LaBRI

Présentation scientifique

Jean-Rémy Falleri

Analyse de différences entre fichiers de code source

cnrs

université de BORDEAUX

Bordeaux INP AQUITAINE

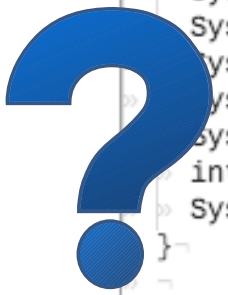
Context

```java
import java.util.Random;

public class Example {

  public void hello() {
    System.out.println("Hello everybody!");
    System.out.println("This code is a magnificent example");
    System.out.println("For the ASE 2014 conference");
    System.out.println("It draws a number at random");
    System.out.println("Adds 10");
    System.out.println("Multiplies by 10");
    System.out.println("And displays it");
    Random r = new Random();
    int i = r.nextInt();
    i += 10;
    i *= 10;
    System.out.println(i);
  }

}
```



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  }

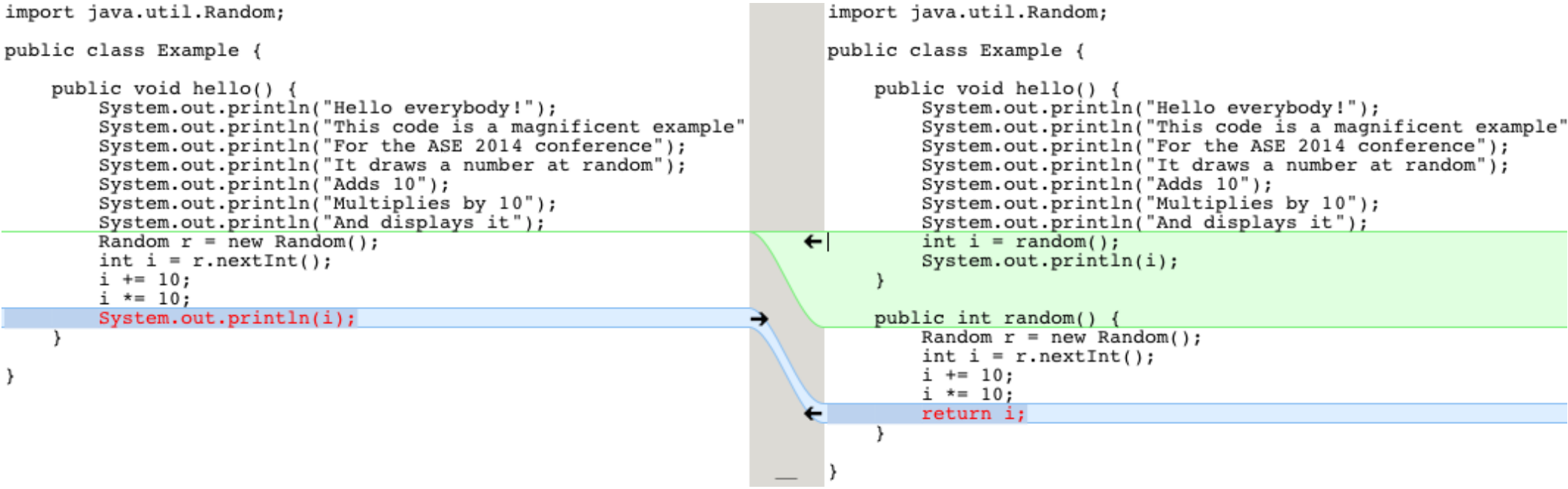
  public int random() {
    Random r = new Random();
    int i = r.nextInt();
    i += 10;
    i *= 10;
    return i;
  }

