Program testing types

- **Black-box testing**
  - Specifications drive test inputs and expected outputs
  - No code, design or internal documentation are available
- **White-box testing**
  - Code structure drives test inputs
  - Specification used to derive tests outputs
  - Code, design, and internal documentation are available
  - Goal is to "cover" the code to gain confidence and detect defects.
White Box Testing

- Statement Coverage
  - Requires all statements to be executed
- Branch Coverage
  - Require decisions evaluate to true and false at least once
  - Implies statement coverage
- Path Coverage
  - Require all possible paths to be executed
  - Implies branch coverage

Coverage Problems

- Statement
  - May not exercise all the conditions in predicates
- Branch
  - May not exercise all combinations of branches
- Path
  - combinatorial explosion
  - infinite paths for loops
  - not all paths are feasible
Coverage

- Statements

- Branch

- Path

```java
1. public double fun(double x, int y){
2.     int p;
3.     double z;
4.     if (y > 0)
5.         p = y;
6.     else
7.         p = 0 - y;
8.     z = 1.0;
9.     while ( p-- > 0)
10.        z = z * x;
11.     if ( y < 0 && z != 0.0)
12.        z = 1.0/z;
13.     return z;
14.}
```

IntelliJ IDEA Coverage

- [https://www.youtube.com/watch?v=yNYzZvyA2ik](https://www.youtube.com/watch?v=yNYzZvyA2ik)
IntelliJ IDEA Coverage

<table>
<thead>
<tr>
<th>Package</th>
<th>Classes, %</th>
<th>Method, %</th>
<th>Lines, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>all classes</td>
<td>72.7% (54 22)</td>
<td>30.1% (187)</td>
<td>14.8% (66/308)</td>
</tr>
</tbody>
</table>

Coverage Breakdown

<table>
<thead>
<tr>
<th>Package</th>
<th>Classes, %</th>
<th>Method, %</th>
<th>Lines, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>edu.ca.cs5710.4714.trips</td>
<td>88.7% (23)</td>
<td>58.4% (21)</td>
<td>11.8% (277/240)</td>
</tr>
<tr>
<td>edu.ca.cs5710.4714.trips.Model</td>
<td>100% (65)</td>
<td>78.8% (62)</td>
<td>30% (50/168)</td>
</tr>
<tr>
<td>edu.ca.cs5710.4714.trips.Presenter</td>
<td>28% (0)</td>
<td>37.7% (24)</td>
<td>32% (4/12)</td>
</tr>
<tr>
<td>edu.ca.cs5710.4714.trips.View</td>
<td>12.6% (7)</td>
<td>24.7% (36)</td>
<td>28.4% (75/269)</td>
</tr>
</tbody>
</table>

Branch Coverage
Path Coverage