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Evaluation of Regression Test Optimization Techniques

Final Talk

Regression Testing

- Rerunning tests frequently to detect bugs
 - **Important** part of software development
- Resource + time consuming
- More and **more tests** need more and **more time**



ILLUSTRATED BY SEGUE TECHNOLOGIES
www.seguetech.com

Tests can take a long time



Critical bugs need to be fixed fast

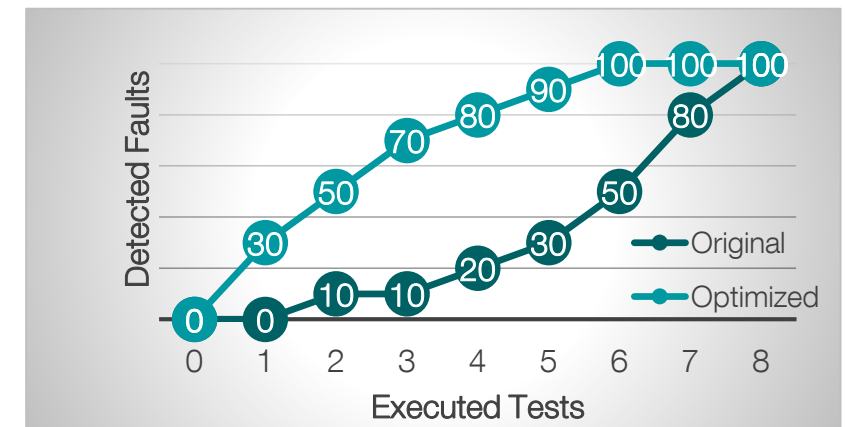
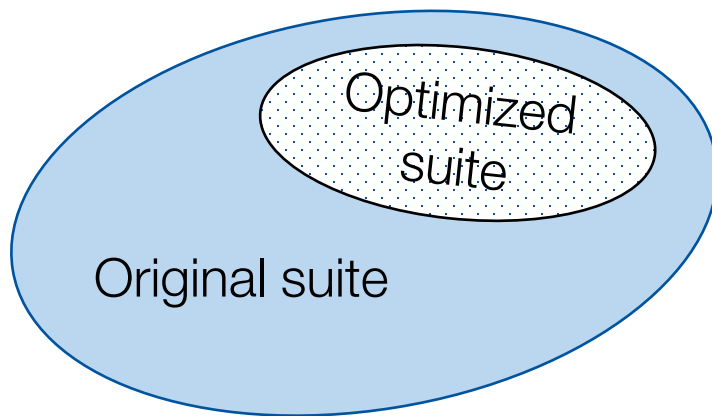