}
```

Previous version

Current version

Current approach



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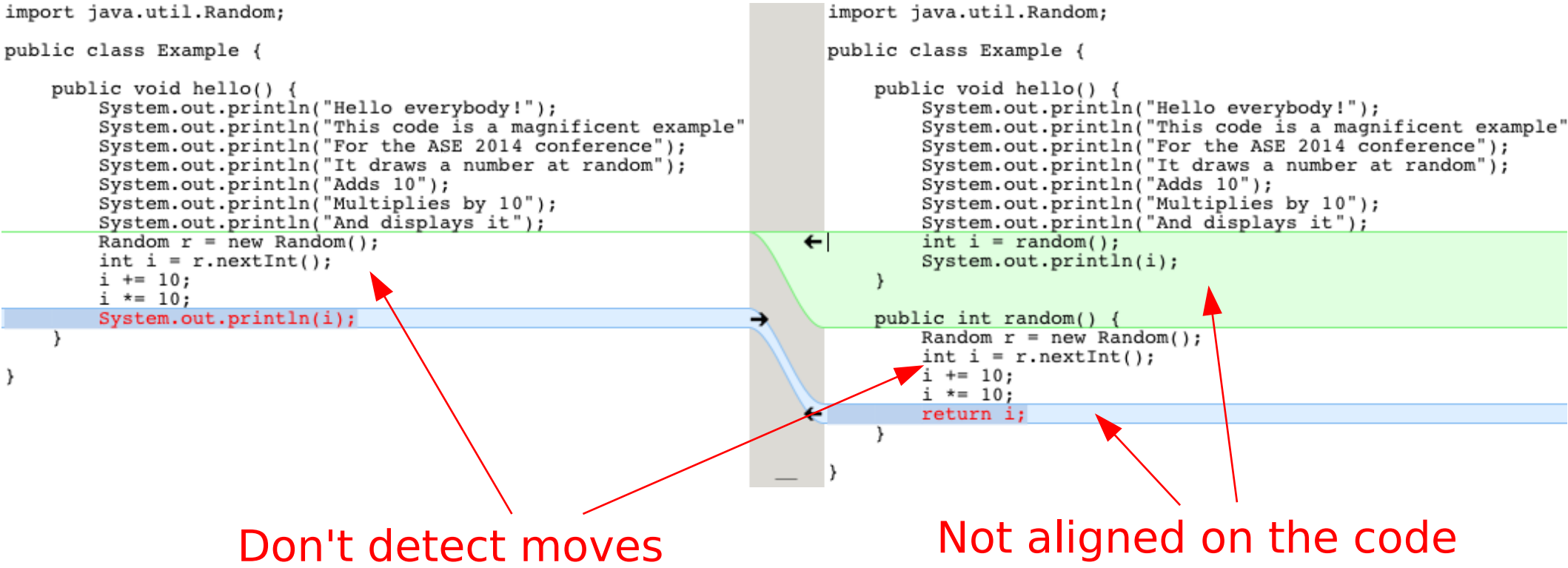
Meld v1.8

Current approach



Don't represent the developer intent

Our proposal

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GumTree

- Differencing algorithm
  - Work on syntax trees
  - Detect code moves
- Tool
  - Efficient
  - Empirically validated
  - Freely available

State of the art

- On text
  - Never aligned on the code structure
- On syntax trees
  - Optimal without moves: *O(n^3)* [27]
  - Optimal with moves: *NP-hard* [4]
  - Very few existing heuristics (ex: [6, 13])

GumTree process

1. Parse code files to code agnostic tree structure
2. **Find mappings between nodes**
3. Deduce code edition actions (as in [6])
4. Output code differences

Finding mappings

1. Top-down
   - Find biggest chunks of unmodified code
2. Bottom-up
   - Propagate mappings to the containers of these chunks (functions, classes, …)
   - Extend mappings in the left-over code of these containers

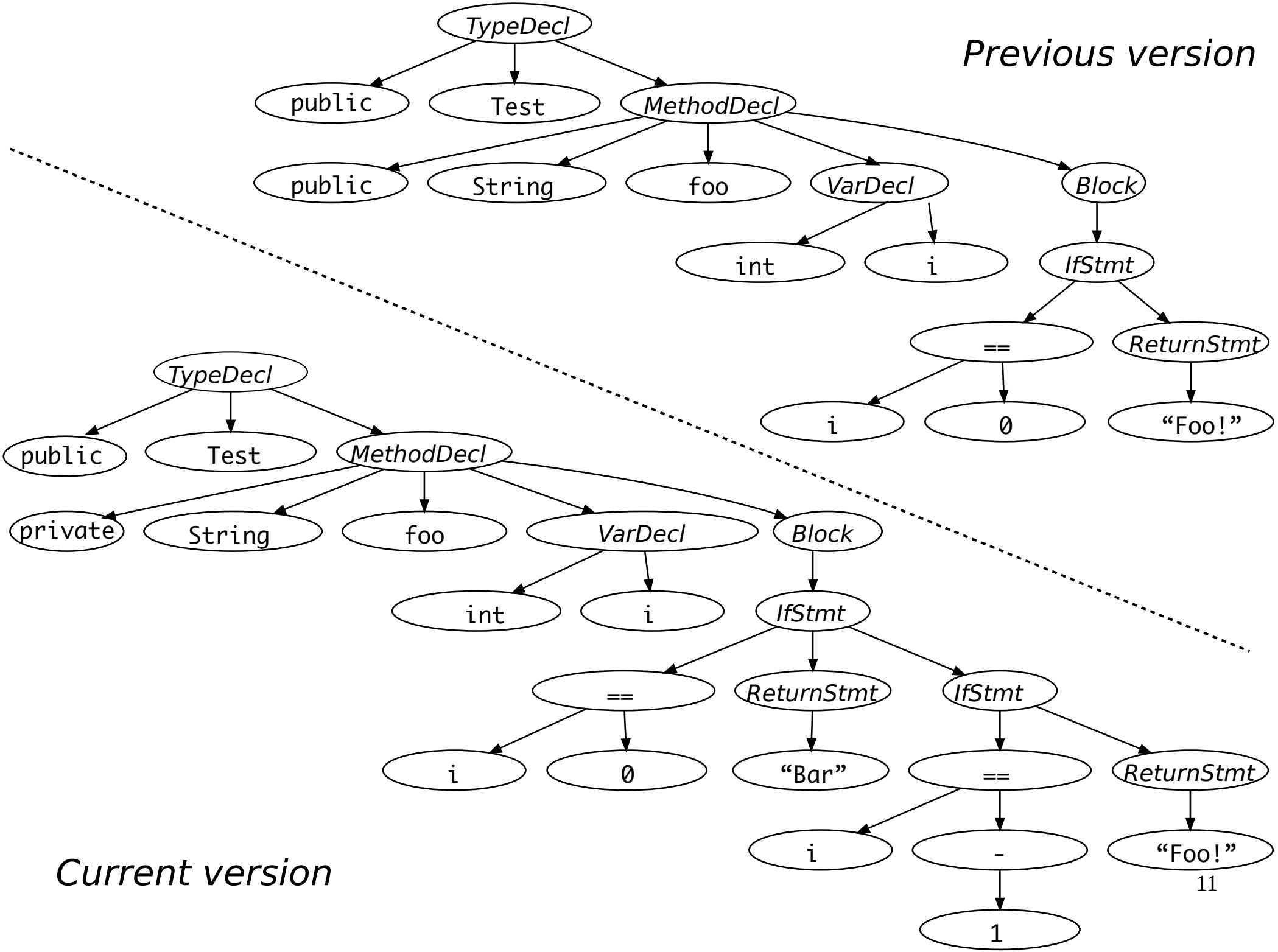
Example

