(String[] args) {
Test5 t5 = new Test5();
t5.Fun1(1, 2.5);
}
}
```

```
Output:
i = 1
d = 2.5
```

Change Method signature

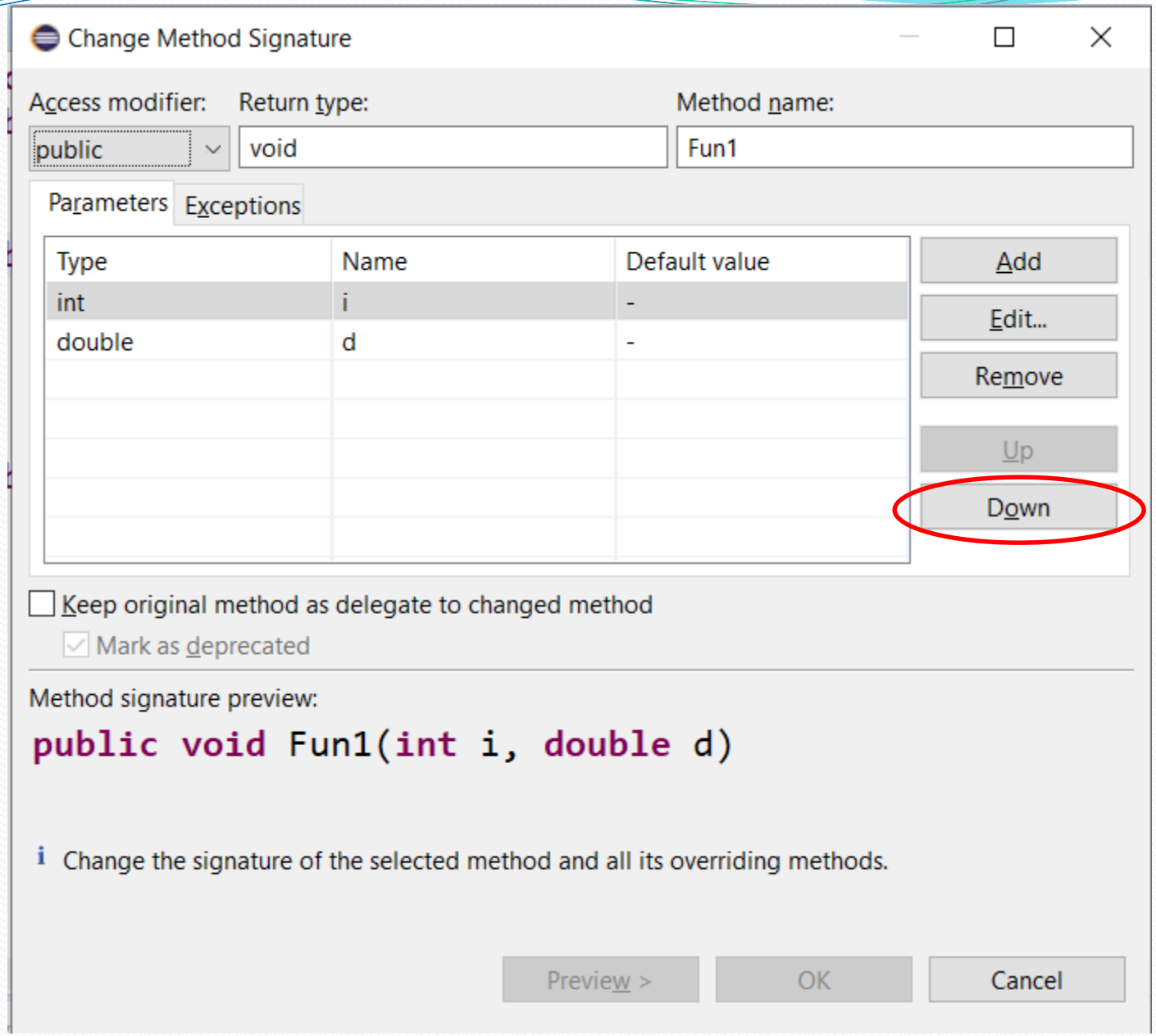
- Select function and press Alt+Shift+C

```
public class Test5{
    public Test5() {
    }

    public void Fun1(int i, double d) {
        System.out.println("i = "+ i);
        System.out.println("d = "+ d);
    }

    public static void main(String[] args) {
        Test5 t5 = new Test5();
        t5.Fun1(1, 2.5);
    }
}
```

Change Method signature



Change Method signature

Change Method Signature

Access modifier: public

Return type: void

Method name: Fun1

Parameters | Exceptions

Type	Name	Default value
double	d	-
int	i	-

Add

Edit...

Remove

Up

Down

☐ Keep original method as delegate to changed method

☑ Mark as deprecated

Method signature preview:

```
public void Fun1(double d, int i)
```

Preview >

OK

Cancel

Change Method signature

```
 public class Test5{
 public Test5() {
}

public void Fun1(double d, int i) {
System.out.println("i = "+ i);
System.out.println("d = "+ d);
}

public static void main(String[] args) {
Test5 t5 = new Test5();
t5.Fun1(2.5, 1);
}
}
```

```
Output:
i = 1
d = 2.5
```