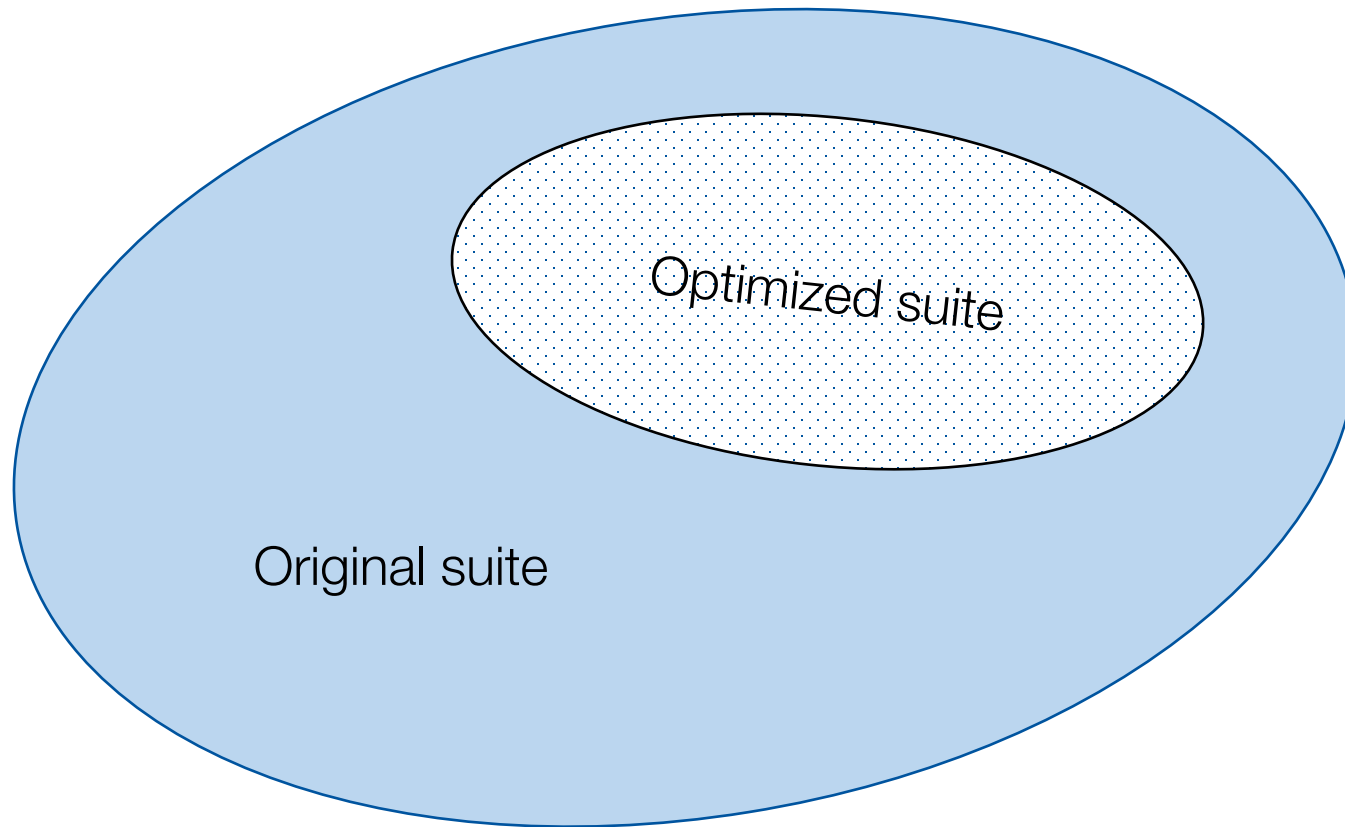


Regression Test Optimization

Selection

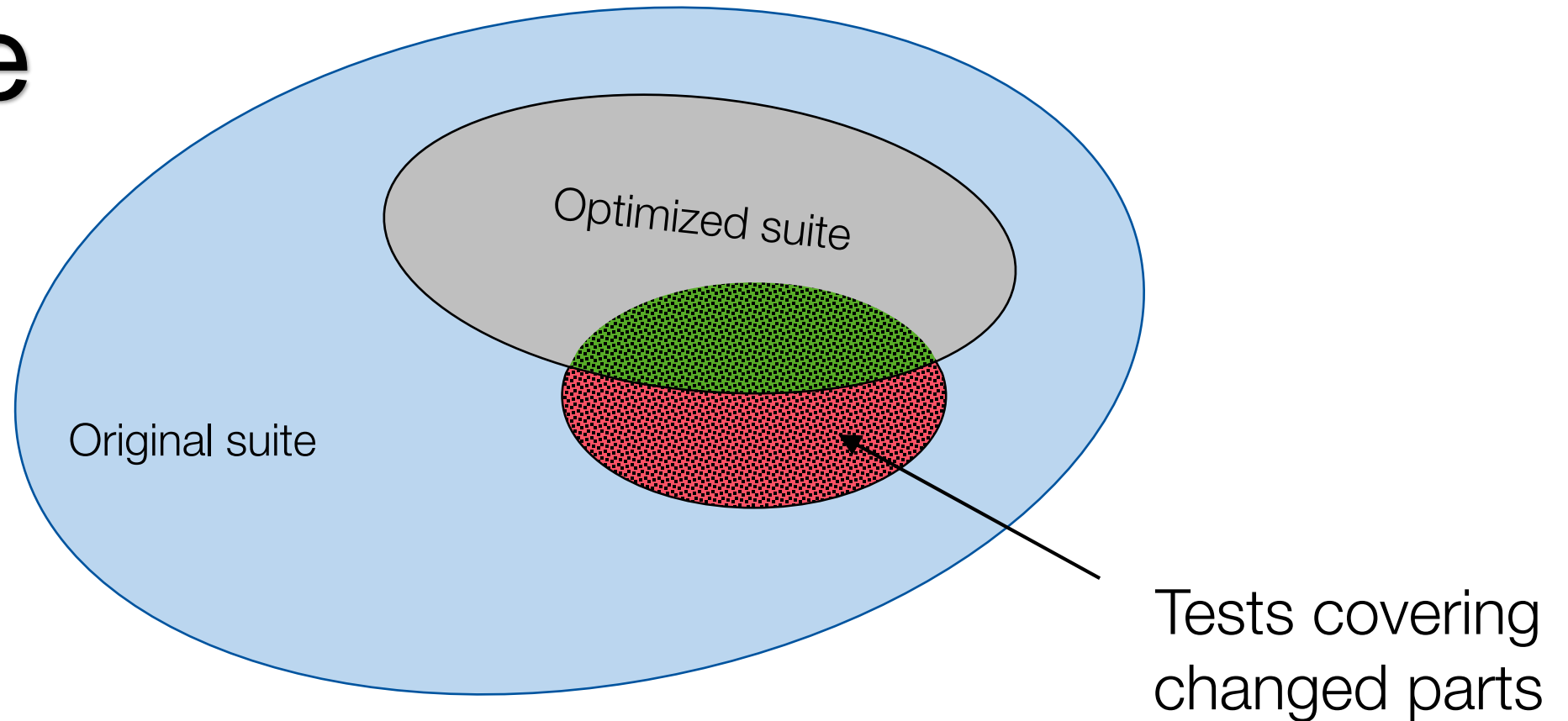
Prioritization



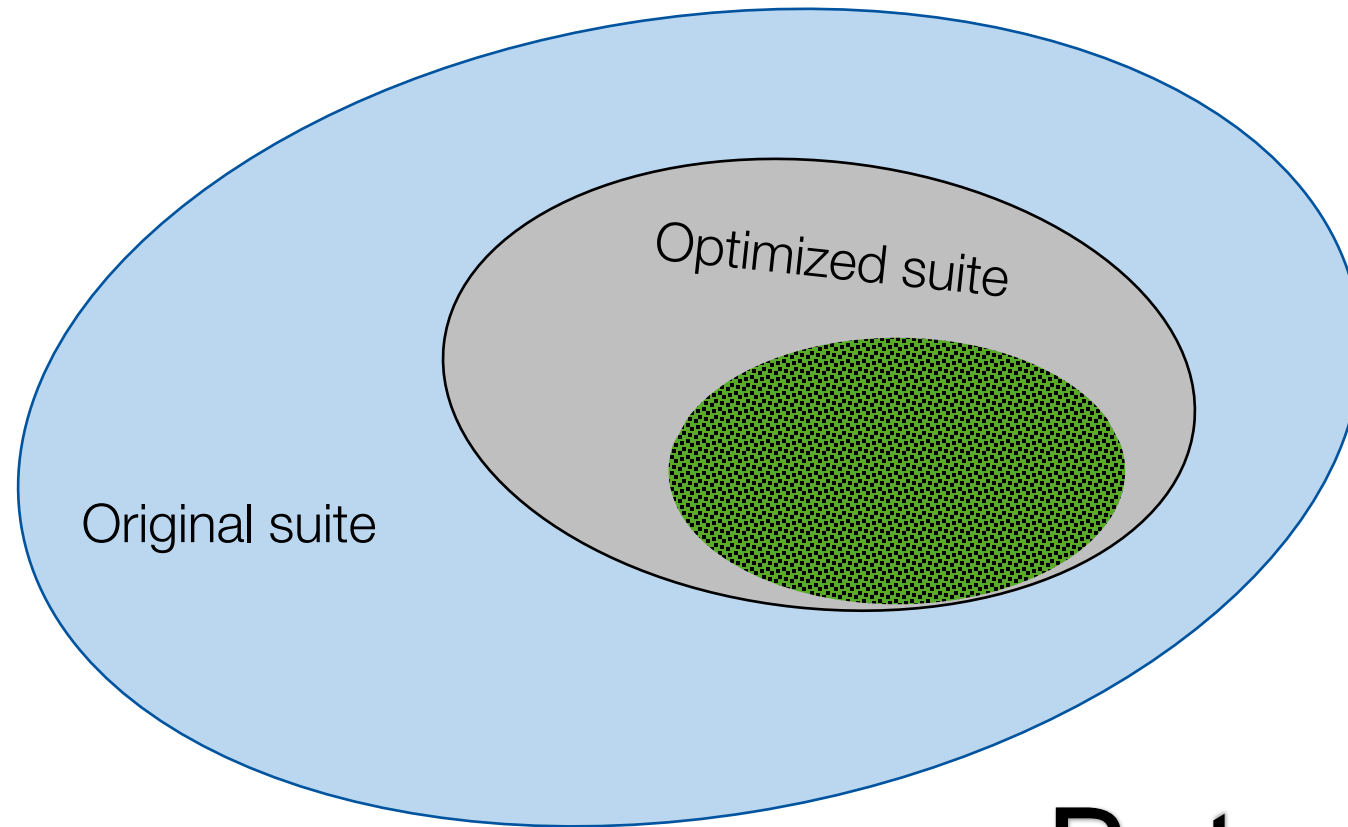


- Select a subset of tests

Not safe

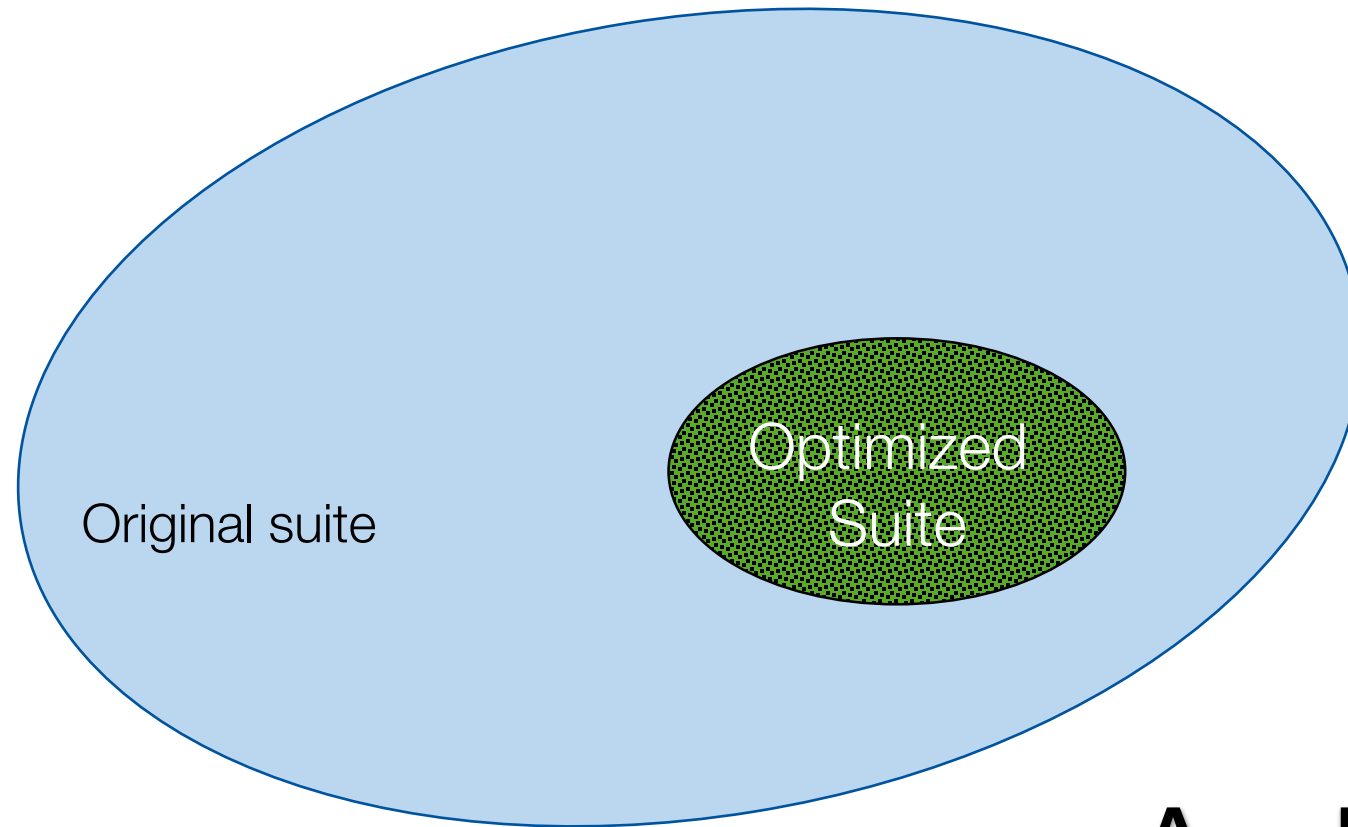


Safe



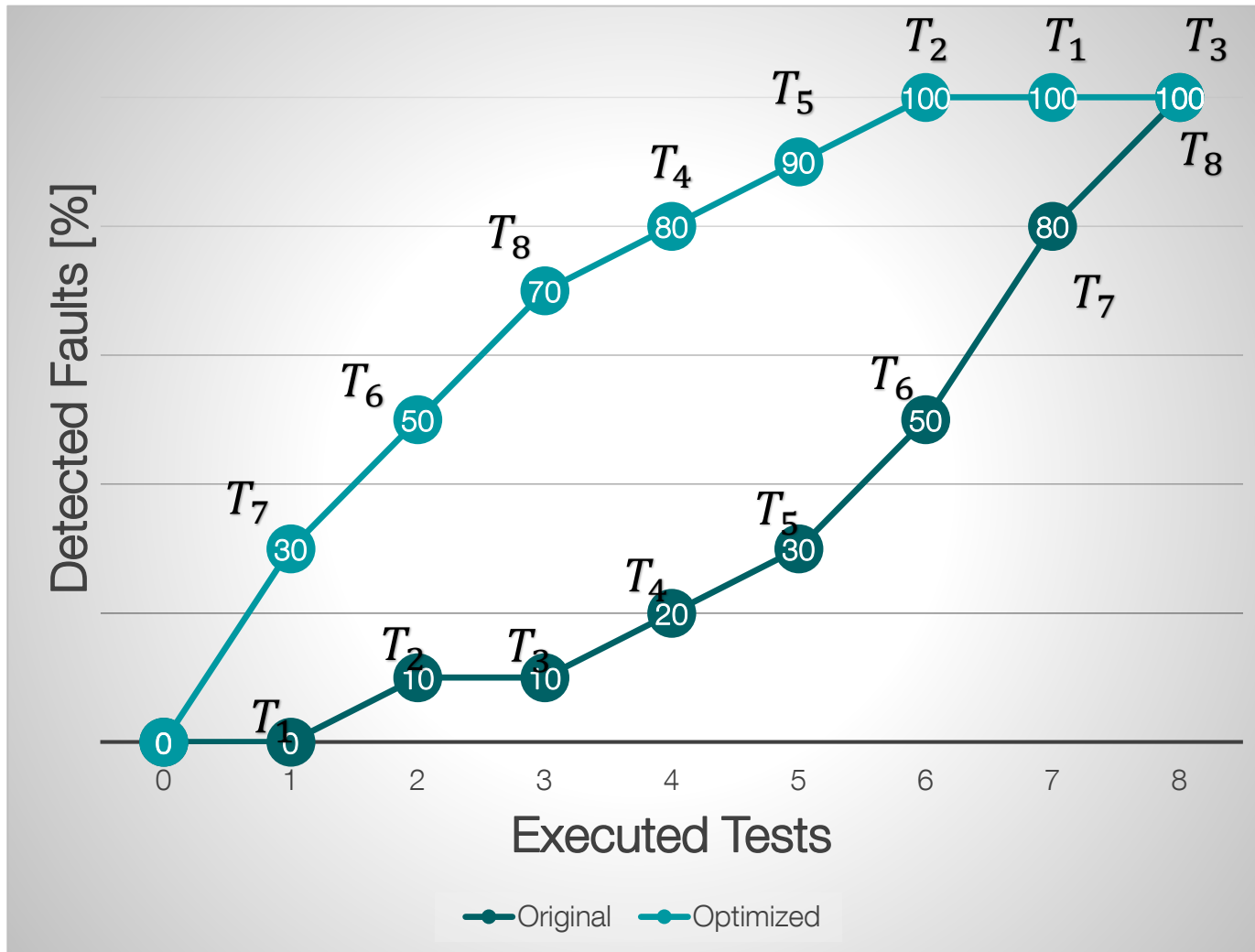
But not precise

Safe



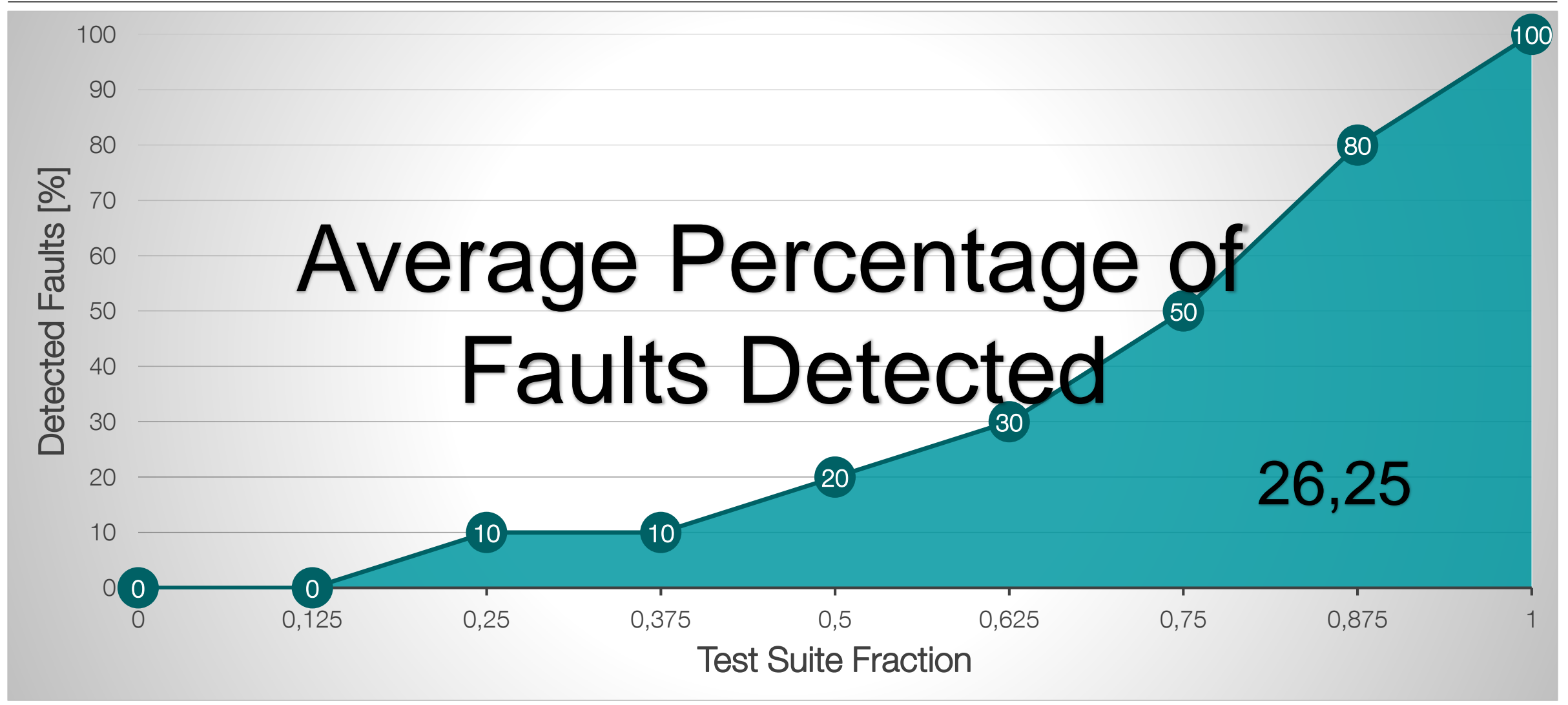
And precise

Regression Test Prioritization

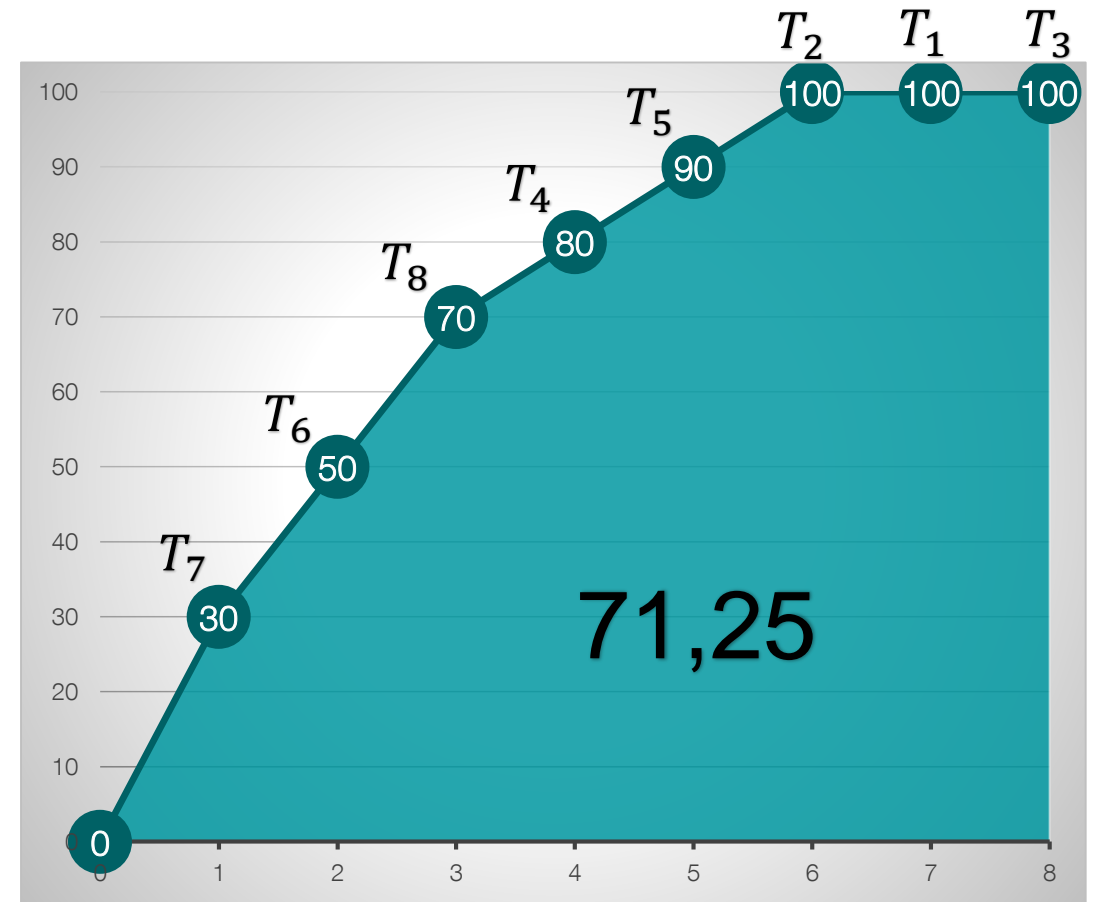
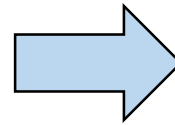
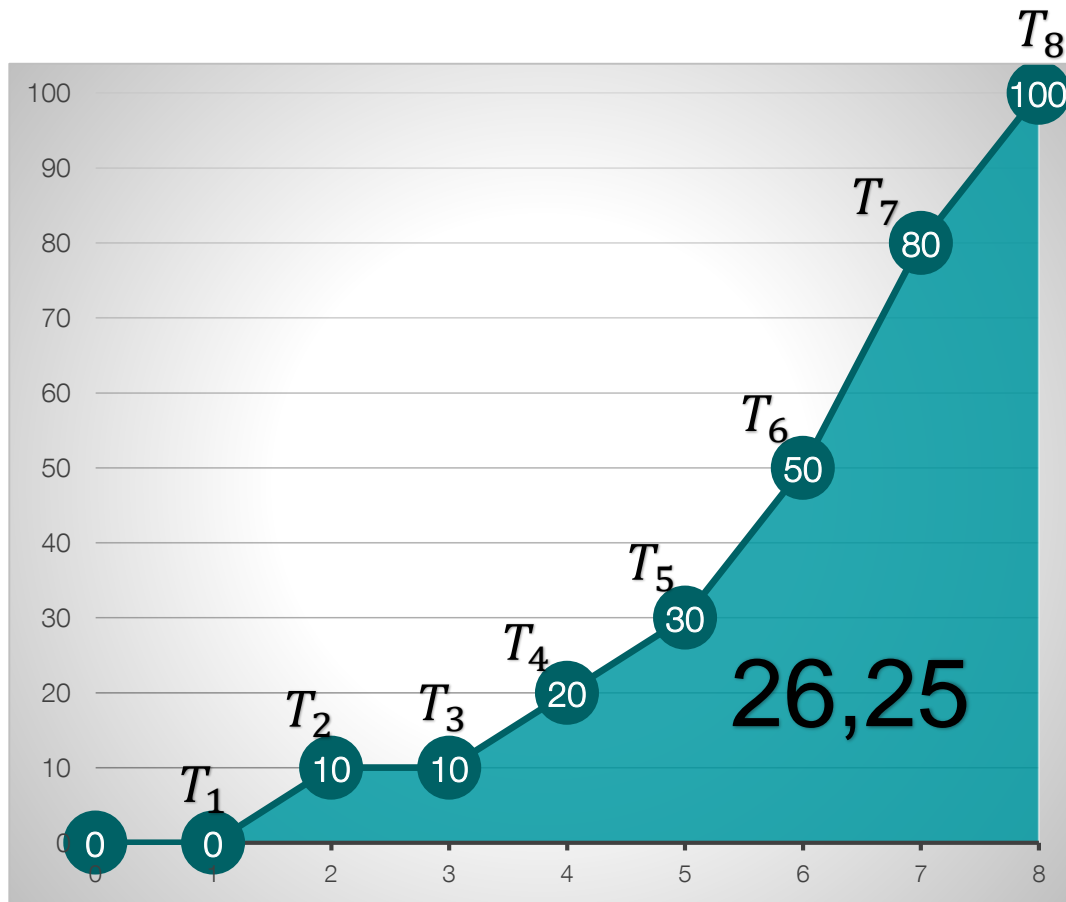


- Prioritize tests to detect faults faster
- “rate of fault detection”

APFD – Average Percentage of Faults Detected



APFD – Average Percentage of Faults Detected



Evaluation of regression test optimization techniques

Existing Evaluations:

- **Artificial** programs
- With **artificial** bugs

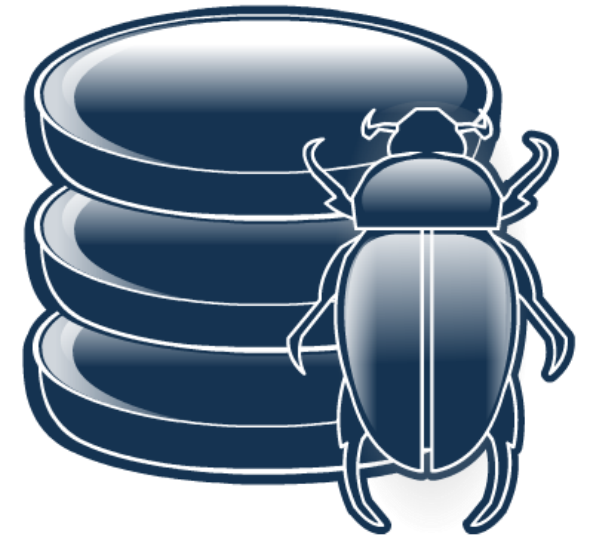
My Evaluation

- **Real** projects
- With **real** bugs



Bug Database

- Collection of real bugs
 - And JUnit Tests that expose them
- Provides buggy and fixed version
- Accessible with command line tool
 - Automated and reproducible