```java
public class Test {
  public String foo(int i) {
    if (i == 0)
      return "Foo!";
  }
}
```

Previous version

```java
public class Test {
  private String foo(int i) {
    if (i == 0)
      return "Bar";
    else if (i == -1)
      return "Foo!";
  }
}
```

Current version


Previous version
TypeDecl
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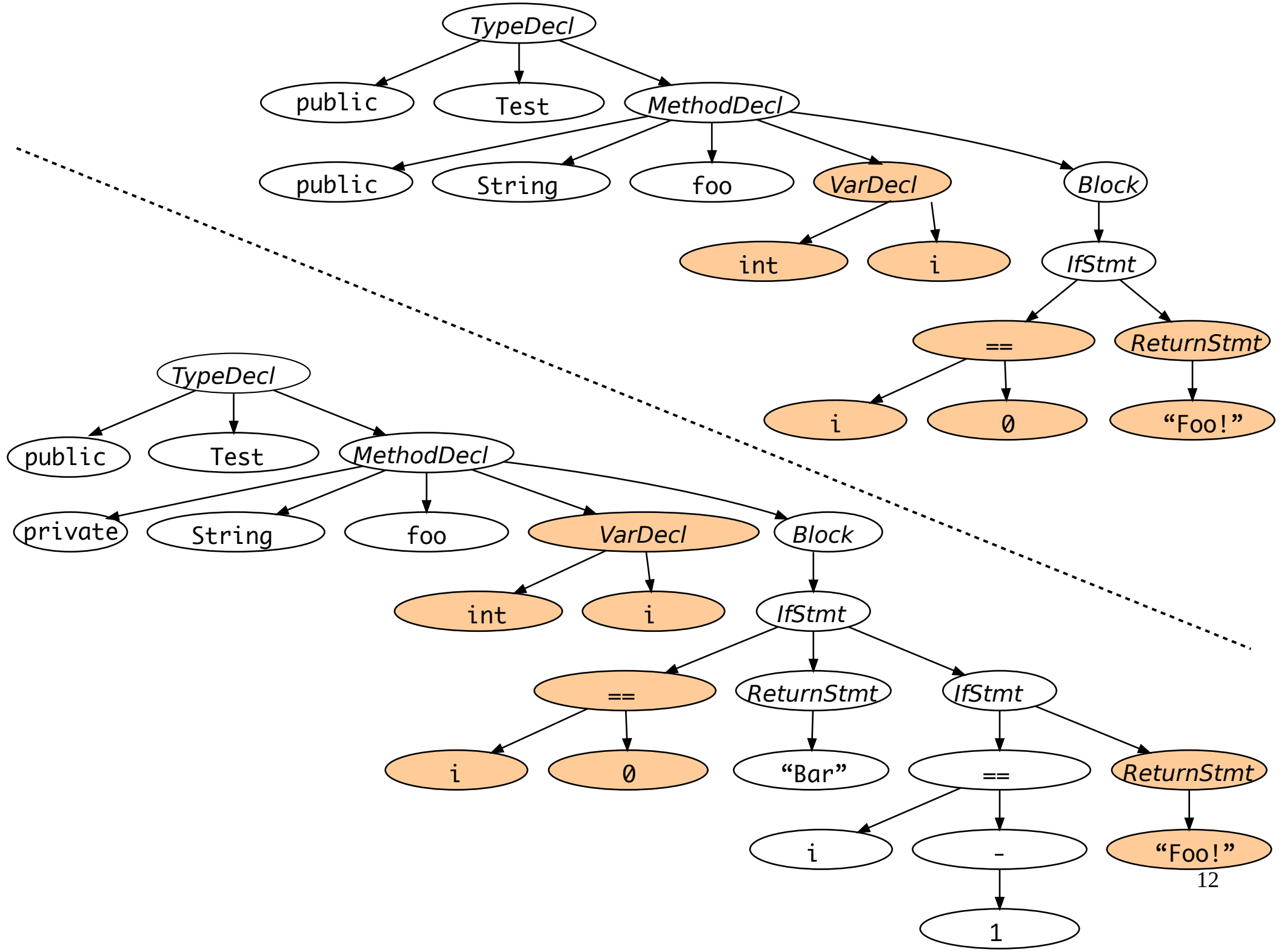