- Tests are added with bug-fix



Evaluation Procedure

Initialization

- Get project and generate required data

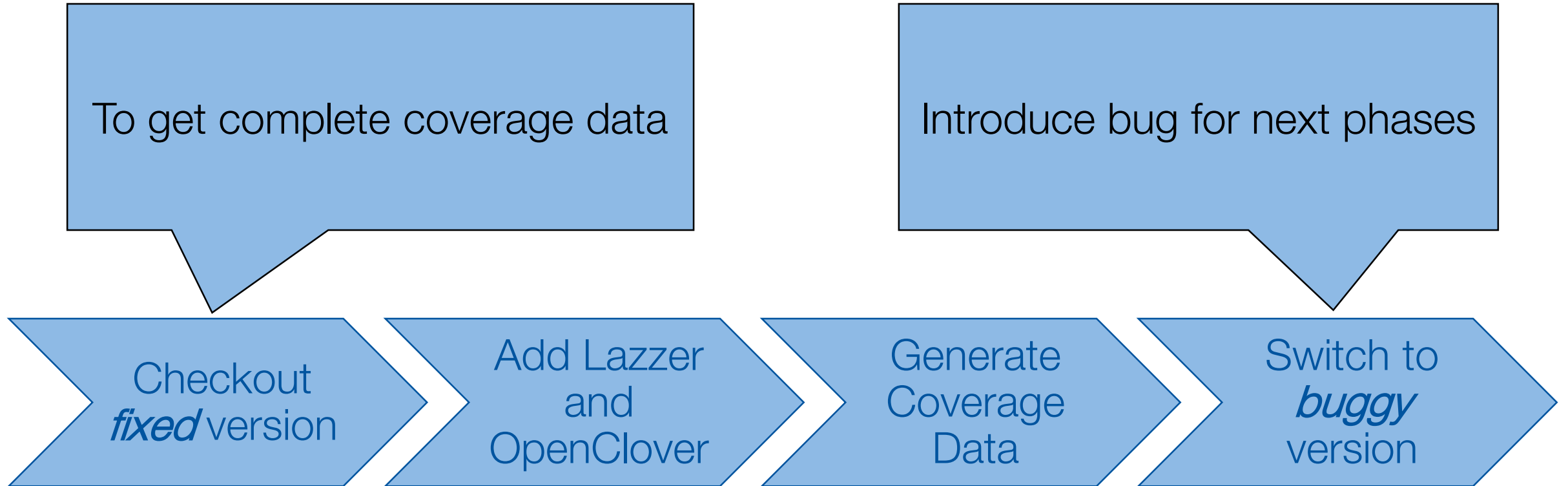
Optimization

- Optimize test suite

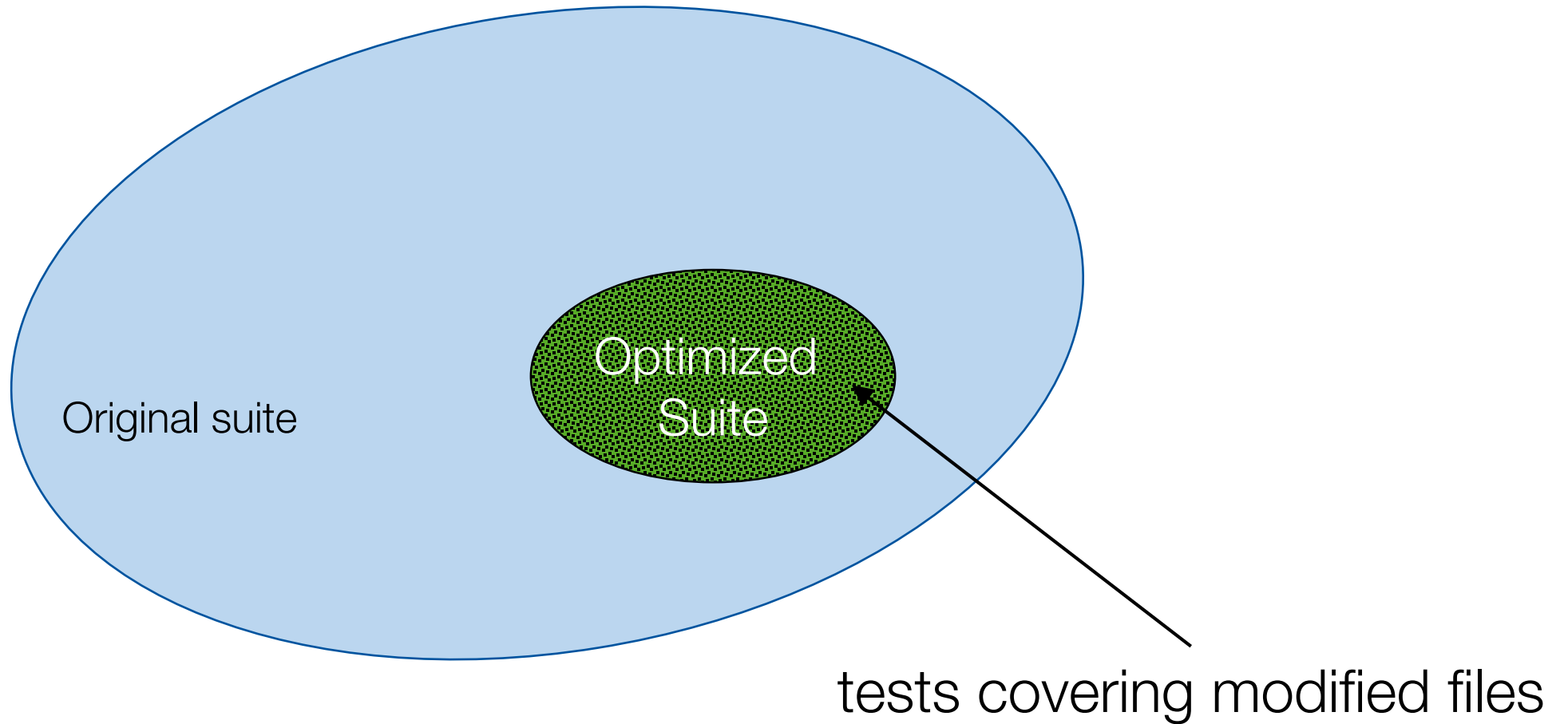
Analysis

- Compare optimized test suite with original test suite

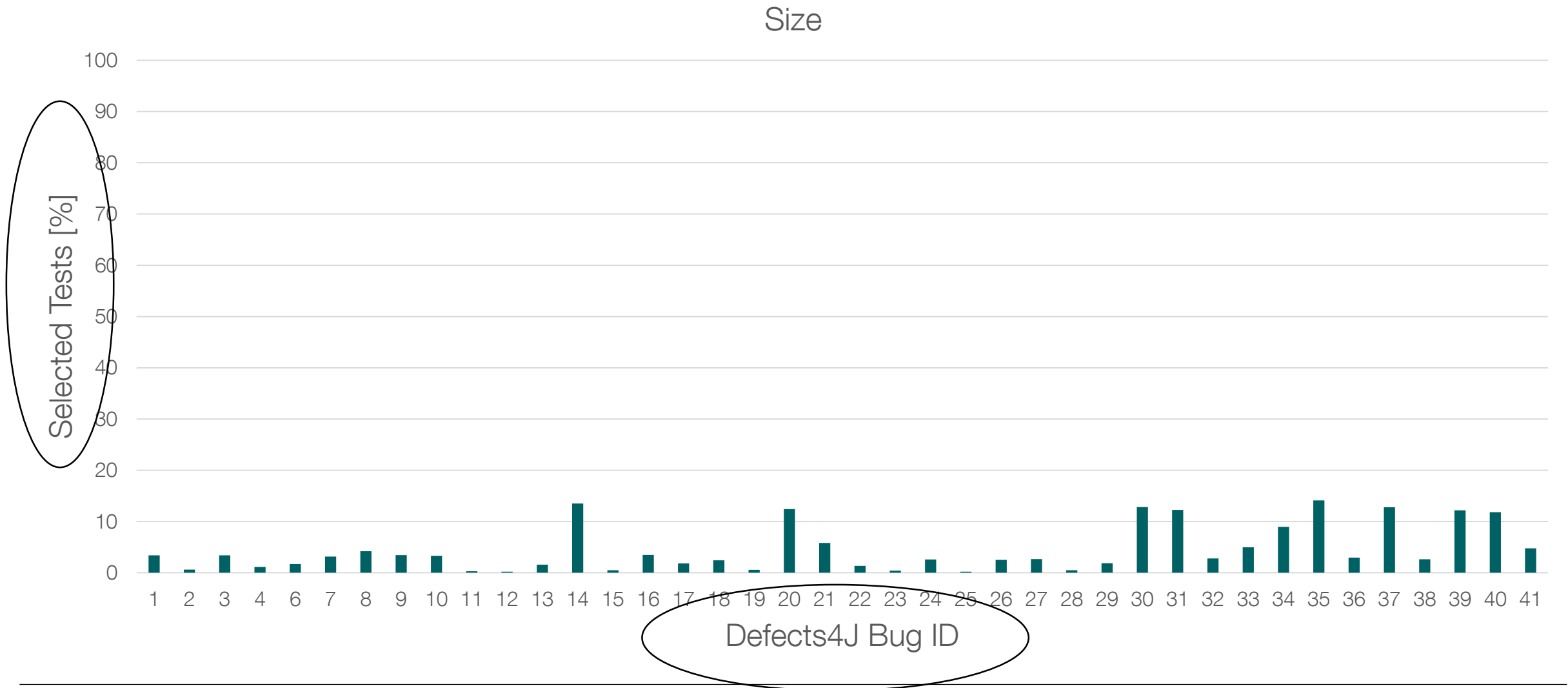
Initialization



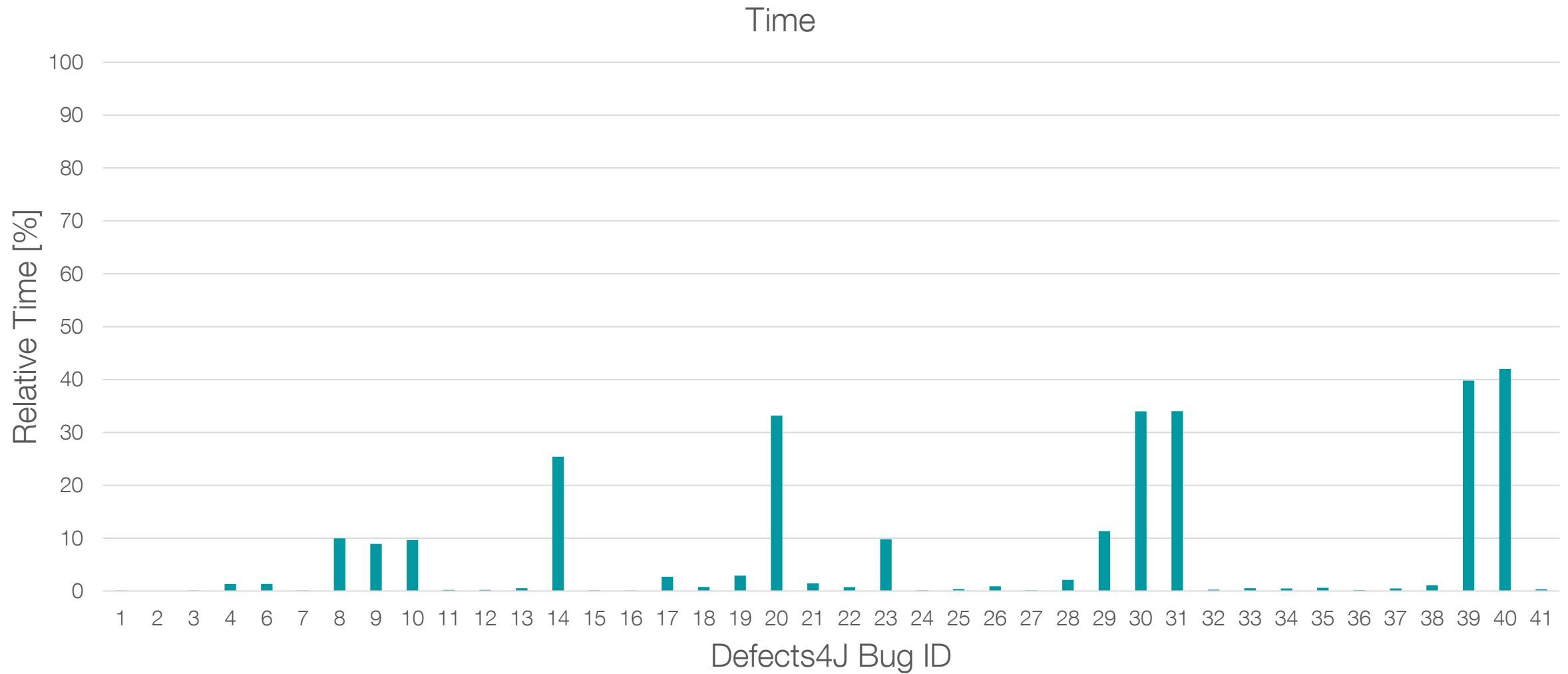
Cover Changes Selection Technique



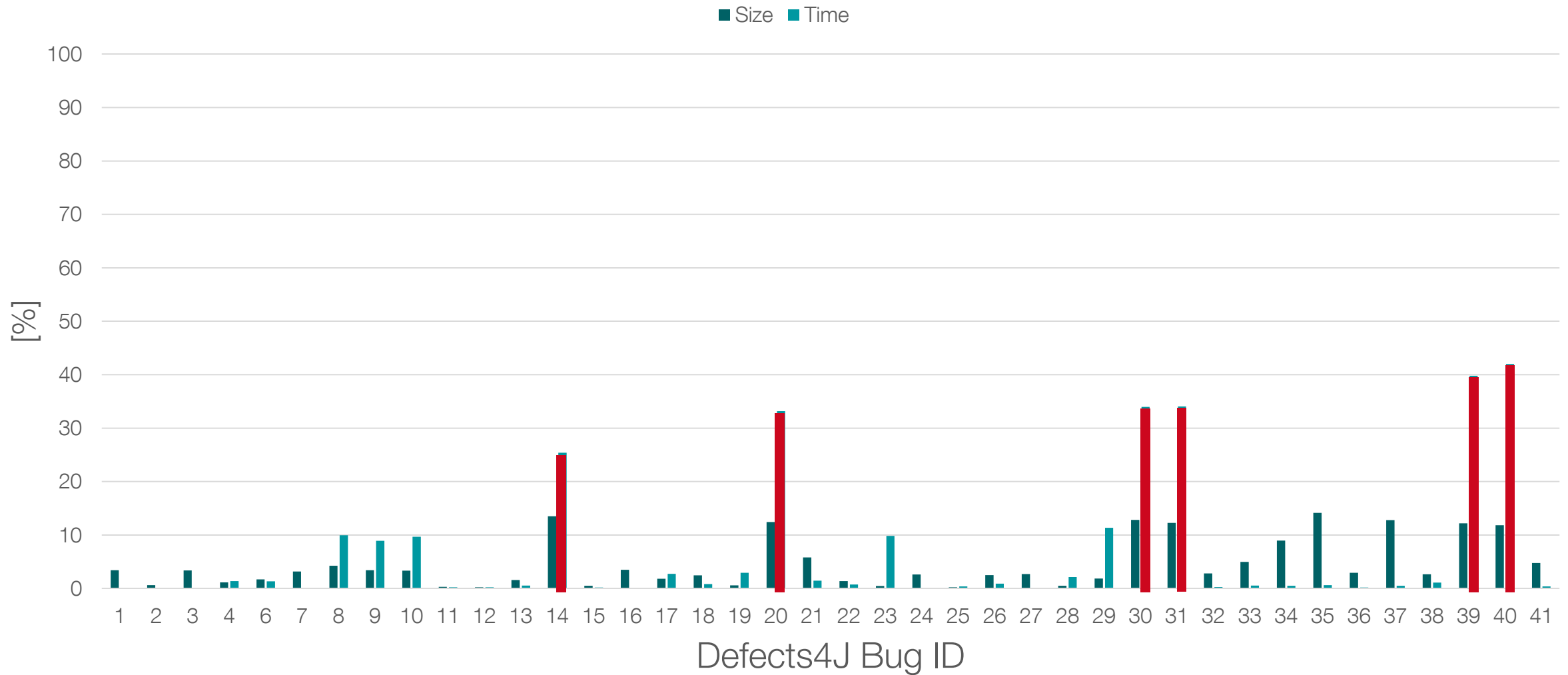
Cover Changes Selection Technique – Apache Commons Lang



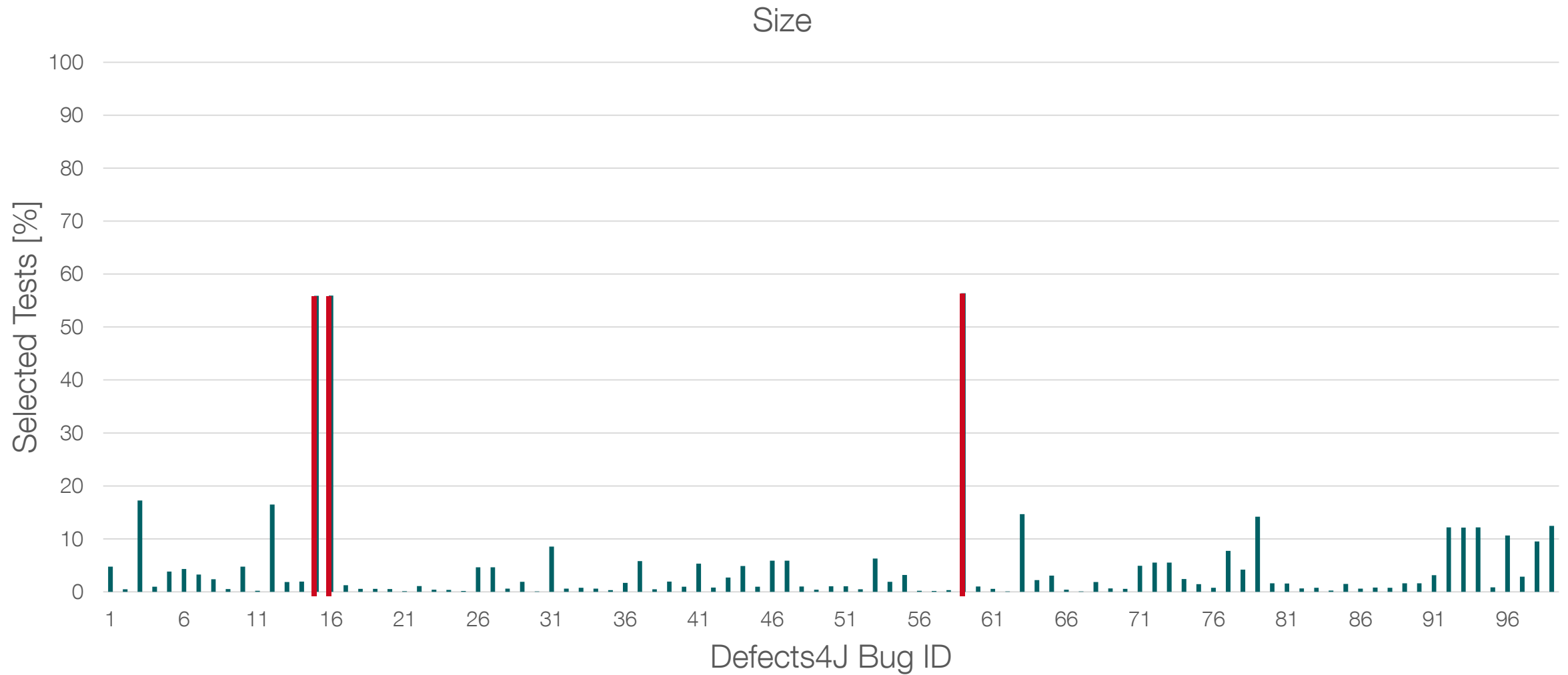
Cover Changes Selection Technique – Apache Commons Lang



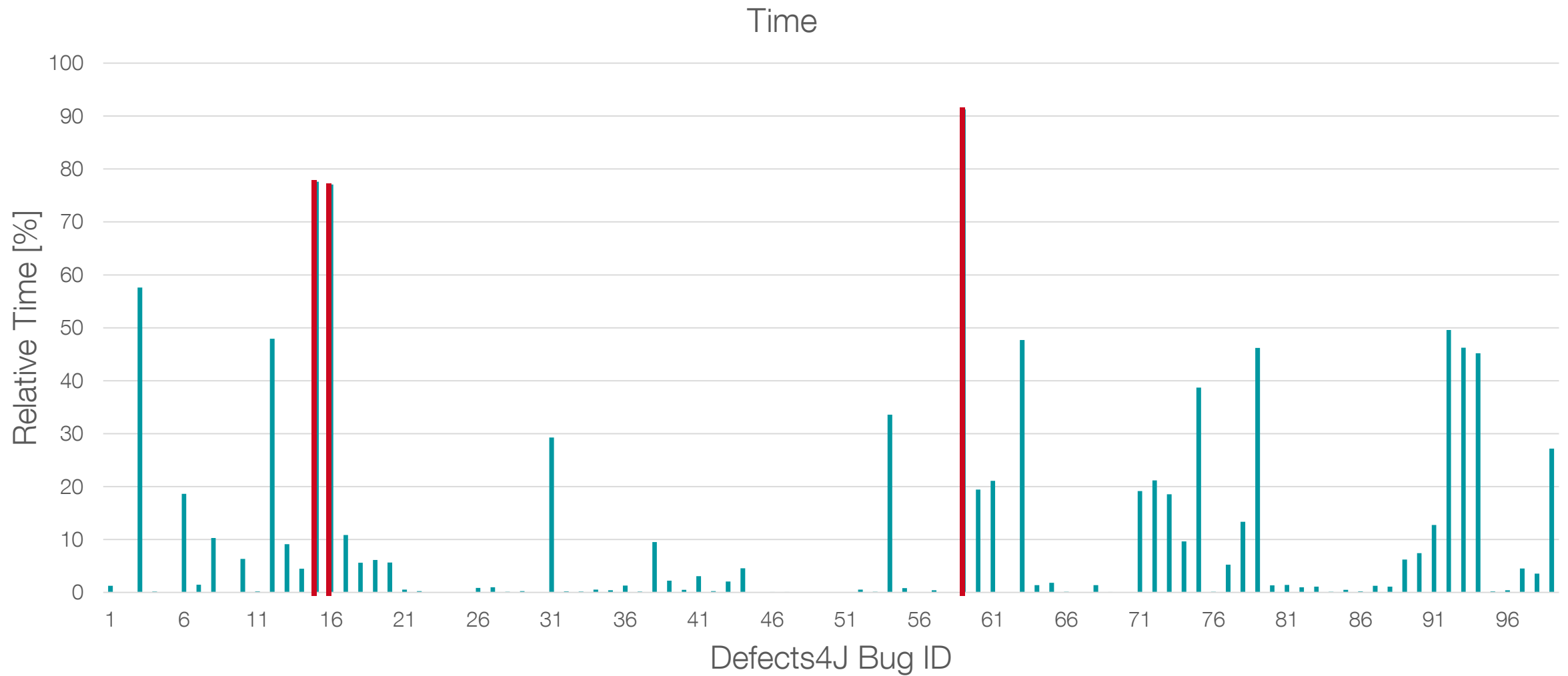
Cover Changes Selection Technique – Apache Commons Lang



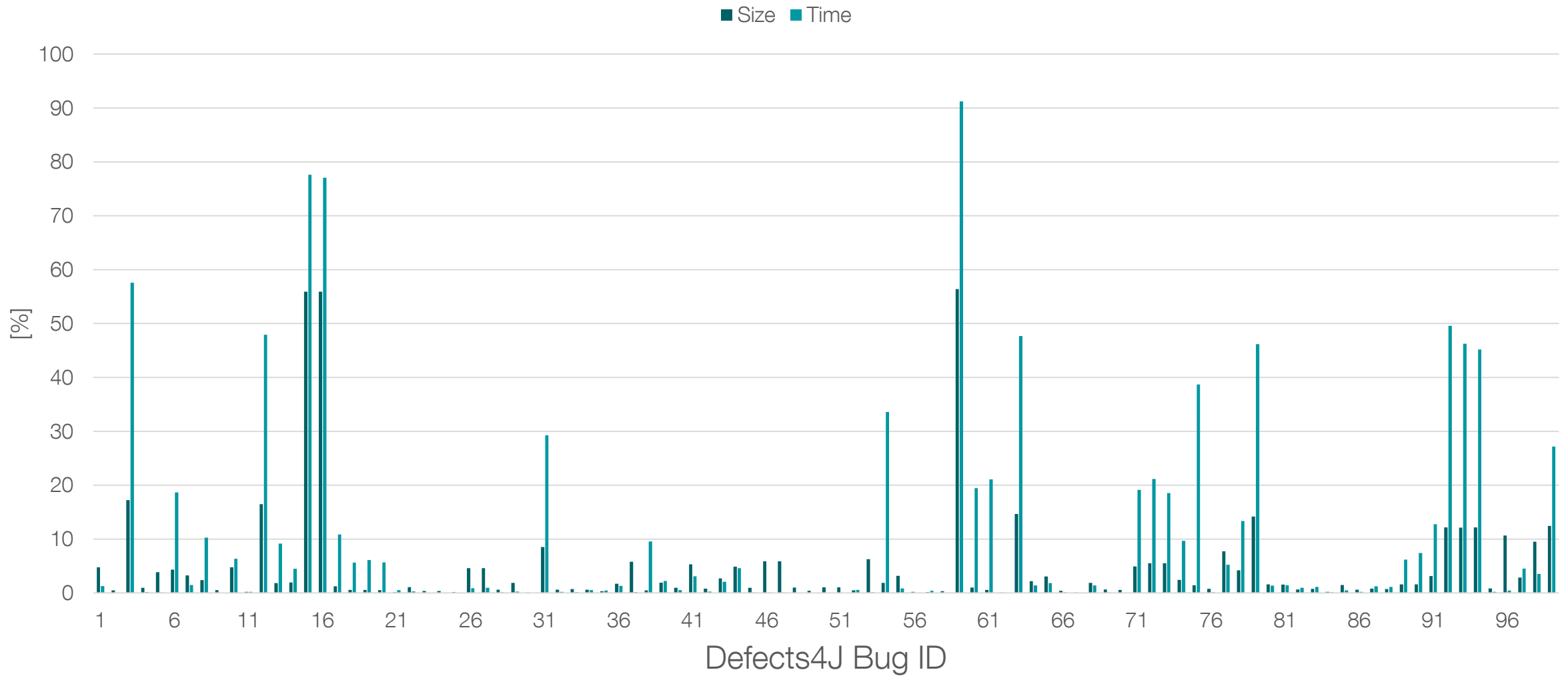
Cover Changes Selection Technique – Apache Commons Math