Current version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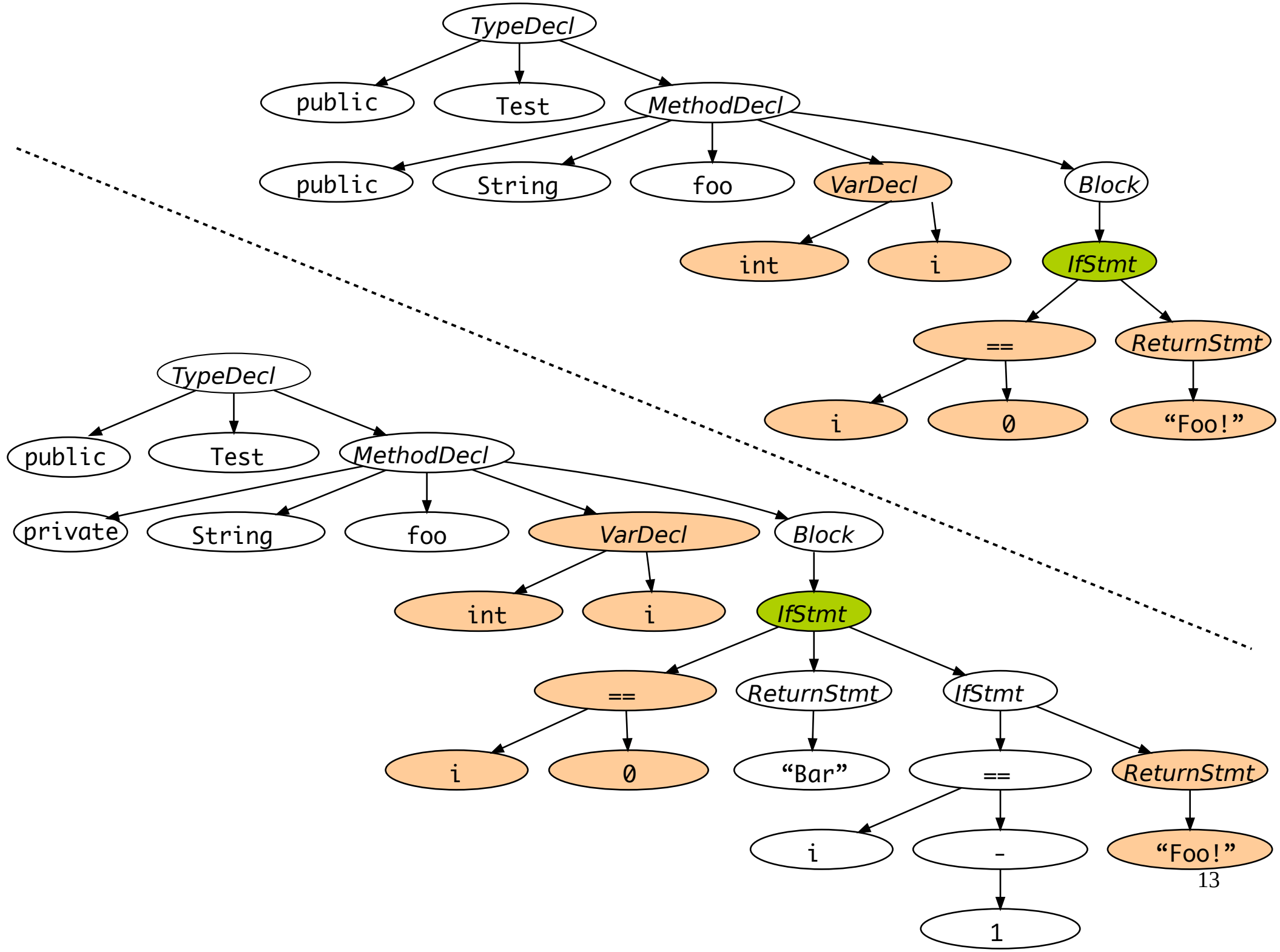
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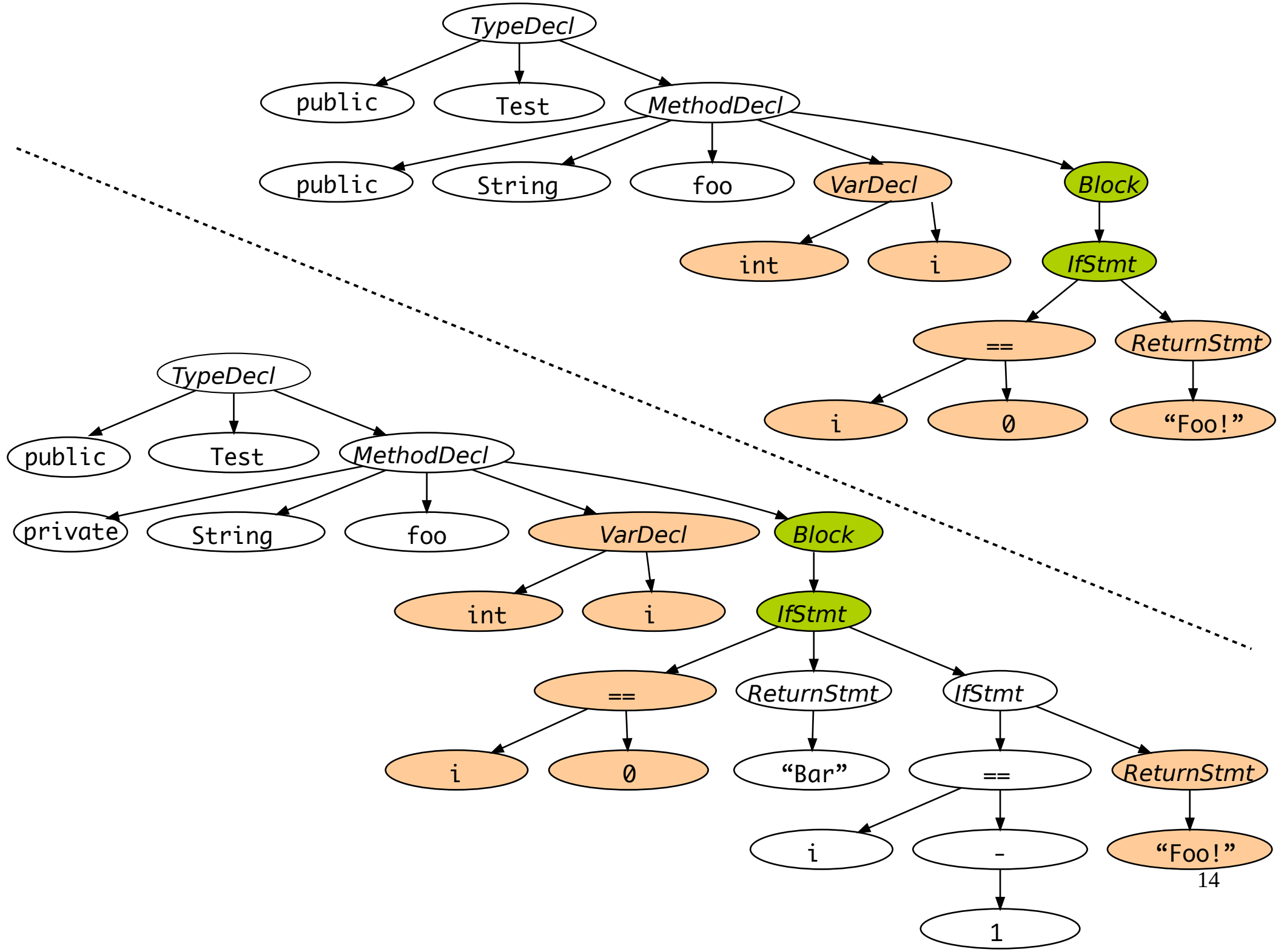
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