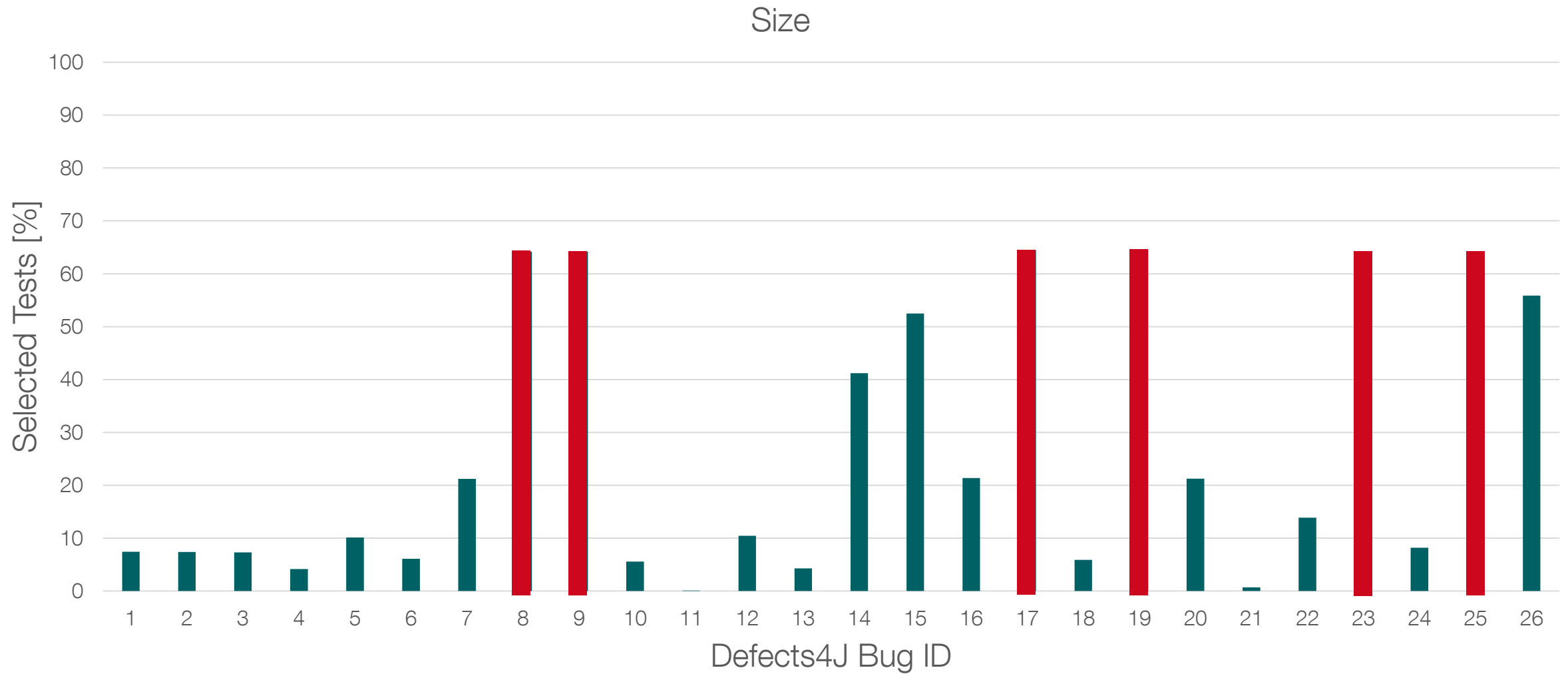
Cover Changes Selection Technique – Apache Commons Math



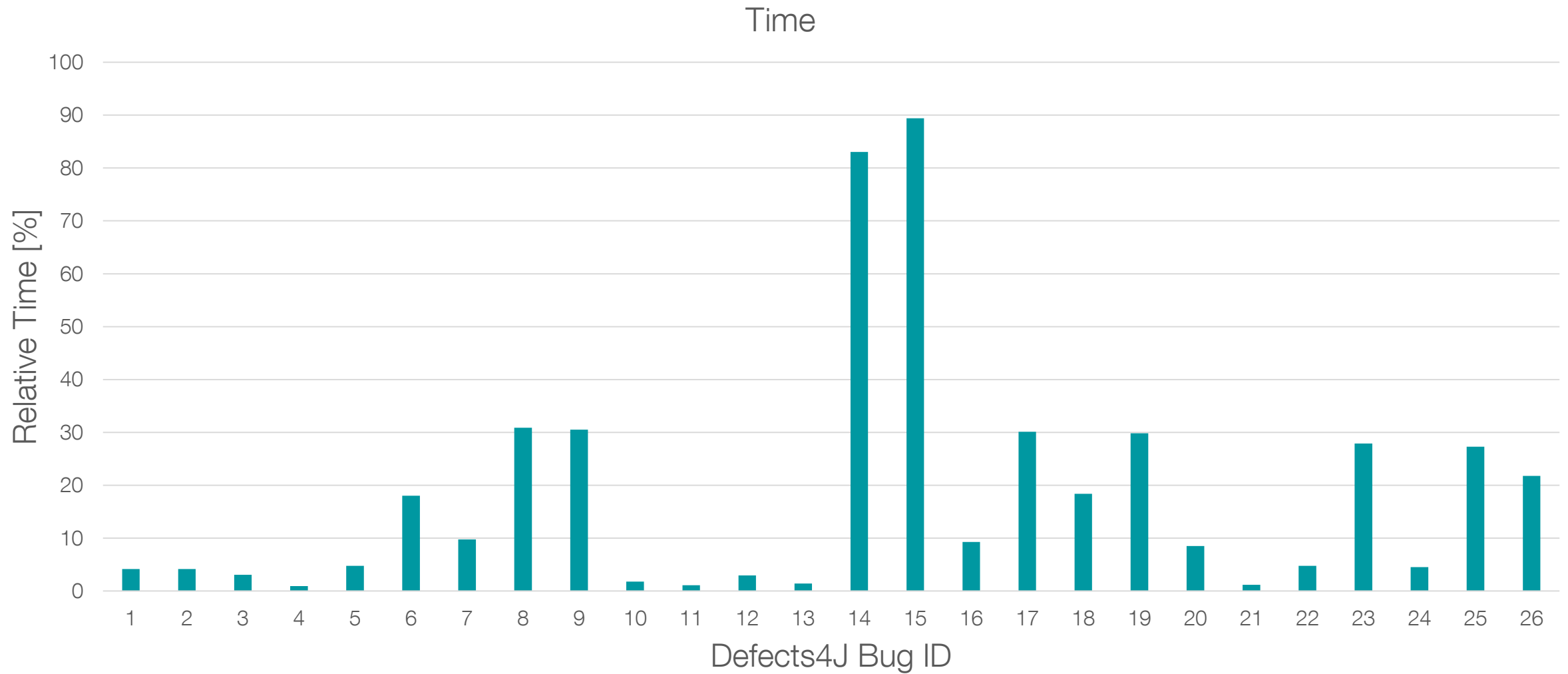
Cover Changes Selection Technique – Apache Commons Math



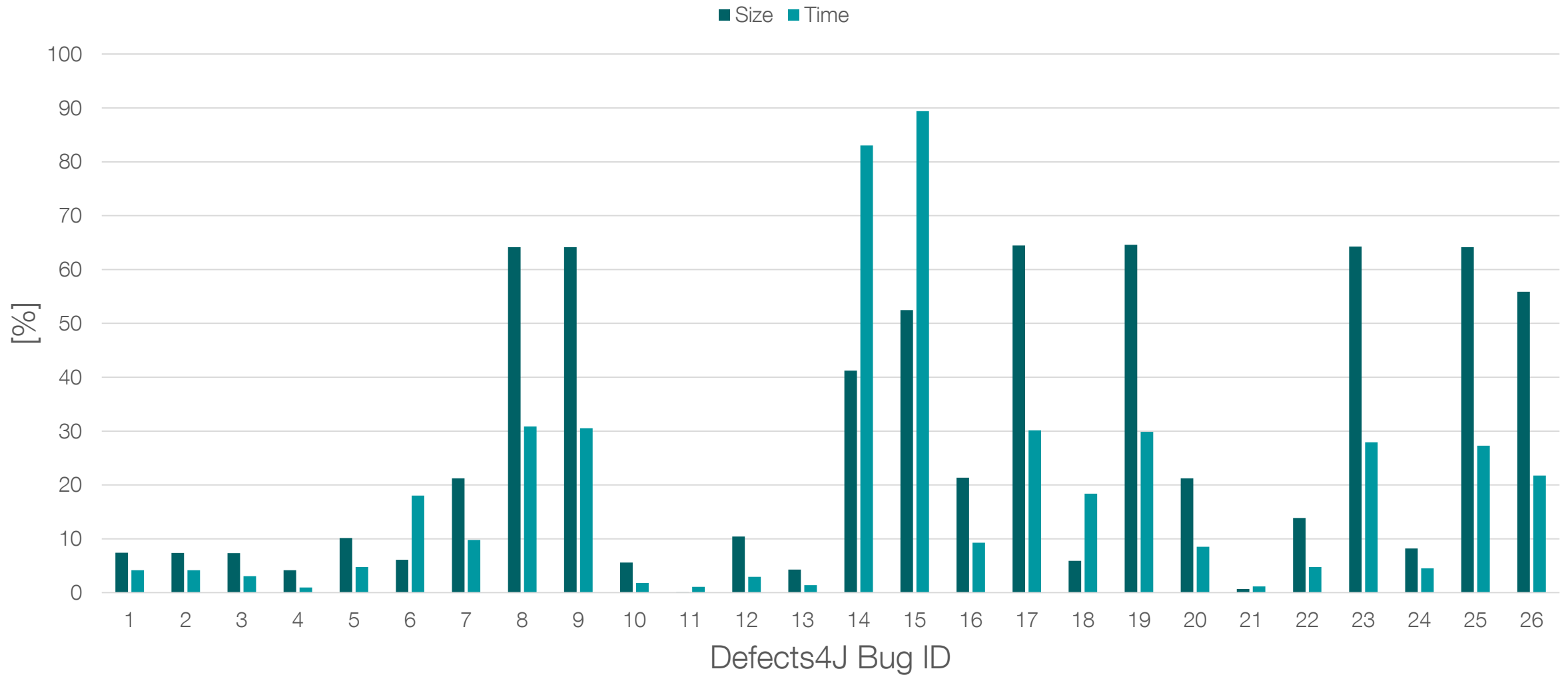
Cover Changes Selection Technique – Joda-Time



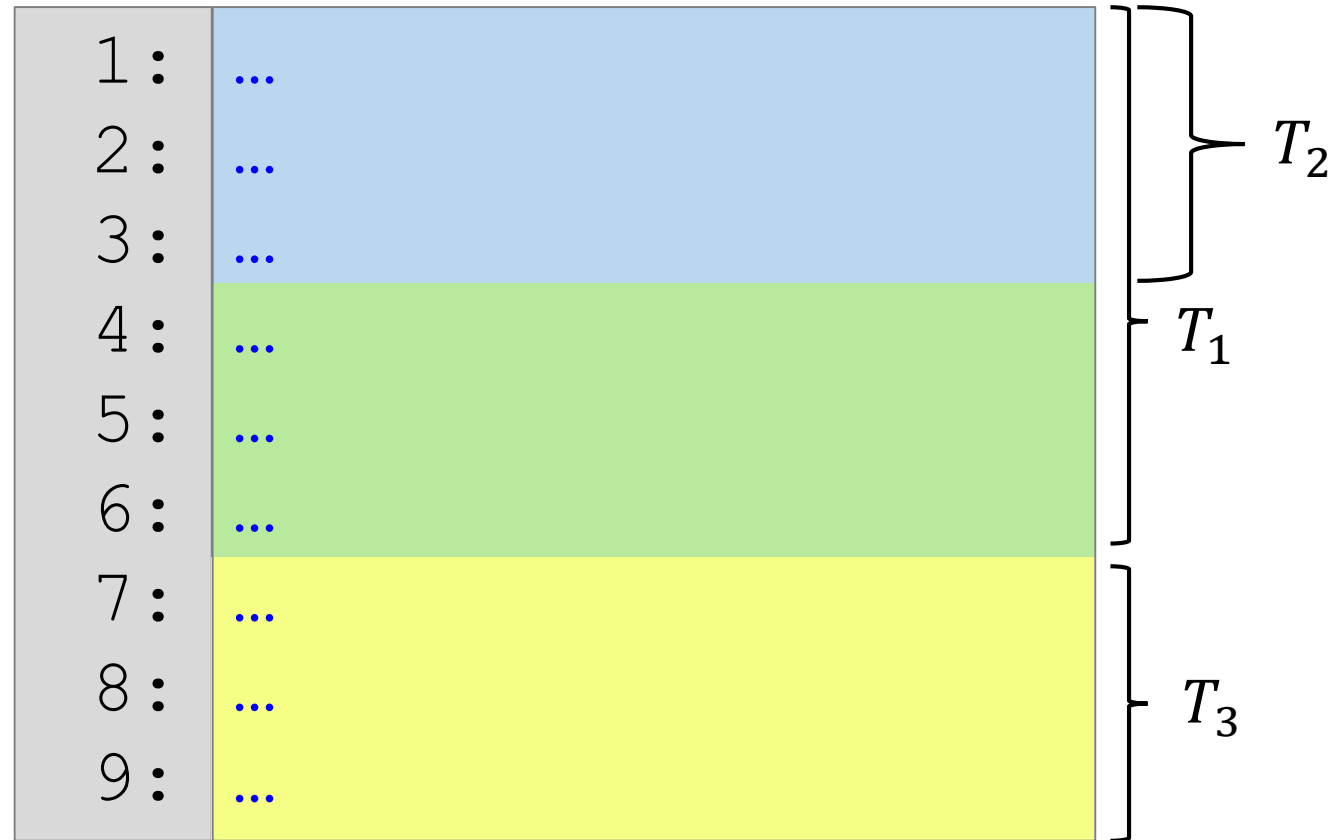
Cover Changes Selection Technique – Joda Time



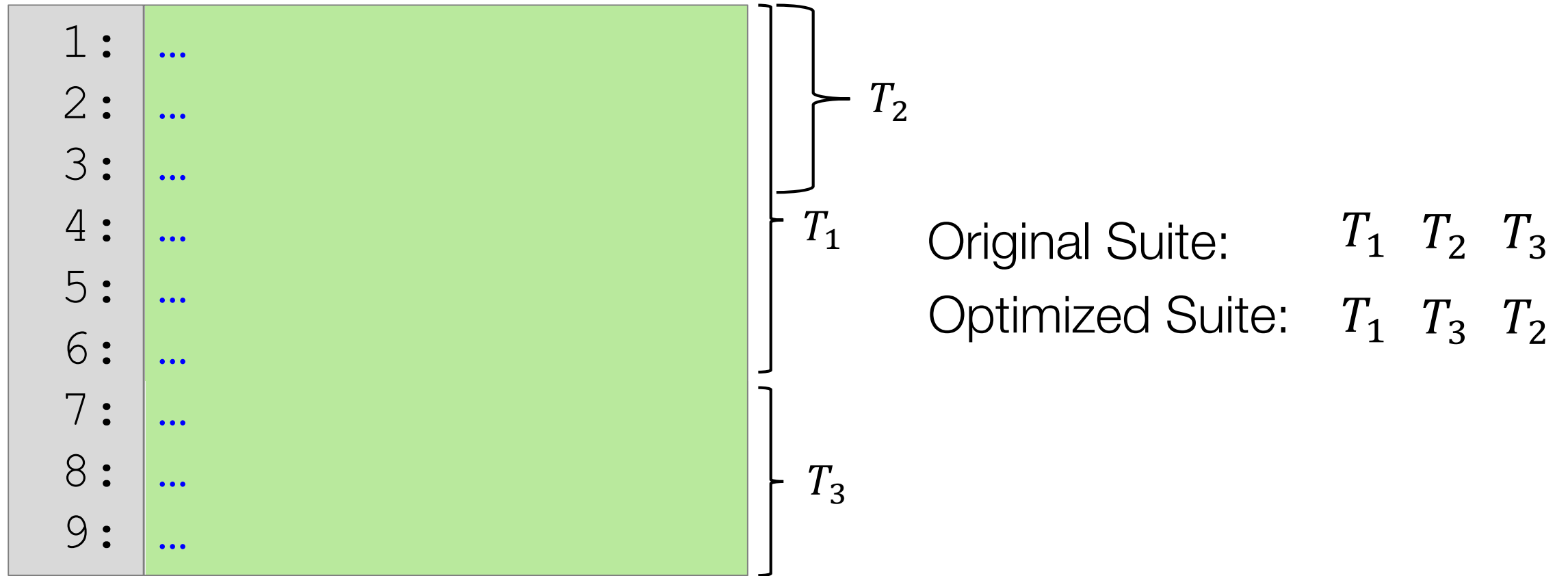
Cover Changes Selection Technique – Joda Time



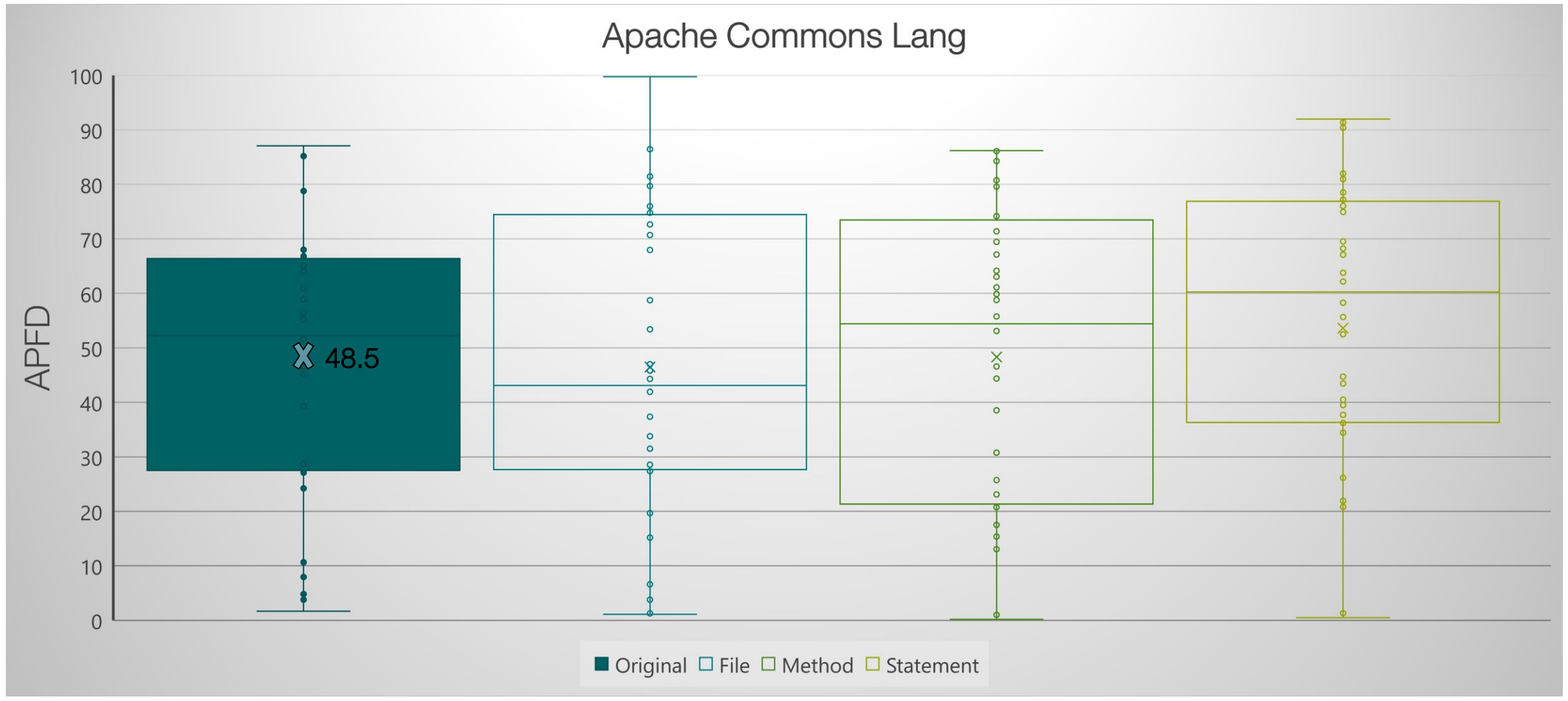
Additional Coverage Prioritization Technique



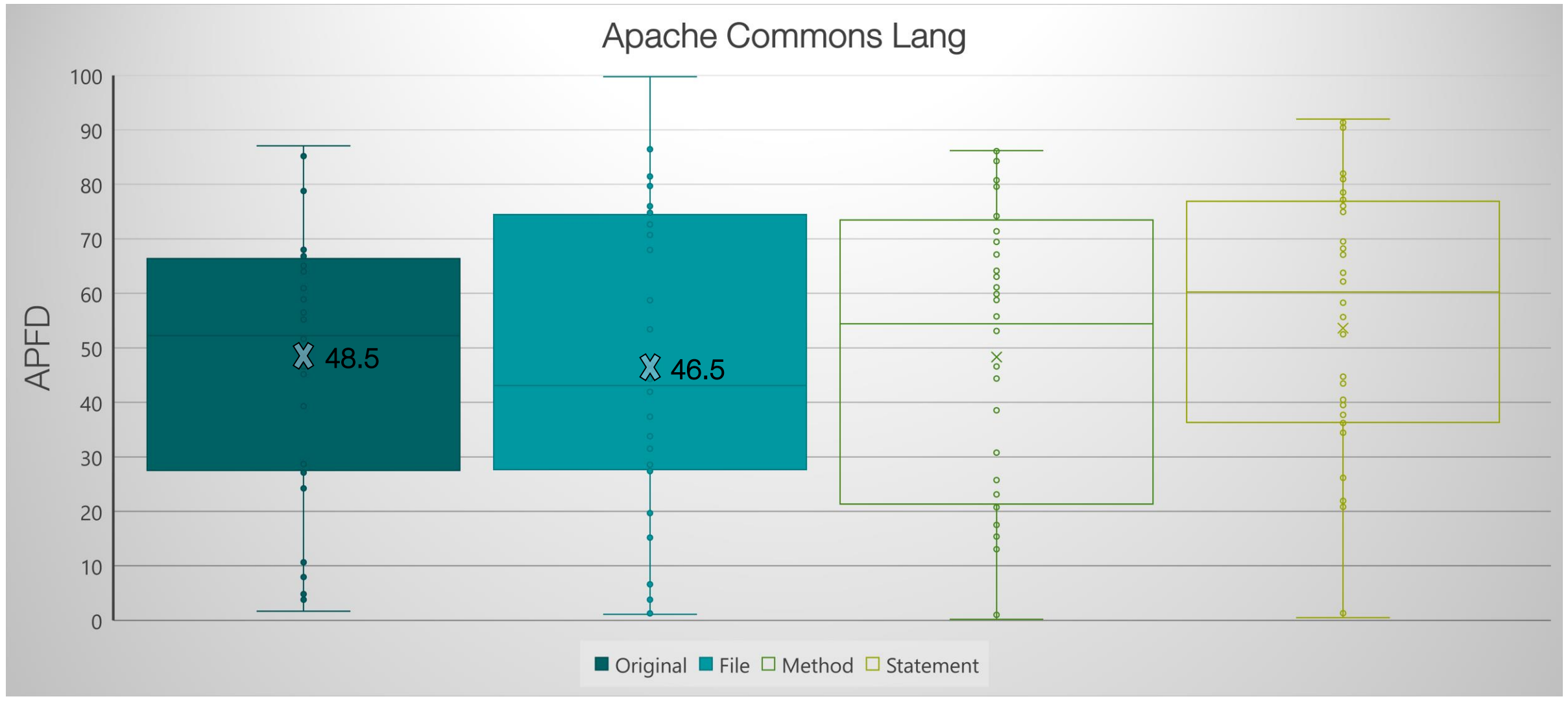
Additional Coverage Prioritization Technique



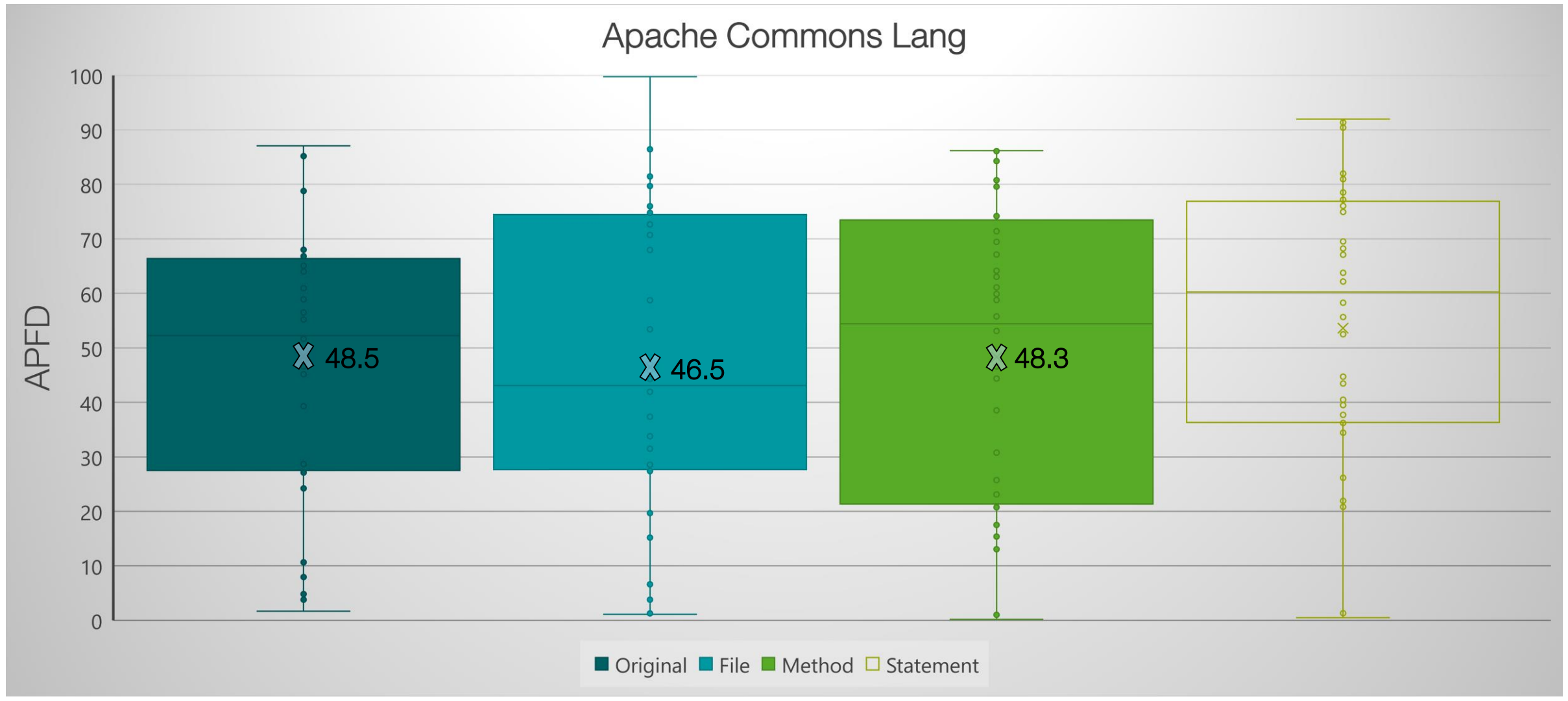
Results – Additional Coverage Prioritization Technique



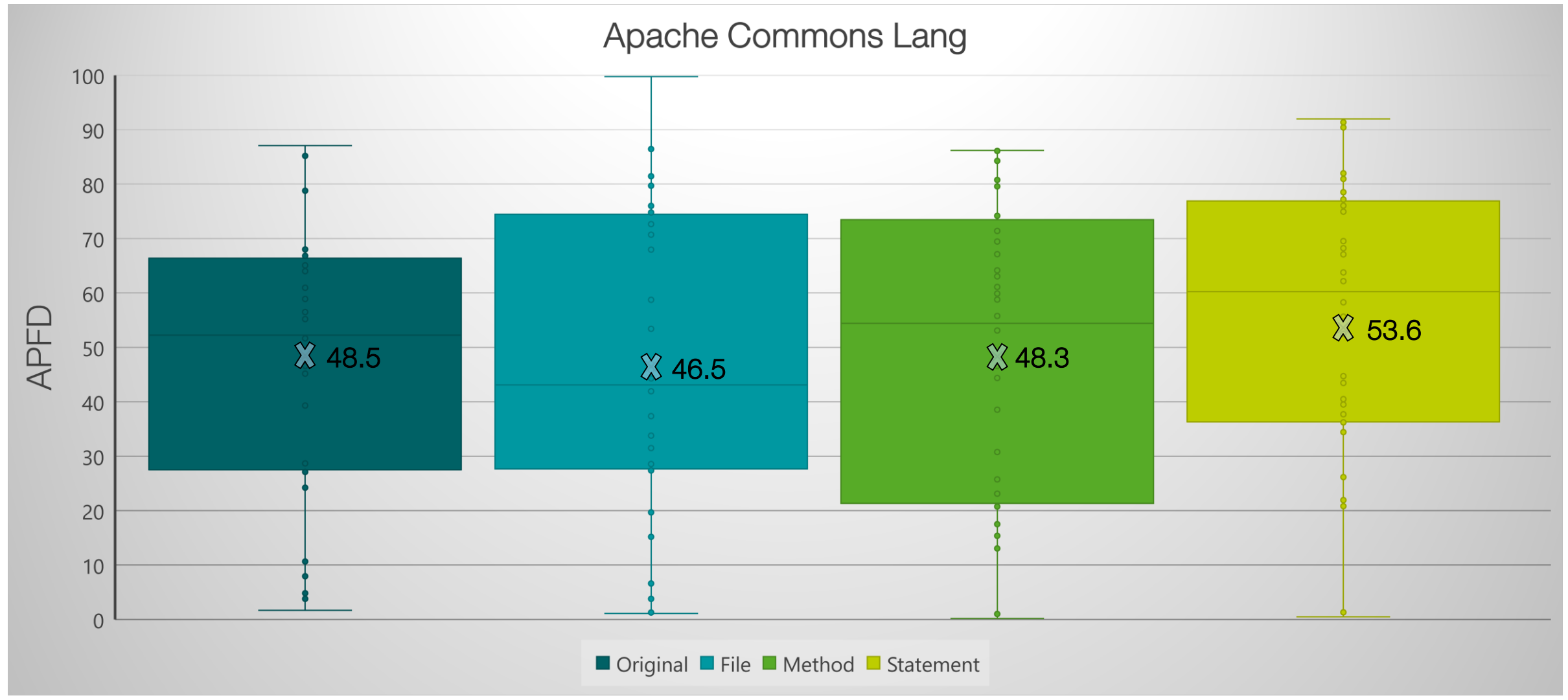
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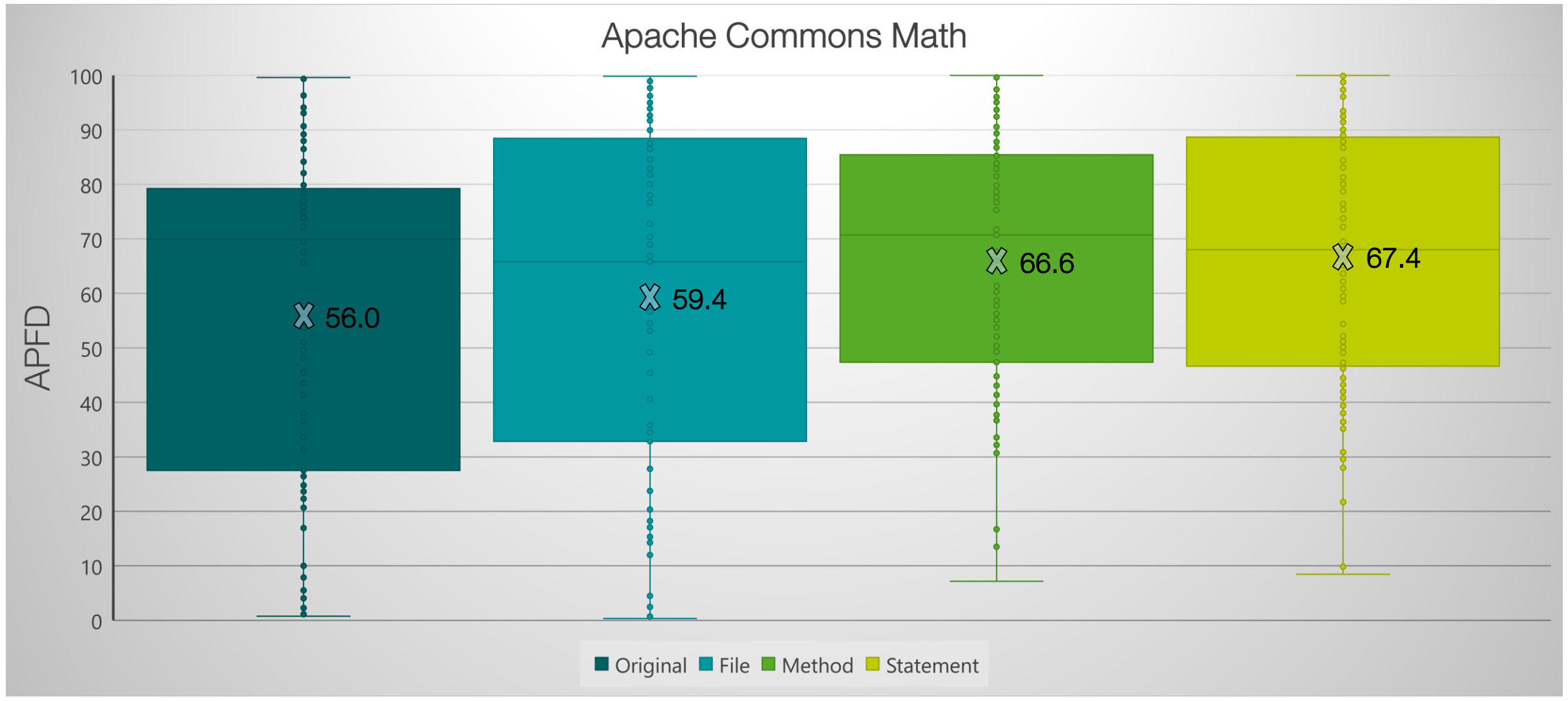
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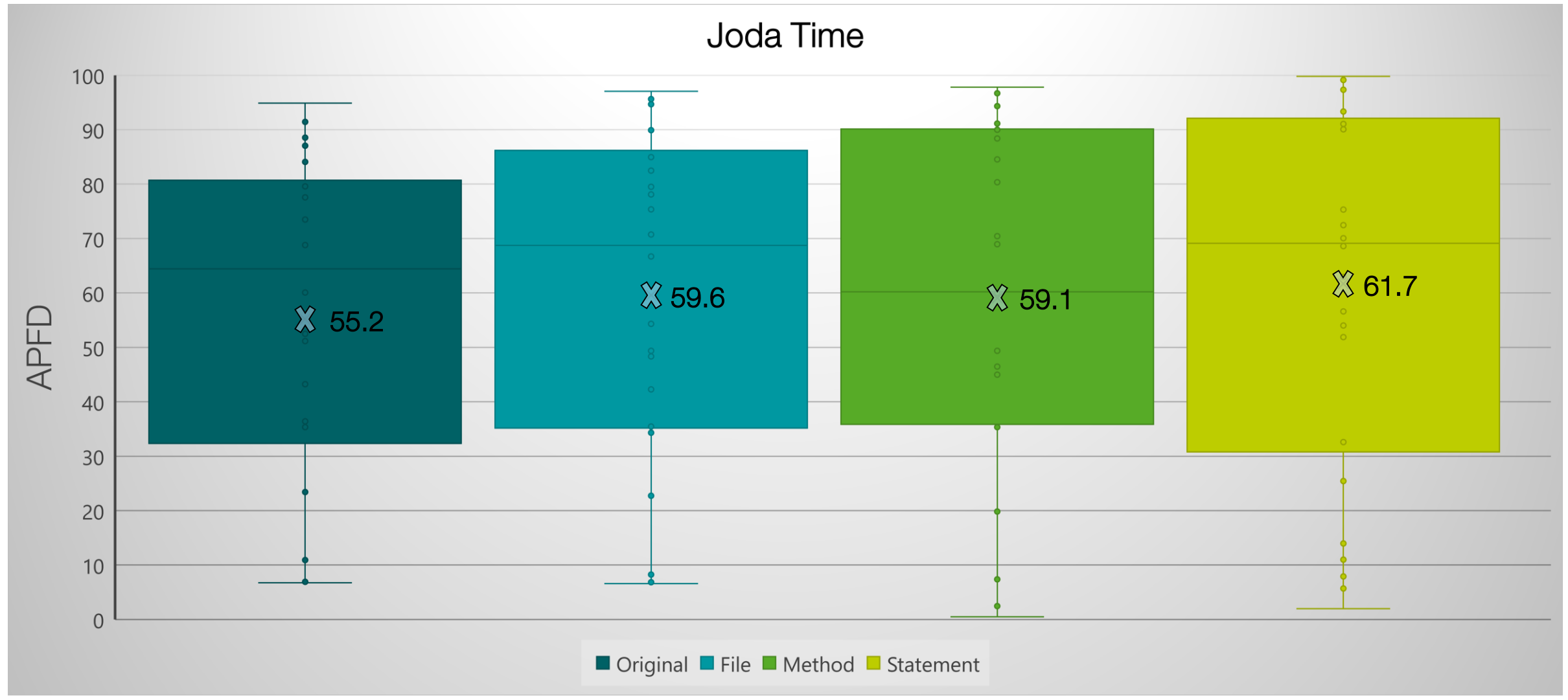
Results – Additional Coverage Prioritization Technique