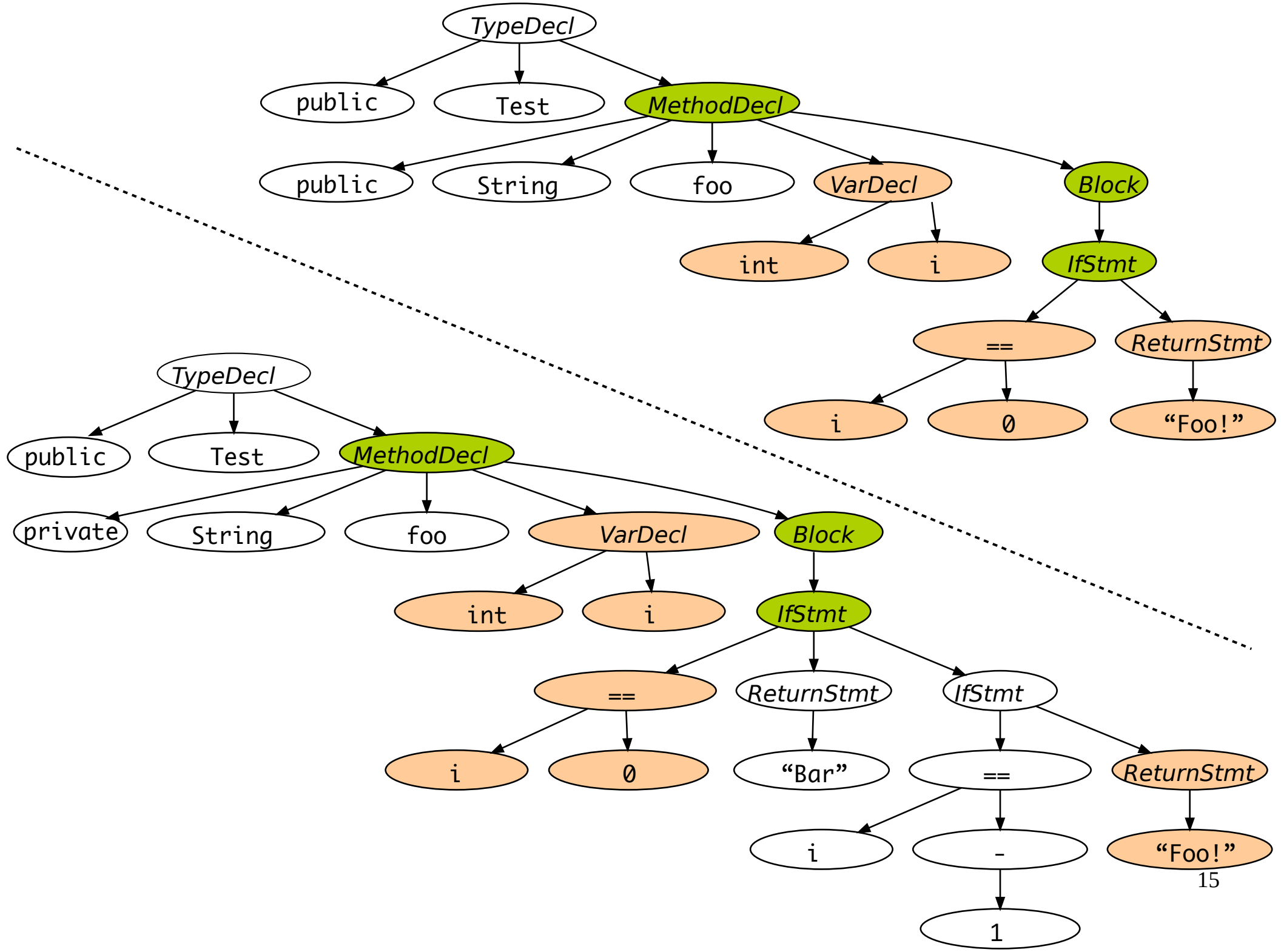
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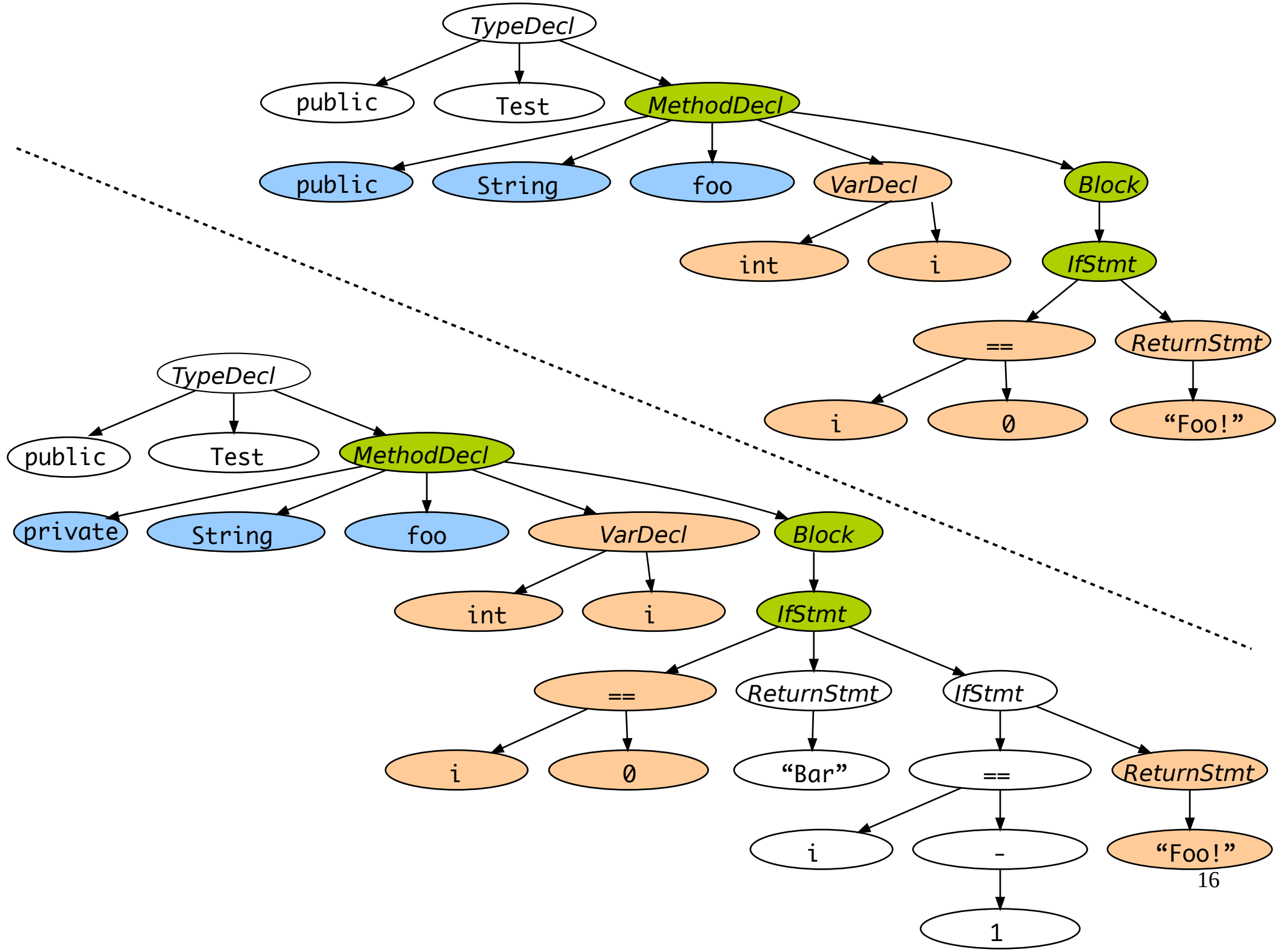
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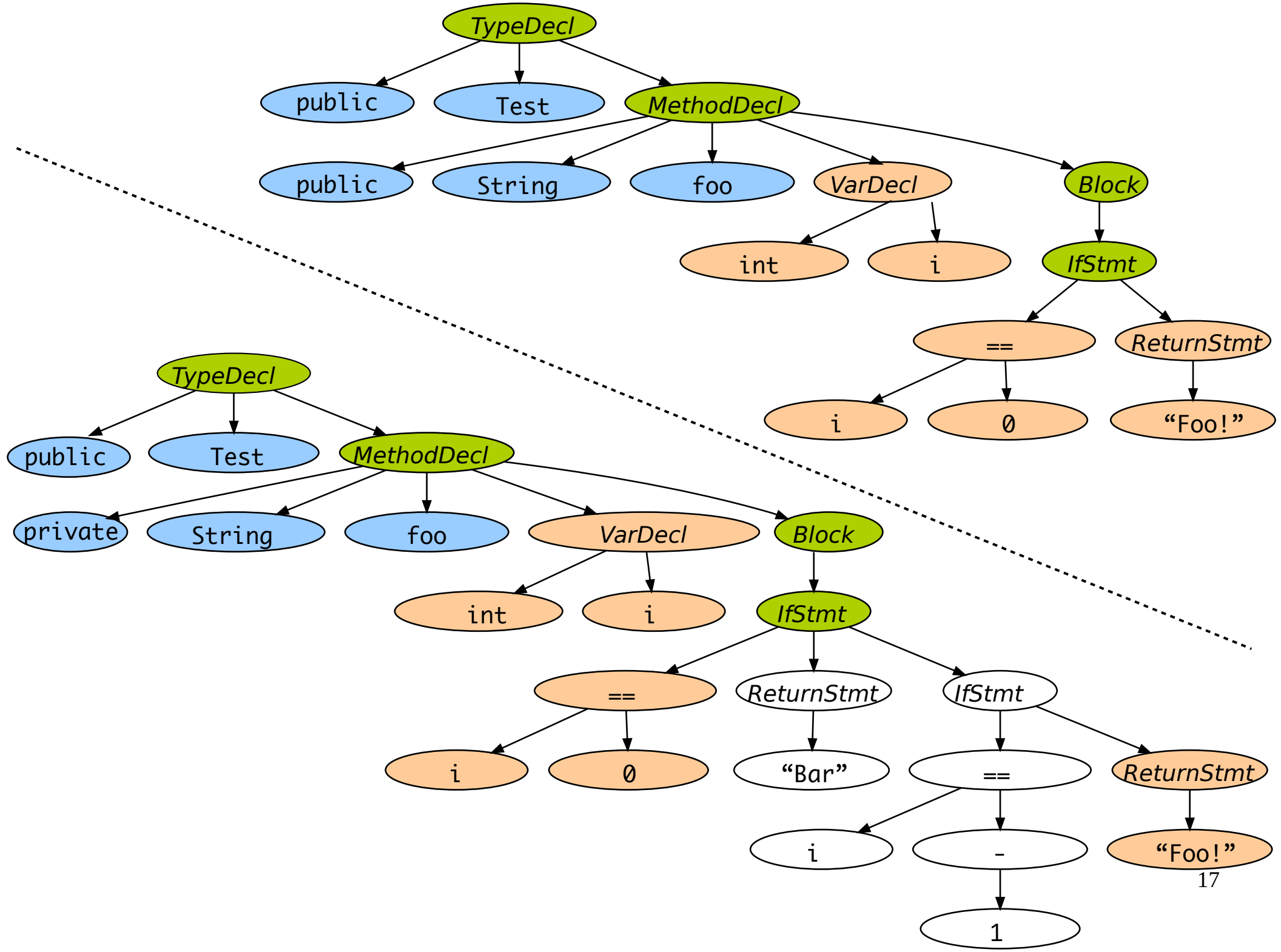
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Output

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public class Test {
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}
```