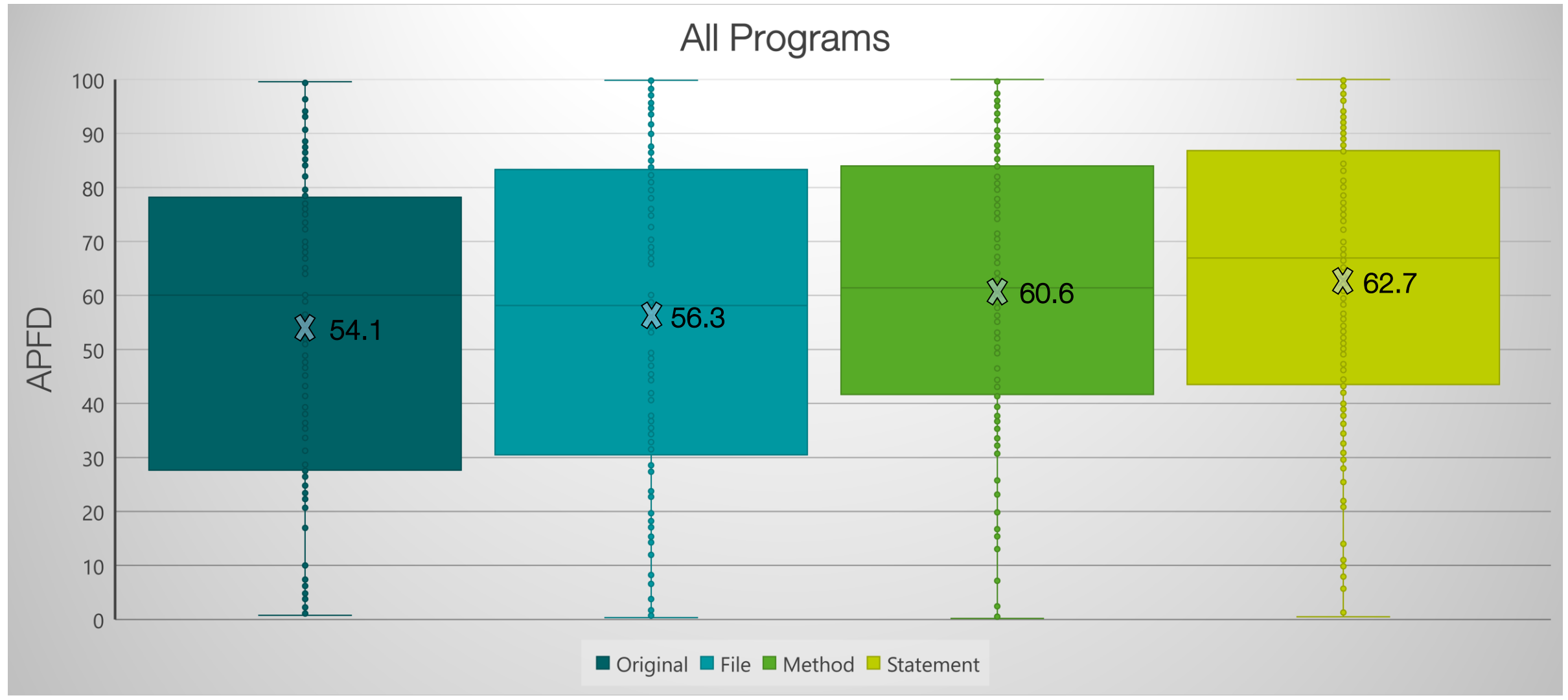
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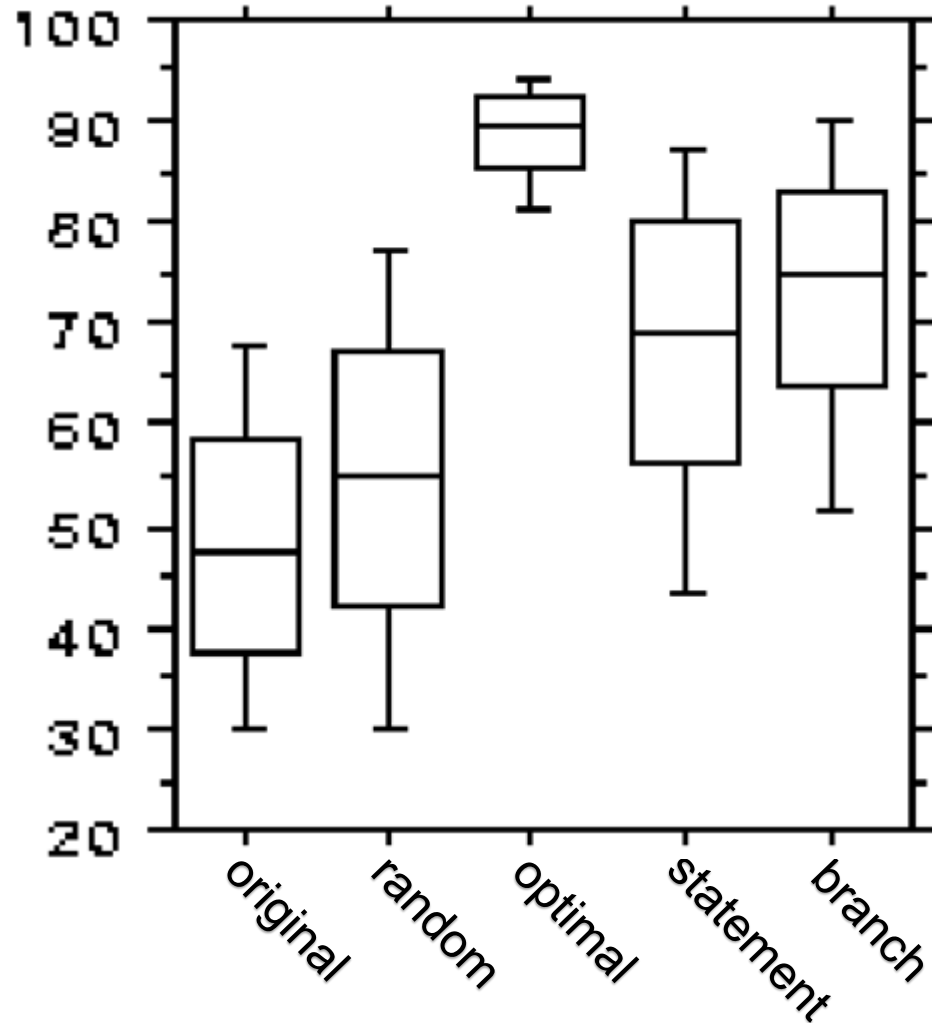
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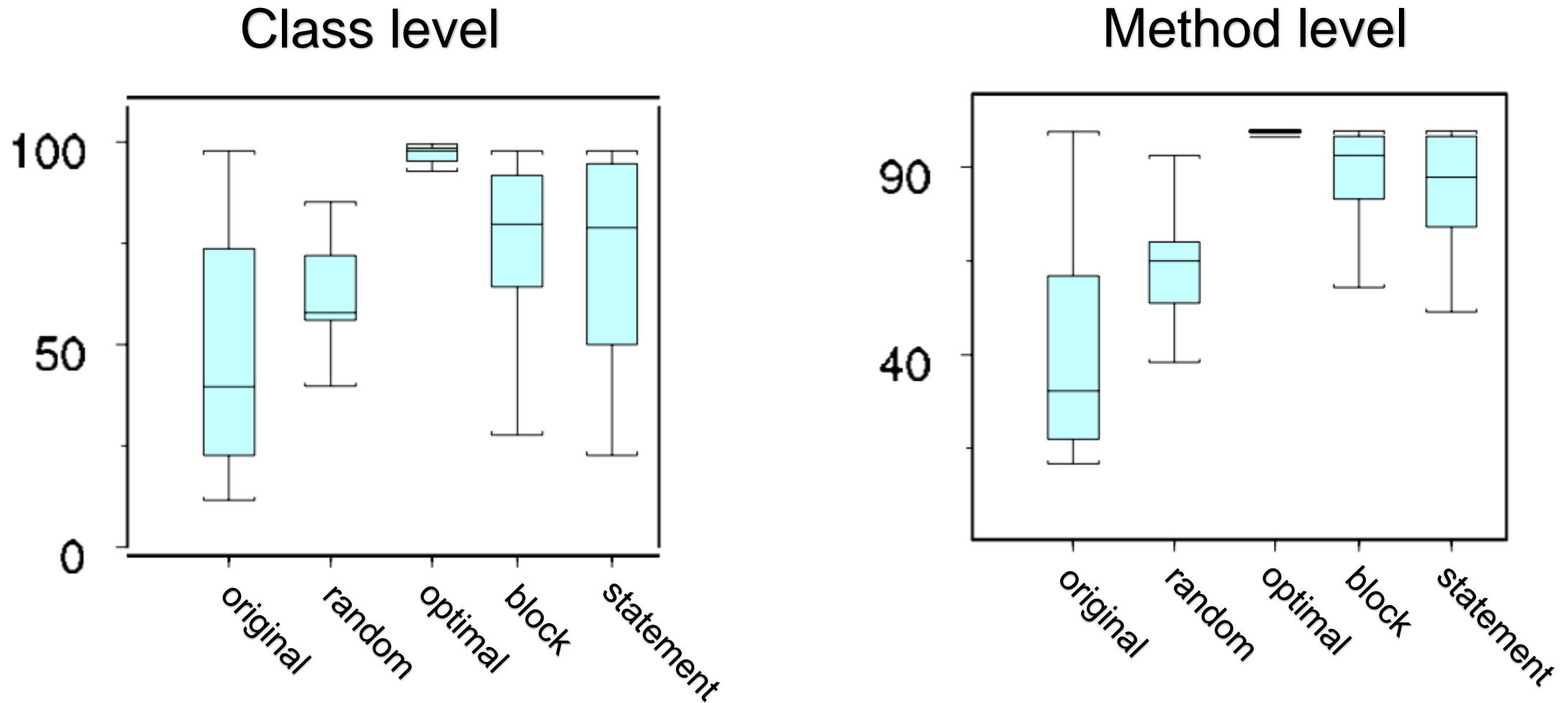
Results in Literature – Rothermel et al.



- Average:
 - Original: 48.29
 - Branch: 71.99
 - Statement: 66.75

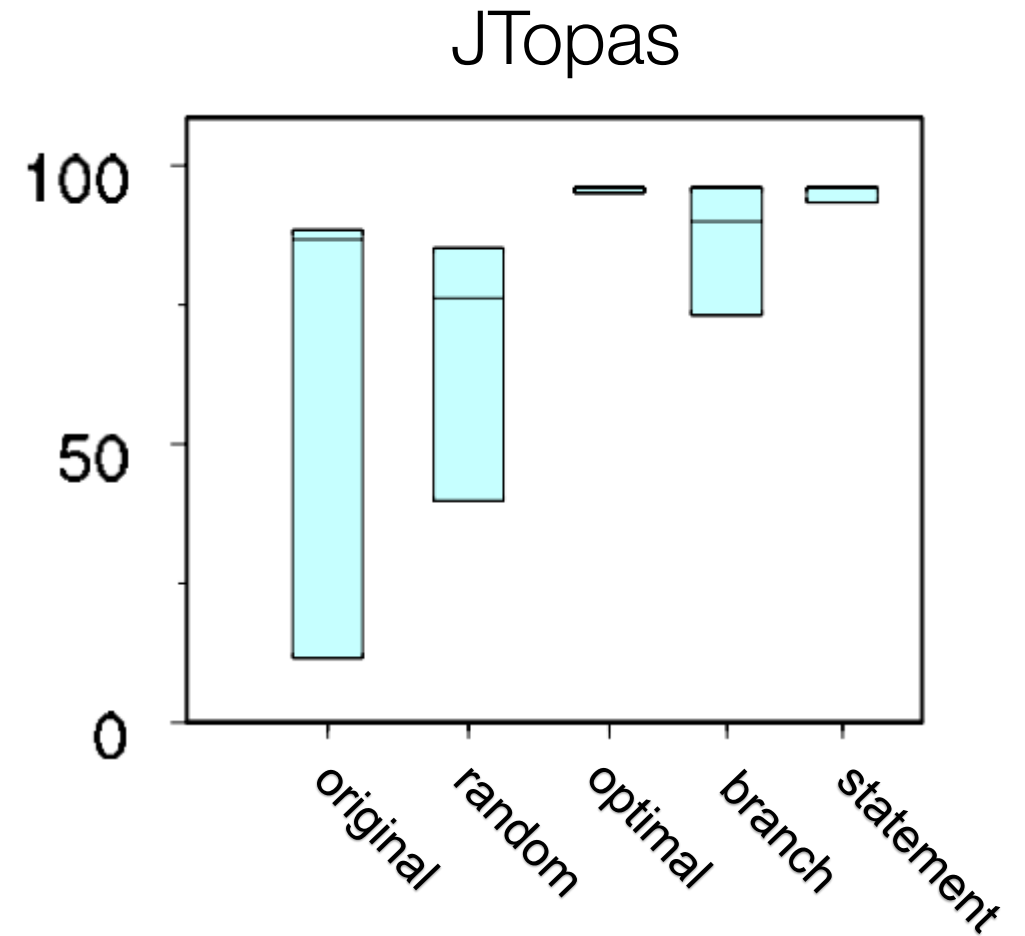
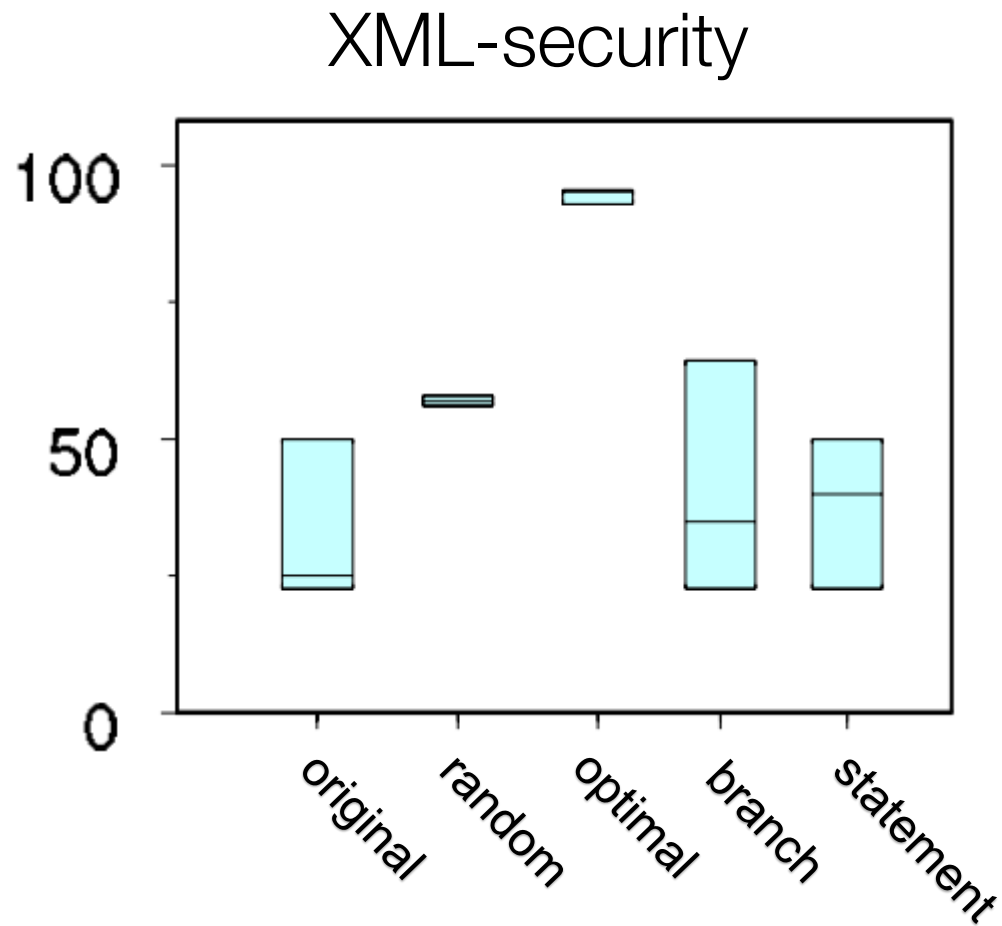
Rothermel et al. – Test Case Prioritization: An Empirical Study

Results in Literature – Do et al. – Method Level vs. Class Level



Do et al. – Empirical Studies of Test Case Prioritization in a JUnit Testing Environment

Results in Literature – Do et al. – Class Level

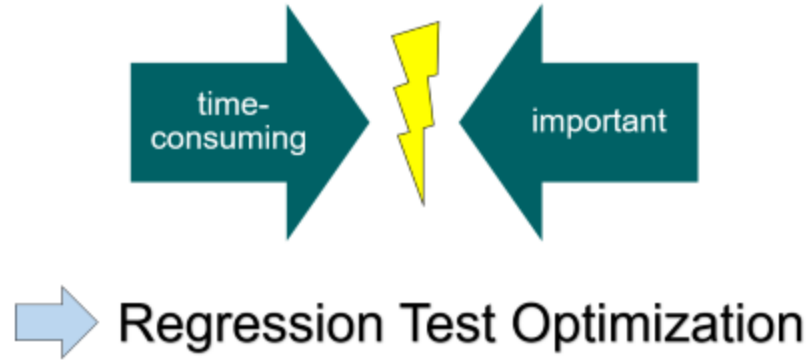


Do et al. – Empirical Studies of Test Case Prioritization in a JUnit Testing Environment

- Bugs are isolated
 - Selection performs too well
- Time for generating coverage ignored
- Coverage data gets outdated



Need for Optimization



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Goal of the Thesis

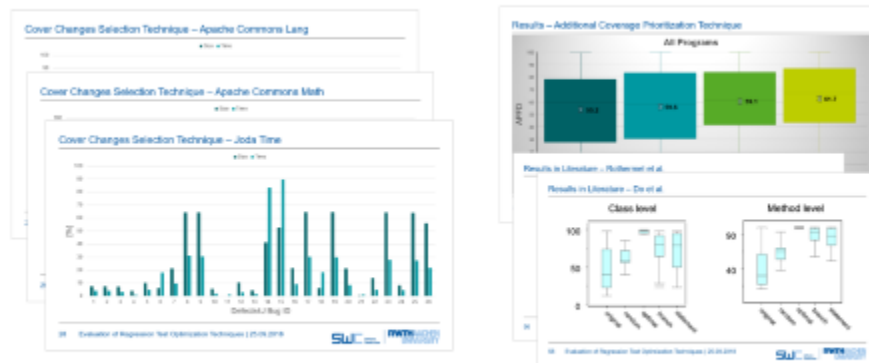
Evaluation of regression test optimization techniques

- Real projects
- With real bugs



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Results



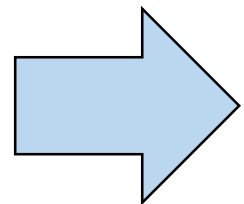
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Threats to Validity

➤ More research needed!



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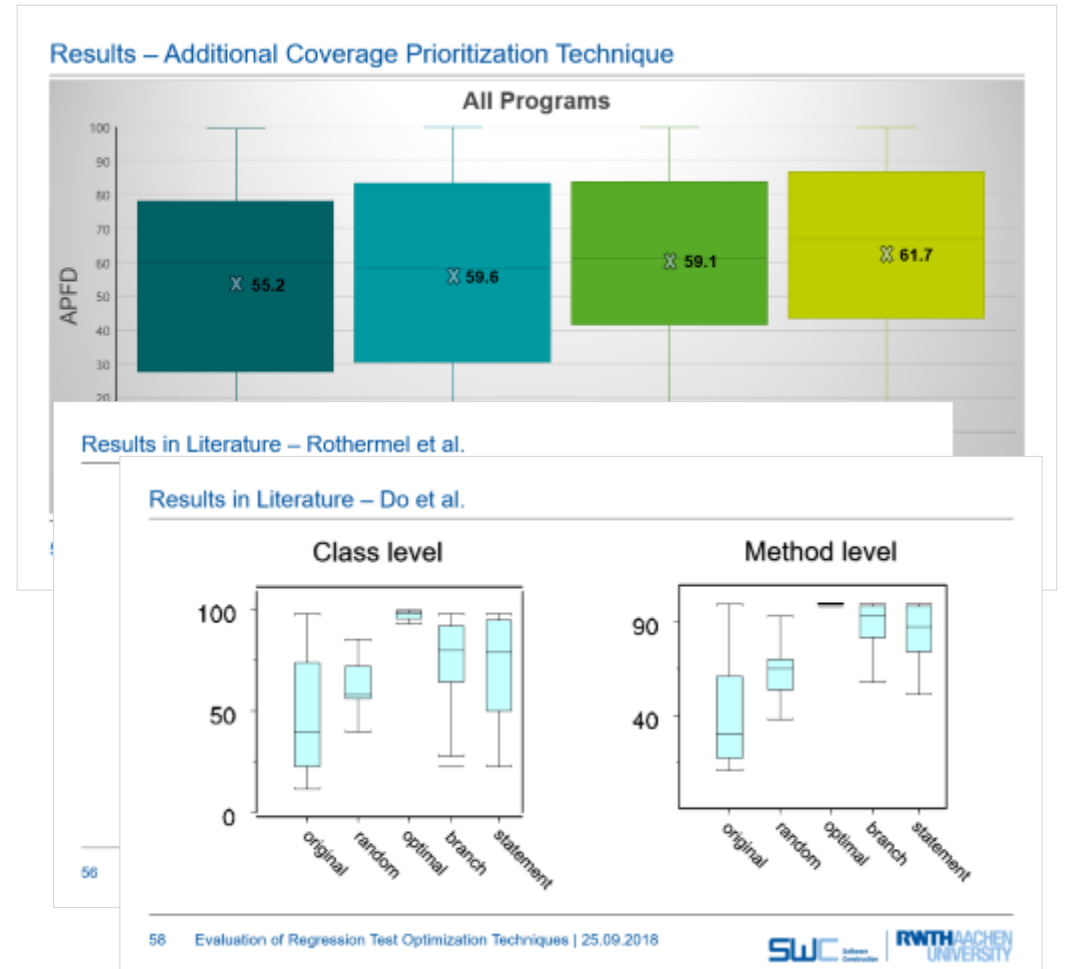
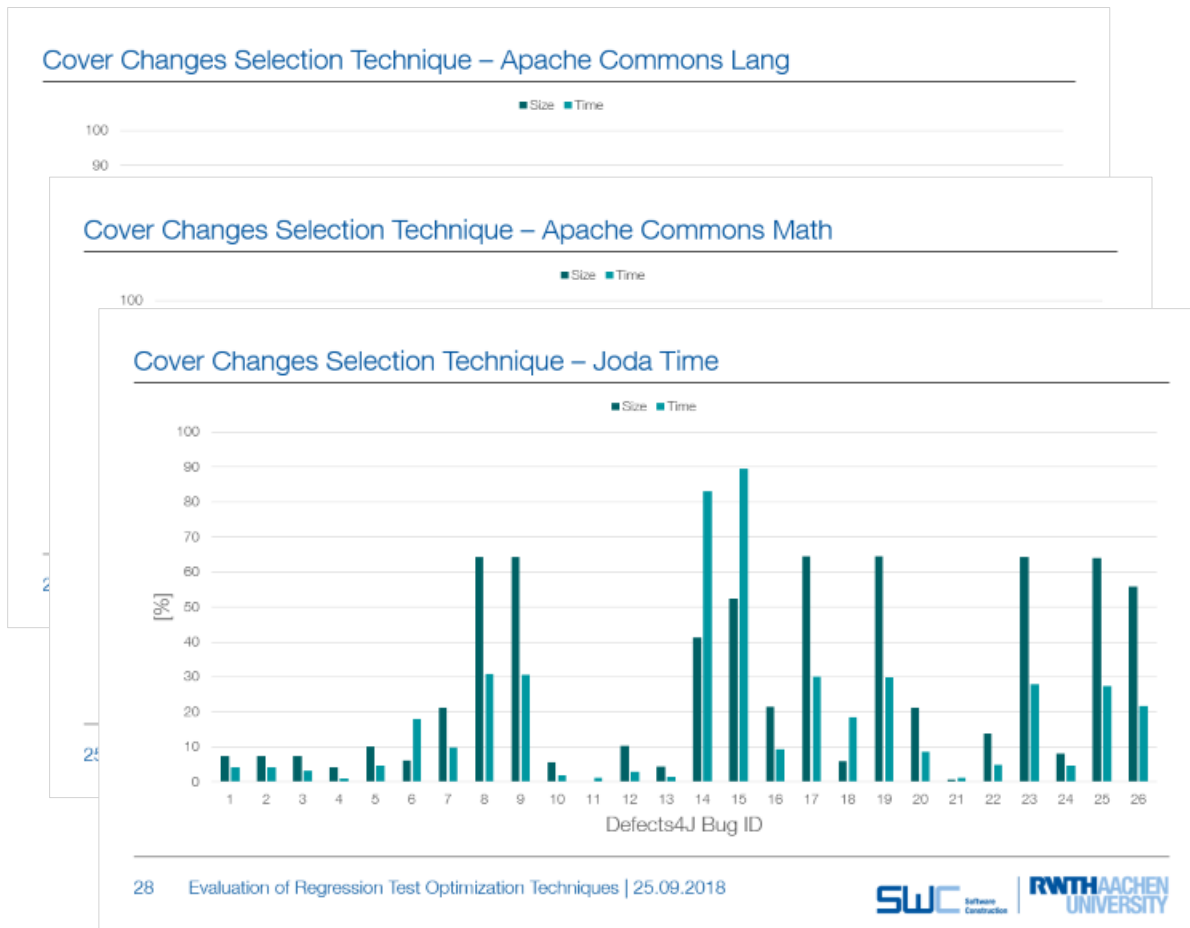
Regression Test Optimization

Evaluation of regression test optimization techniques

- Real projects
- With real bugs



Results



➤ More research needed!