Previous state

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  private String foo(int i) {
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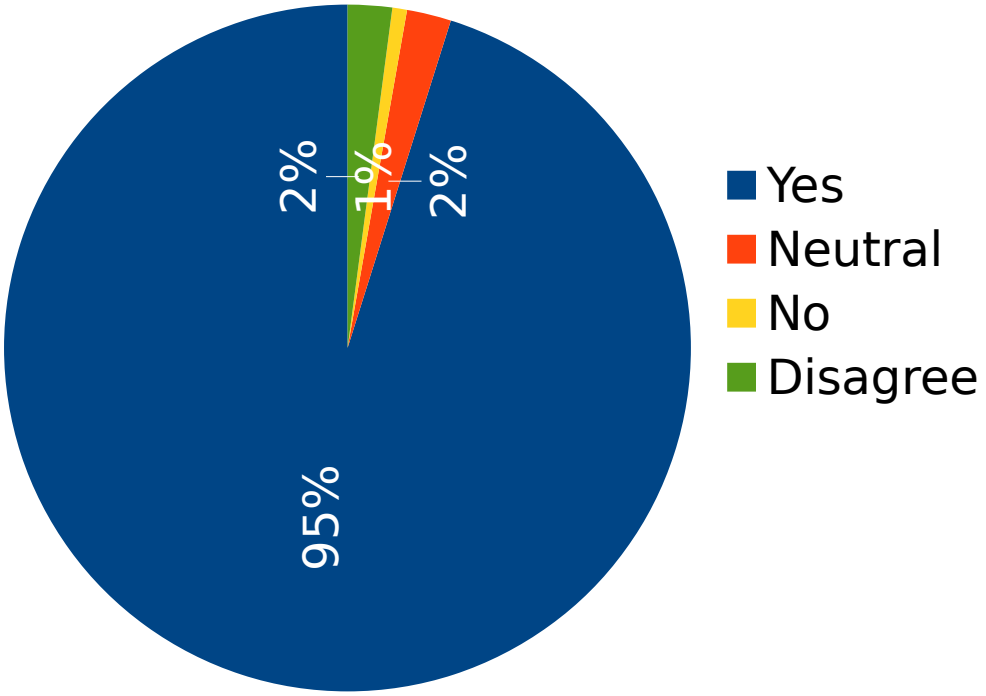
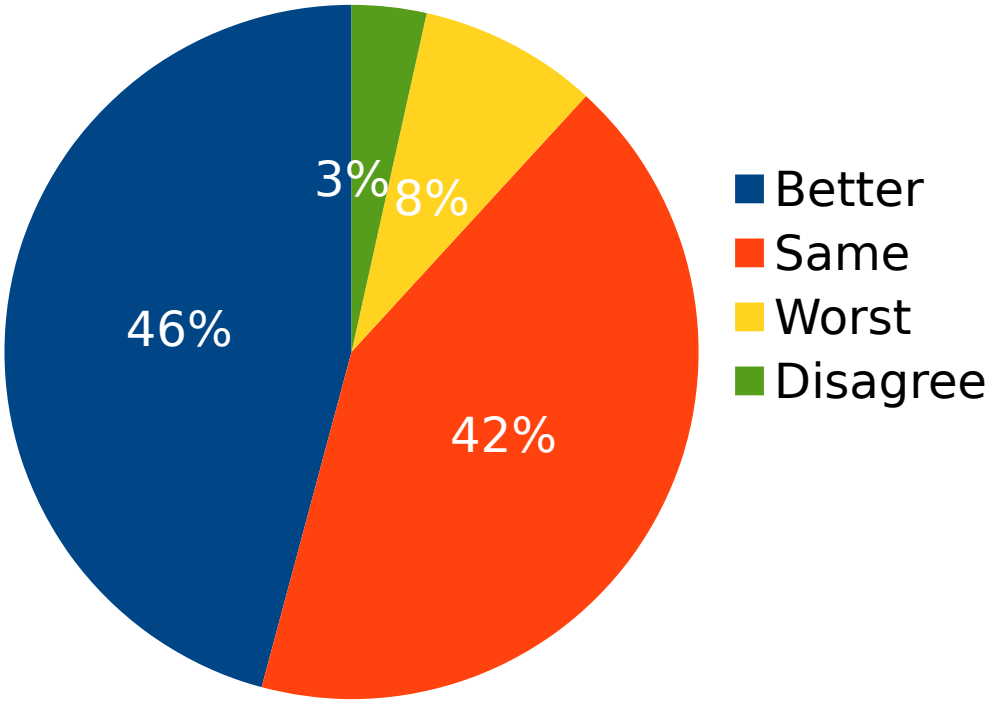
Current state

Human evaluation

GumTree does a good job?



GumTree vs text diff?



Conclusion

- Differencing algorithm
  - Detect code moves
  - Work on syntax trees
- Tool
  - Efficient
    - O(n^2)
    - Only 2 or 3 times slower than parsing
  - Empirically validated
    - Shorter edit script with more move than other heuristics
  - Freely available
    - Two articles