Need for Optimization

time-consuming

important

Regression Test Optimization

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Regression Test Optimization

Regression Test Optimization

Selection

Prioritization

Original suite

Optimized suite

Detected Faults

Executed Tests

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Thank You!

Results

Cover Changes Selection Technique – Apache Commons Lang

Cover Changes Selection Technique – Apache Commons Math

Cover Changes Selection Technique – Joda Time

Detected Bugs

Results in Libraries – Full test of all

Results in Libraries – Do of all

Class level

Method level

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Threats to Validity

- Bugs are isolated
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Results – Additional Coverage Prioritization

Results – Additional Coverage Prioritization Technique

Apache Commons Lang

Results – Additional Coverage Prioritization Technique

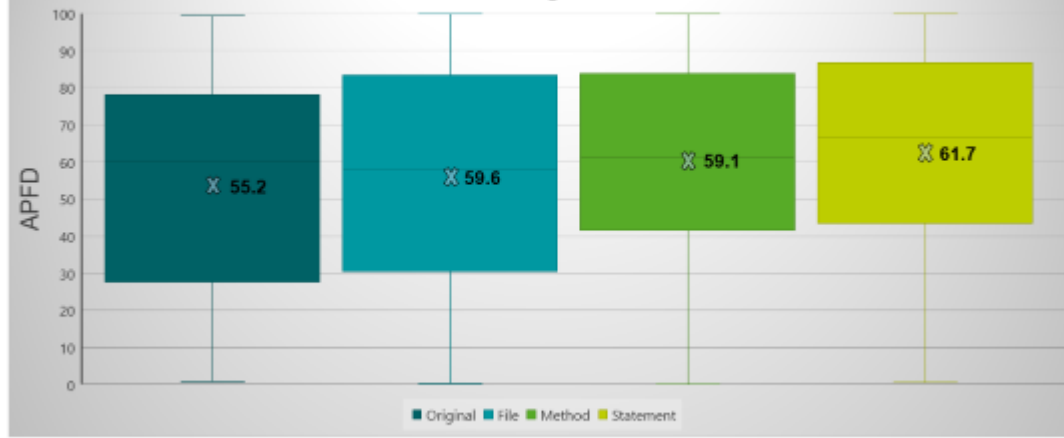
Apache Commons Math

Results – Additional Coverage Prioritization Technique

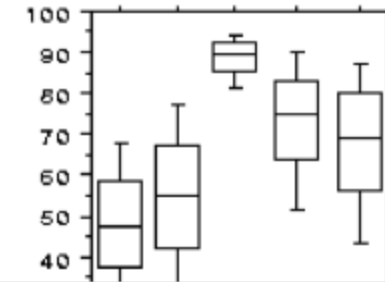
Apache Commons Math

Results – Additional Coverage Prioritization Technique

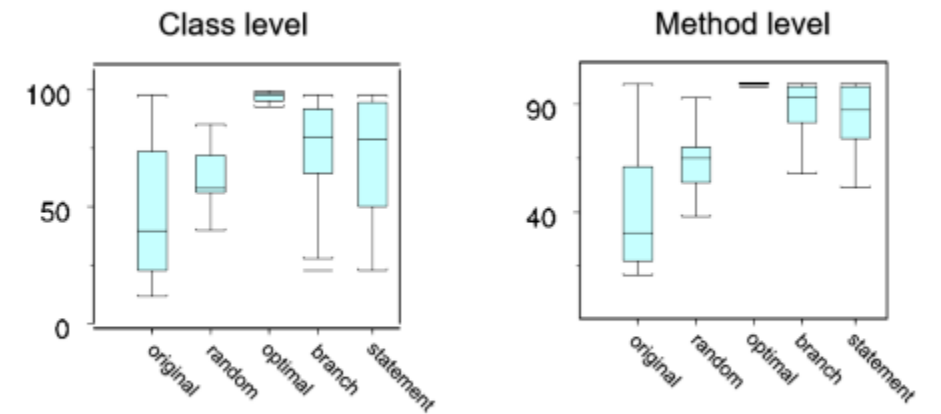
All Programs



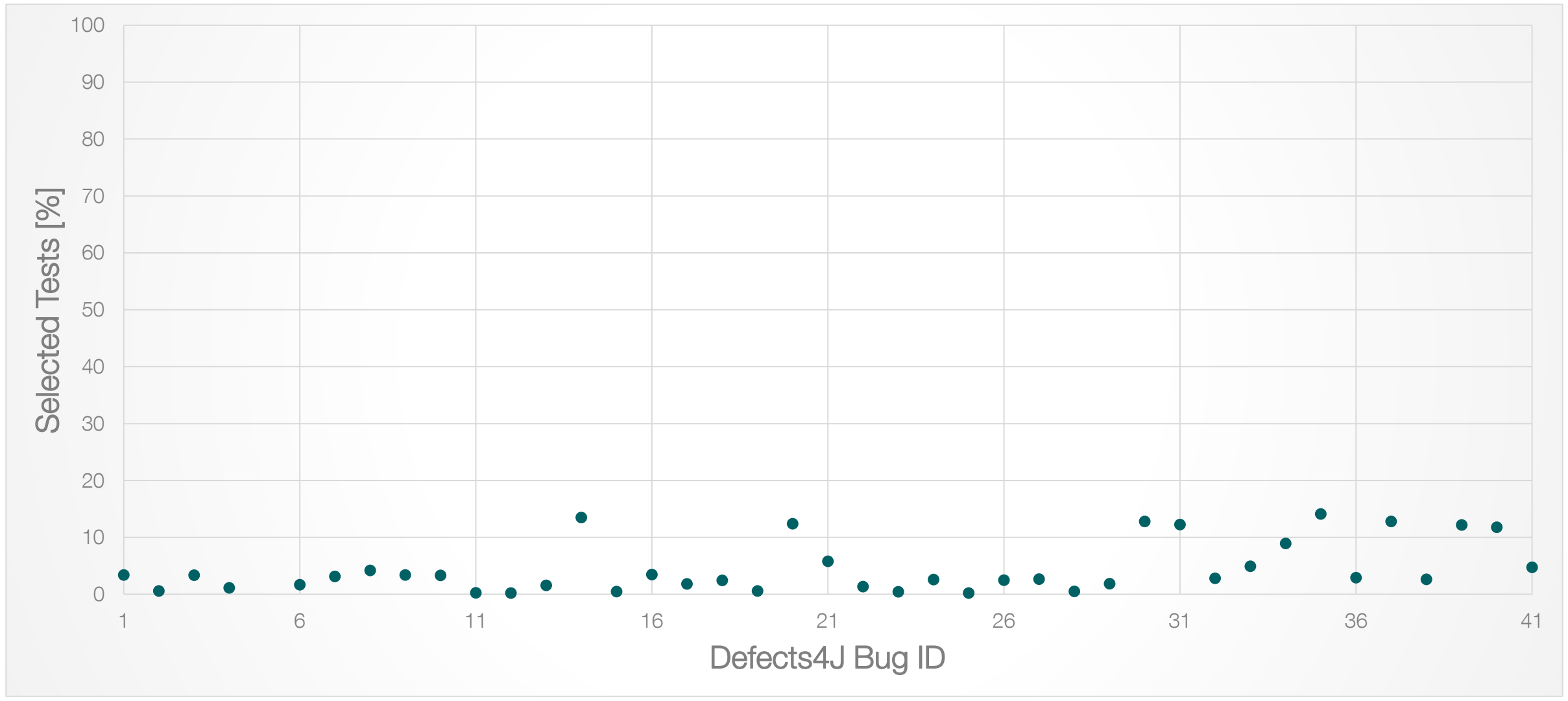
Results in Literature – Rothermel et al.



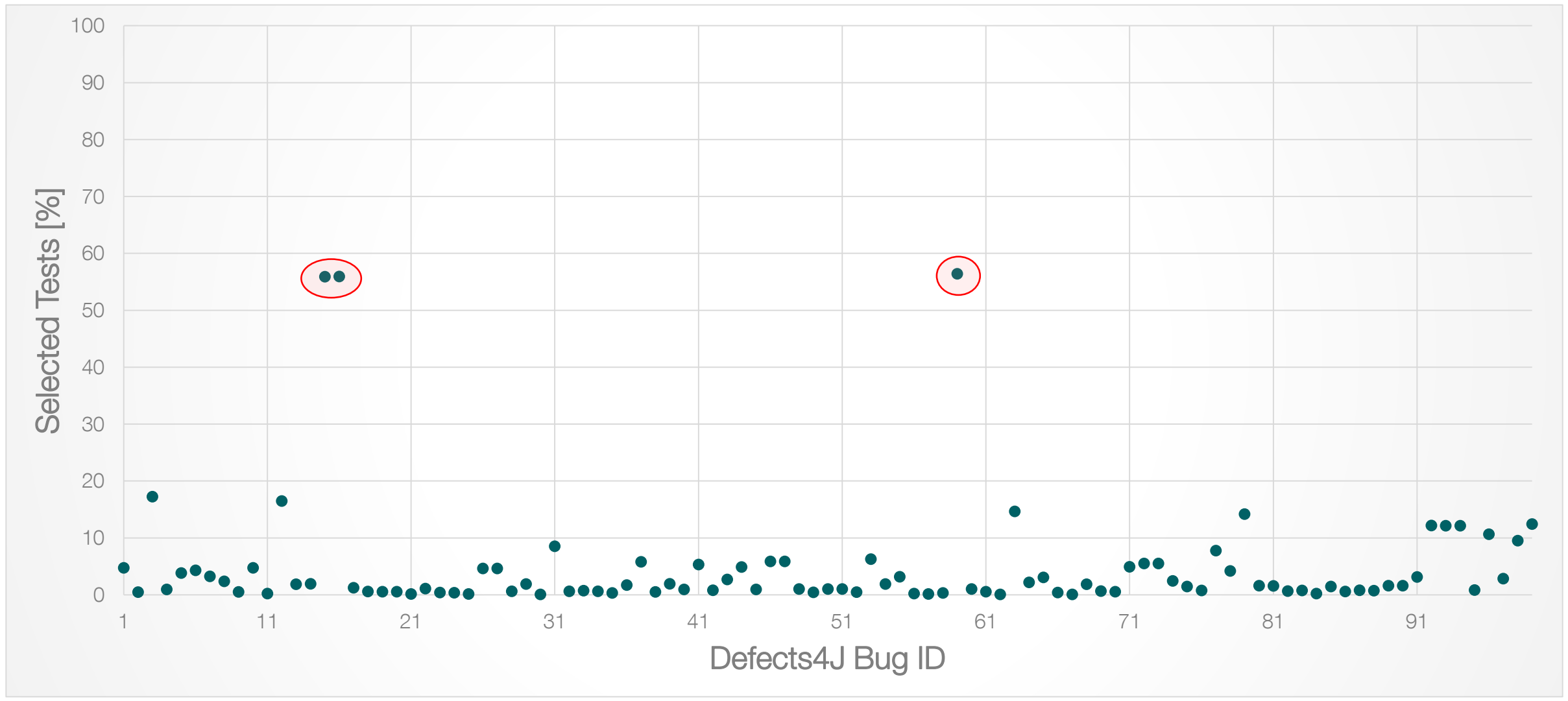
Results in Literature – Do et al.



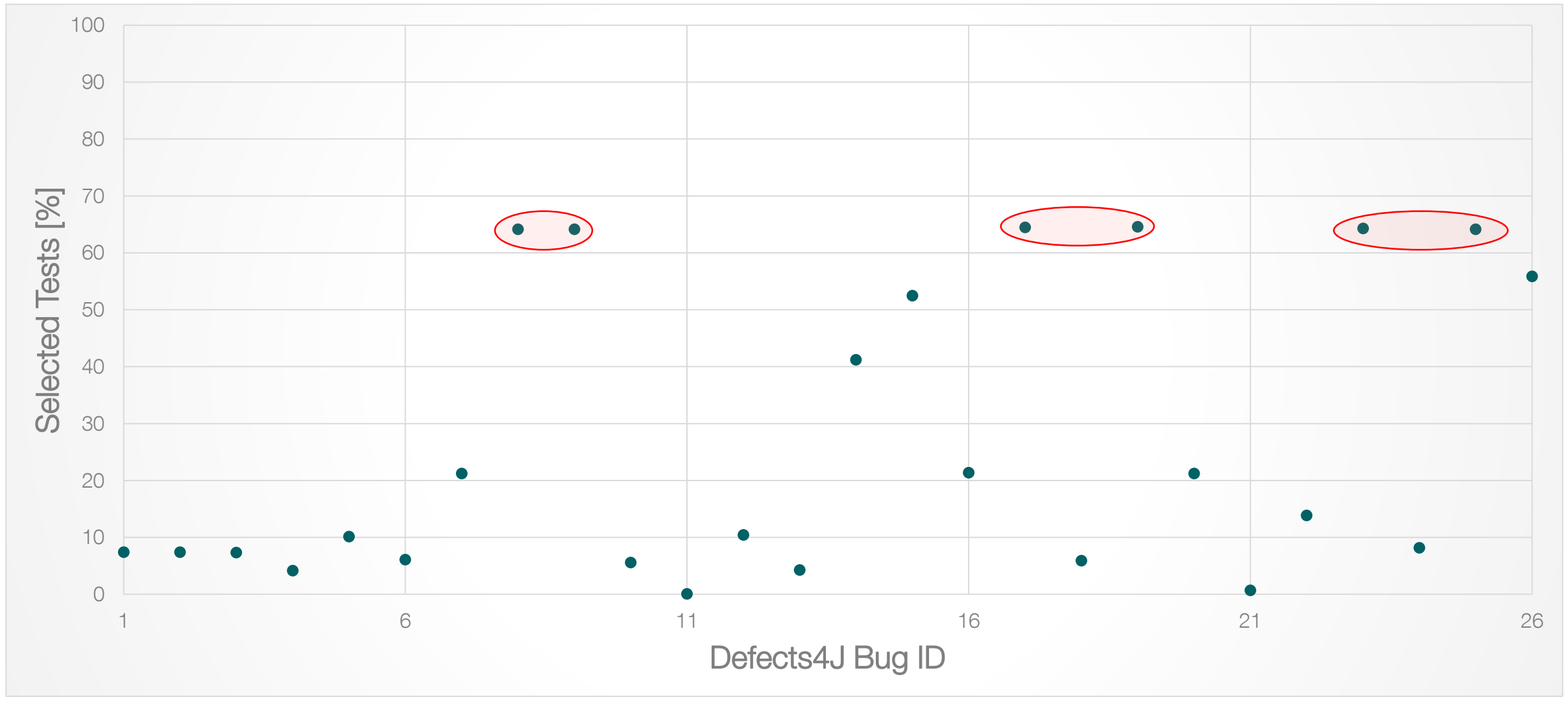
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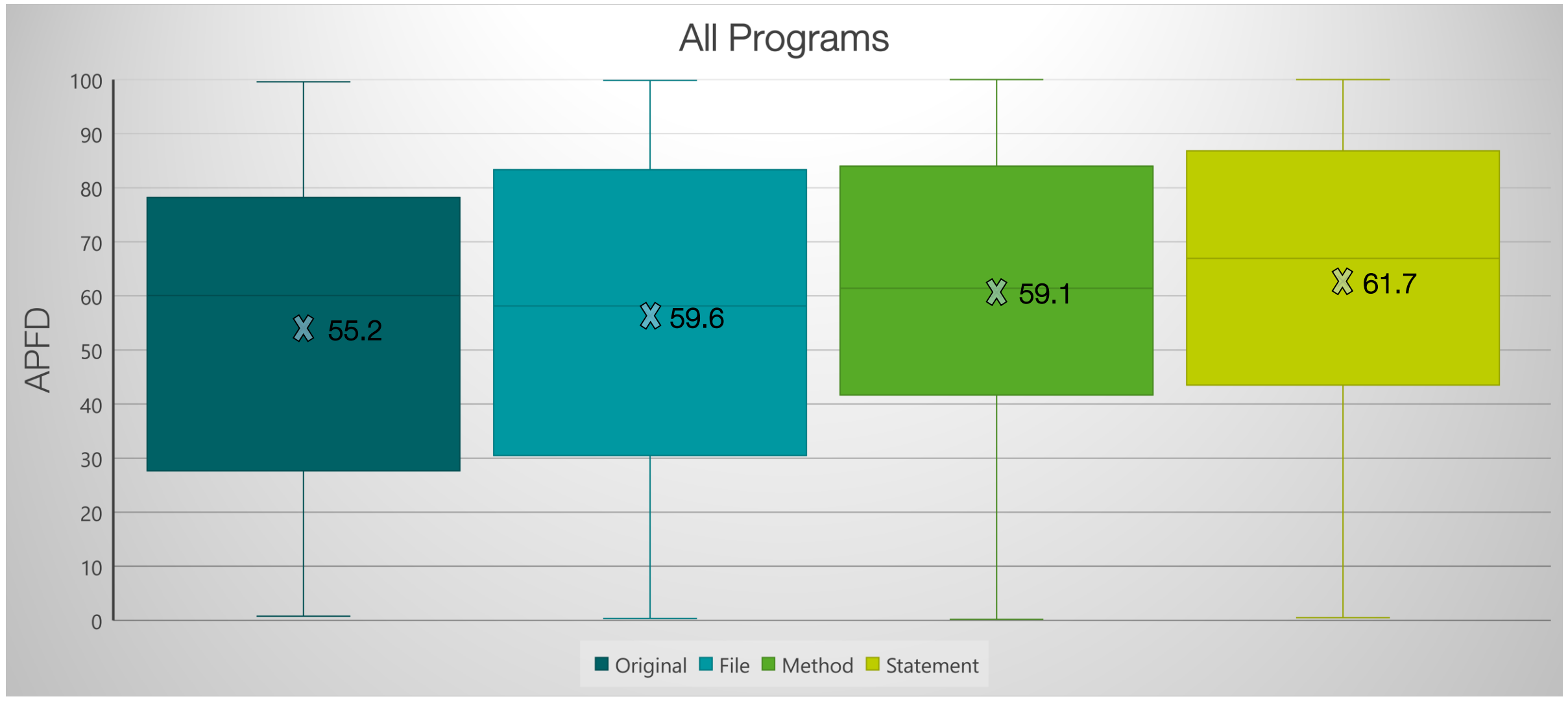
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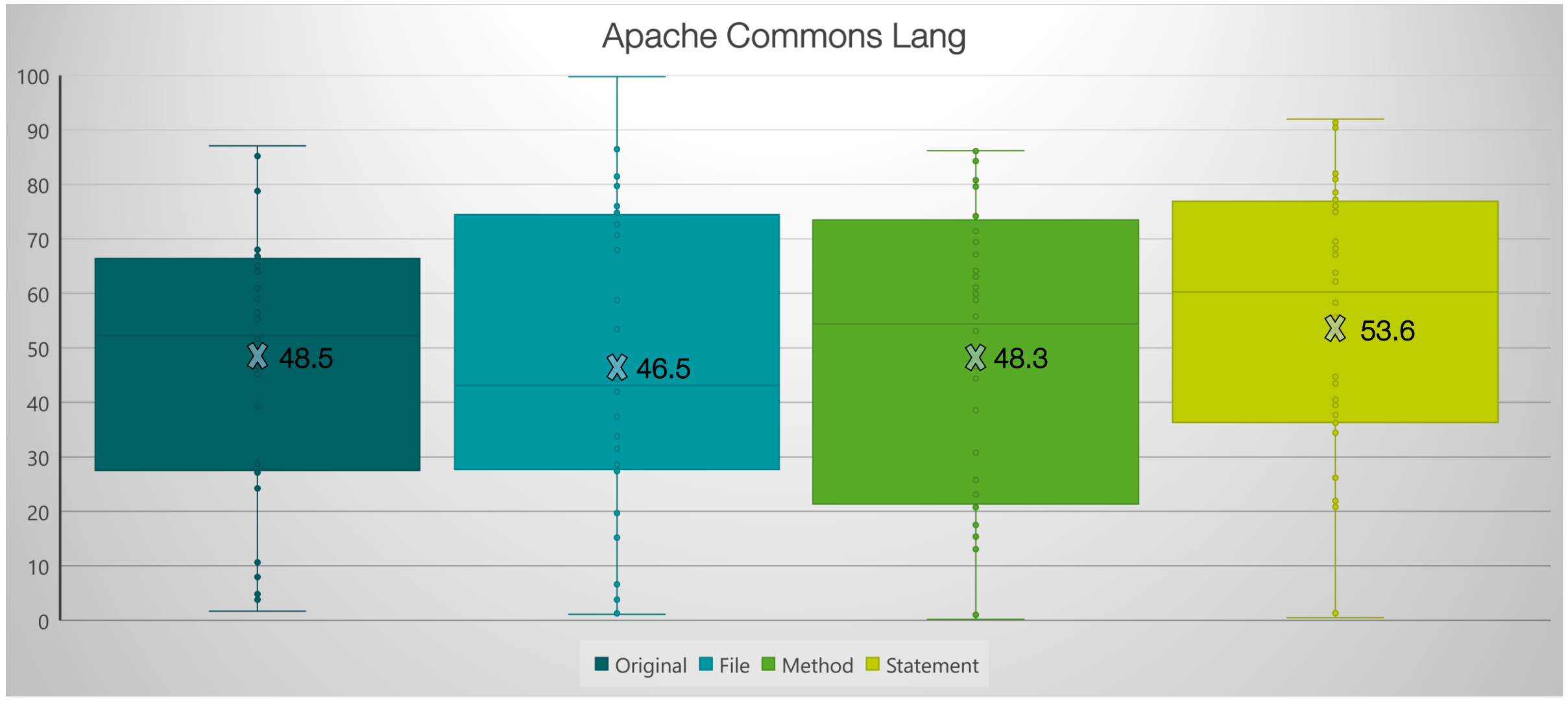
Cover Changes Selection Technique – Joda Time



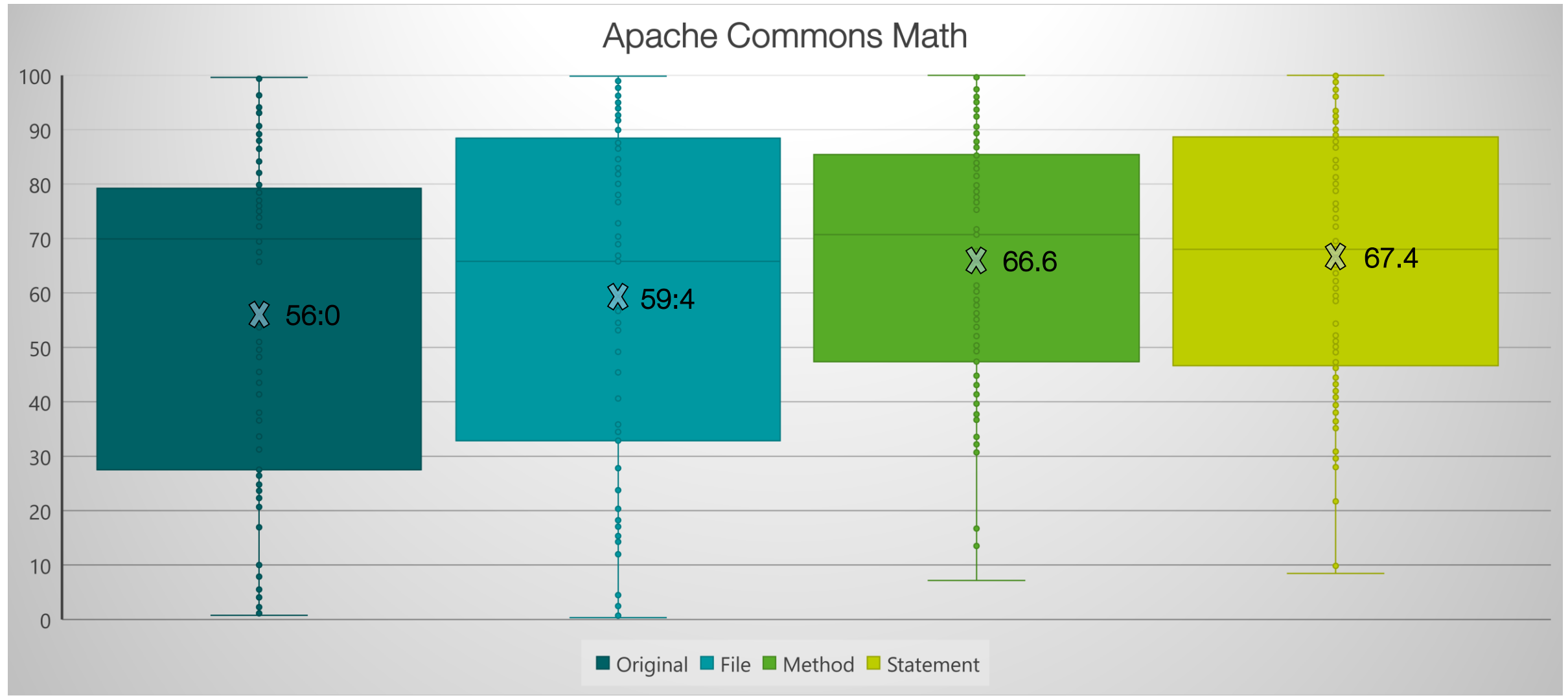
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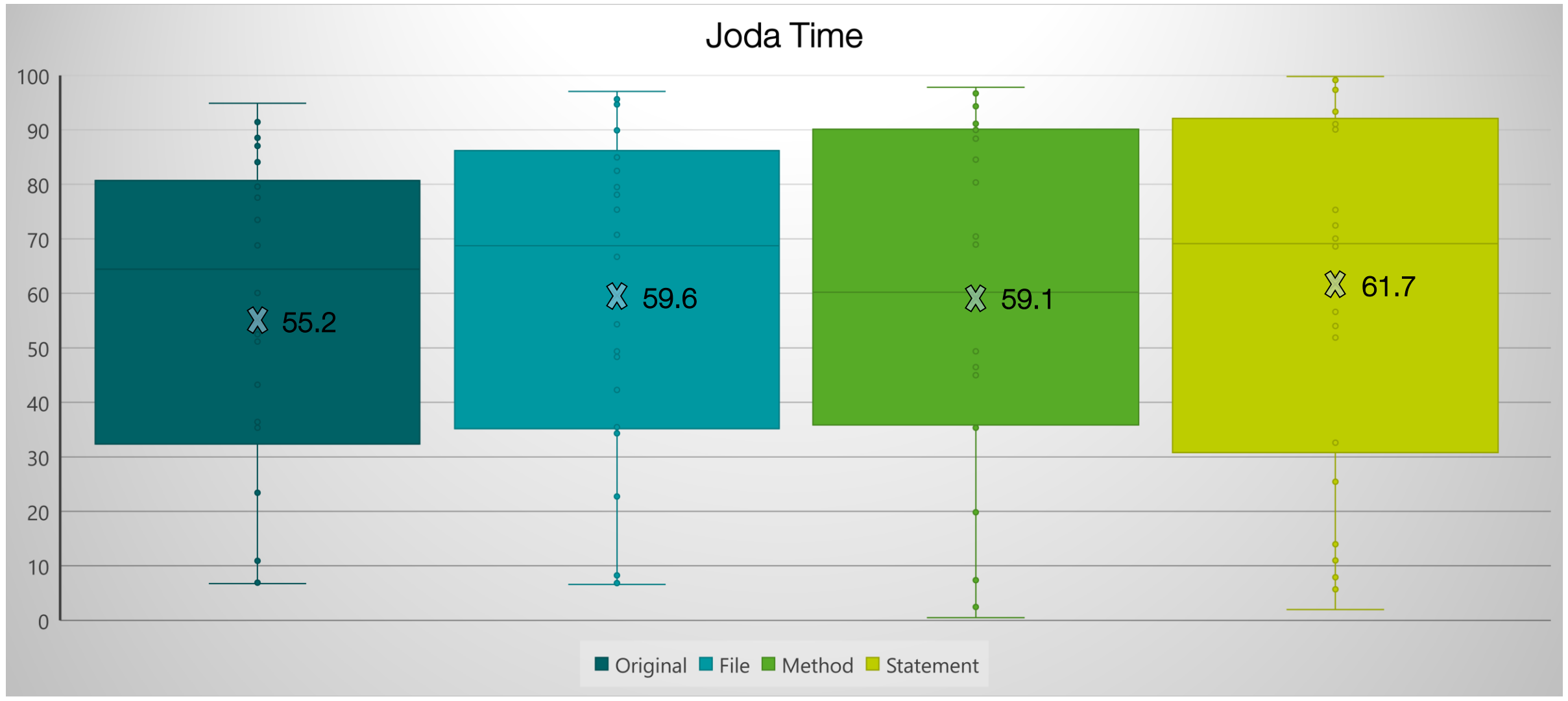
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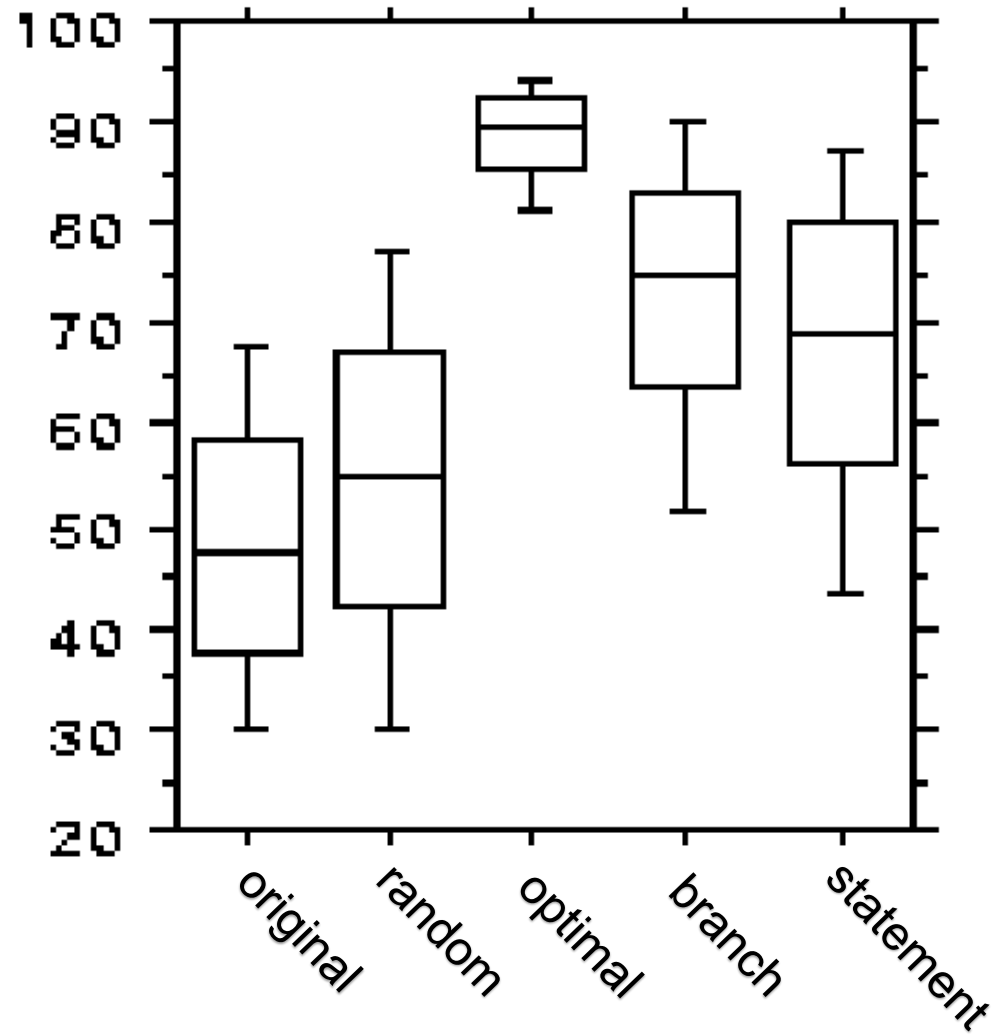


Results – Additional Coverage Prioritization Technique



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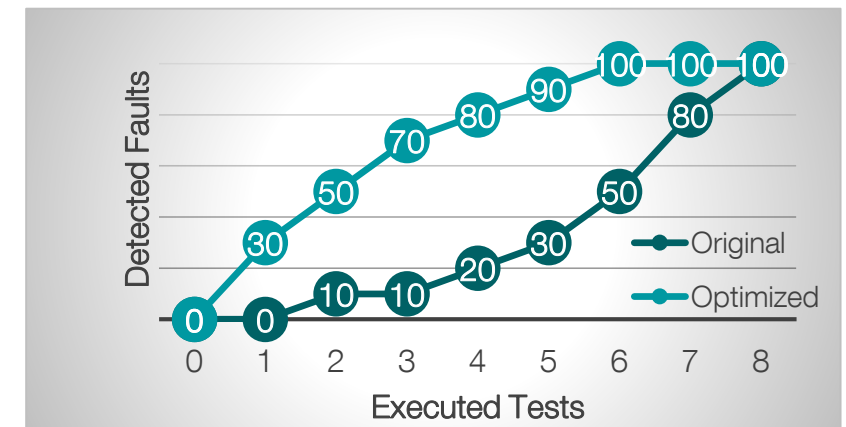
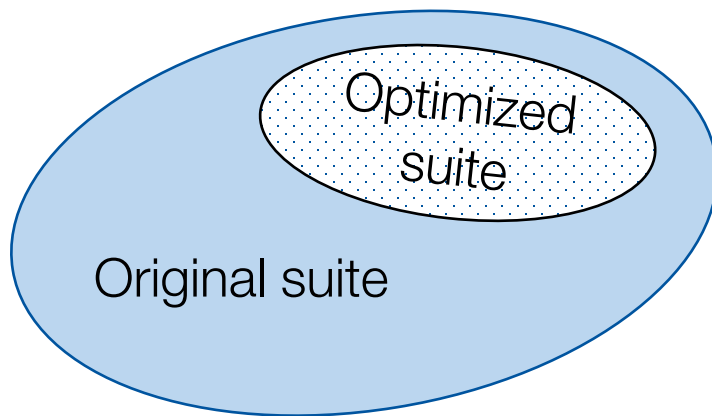




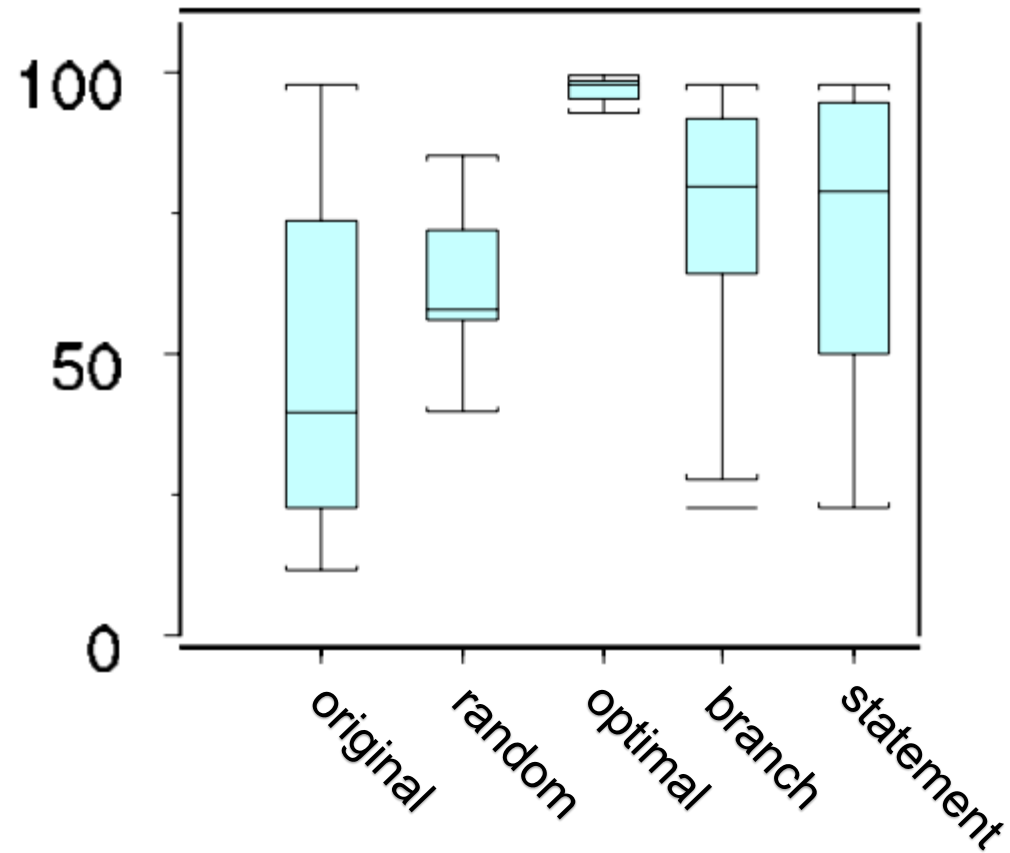
Regression Test Optimization

Selection

Prioritization



Class level



Method level

