A Framework to Support Research in and Encourage Industrial Adoption of Regression Testing Techniques

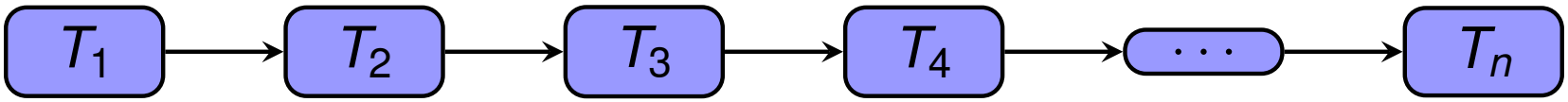
Jonathan Miller Kauffman and Gregory M. Kapfhammer

Department of Computer Science
Allegheny College

Testing: Academic & Industrial Conference –
Practice and Research Techniques
Montréal, Québec, Canada
April 21, 2012

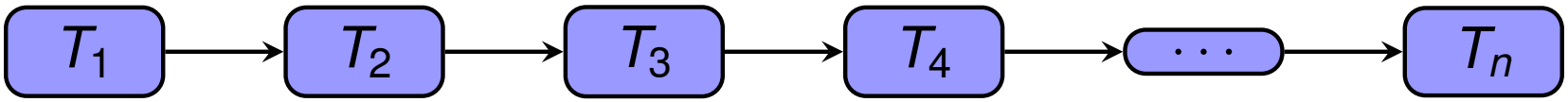
ALLEGHENY COLLEGE

Regression Testing



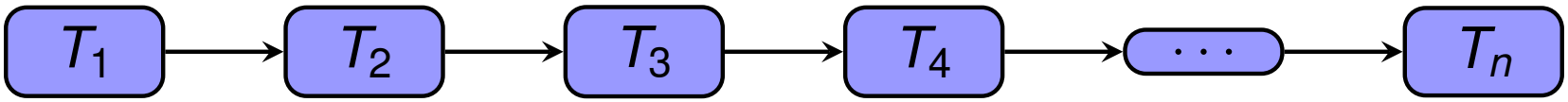
Regression Testing

Developers may introduce faults when adding new functionality



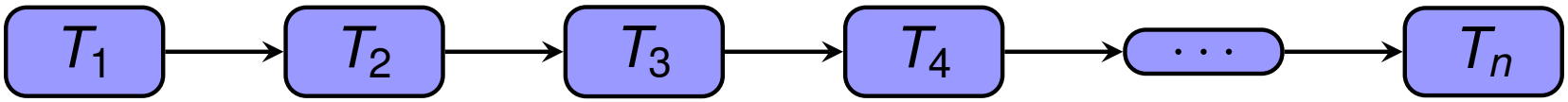
Regression Testing

Run a regression test suite to detect these faults

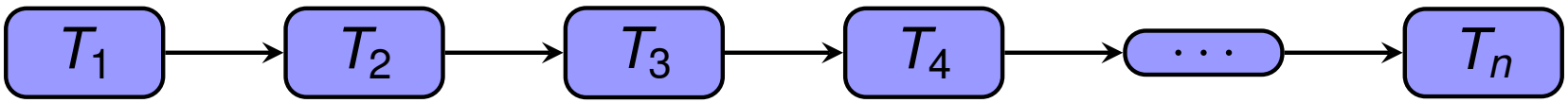


Regression Testing

Need ways to manage regression test suites as they grow in size



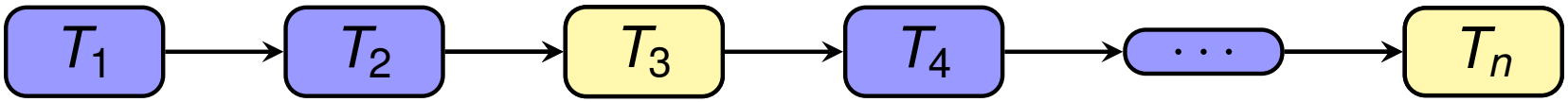
Regression Testing



Regression Testing Technique

Regression Testing

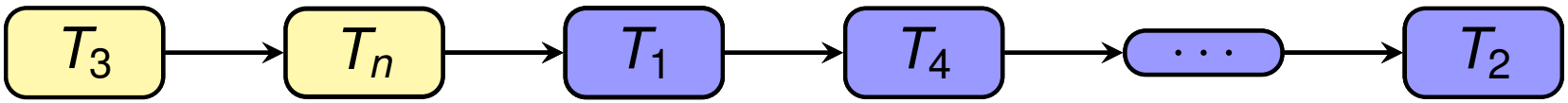
What if Some Test Cases are More Effective?

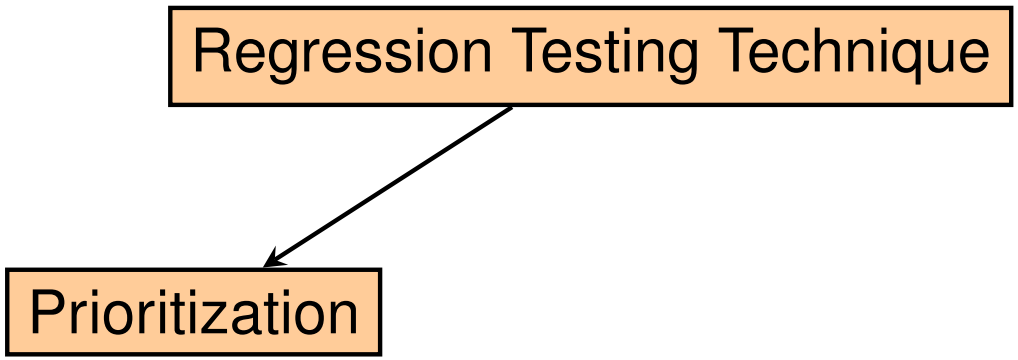


Regression Testing Technique

Regression Testing

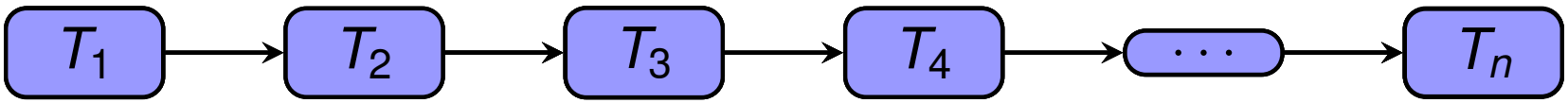
What if Some Test Cases are More Effective?

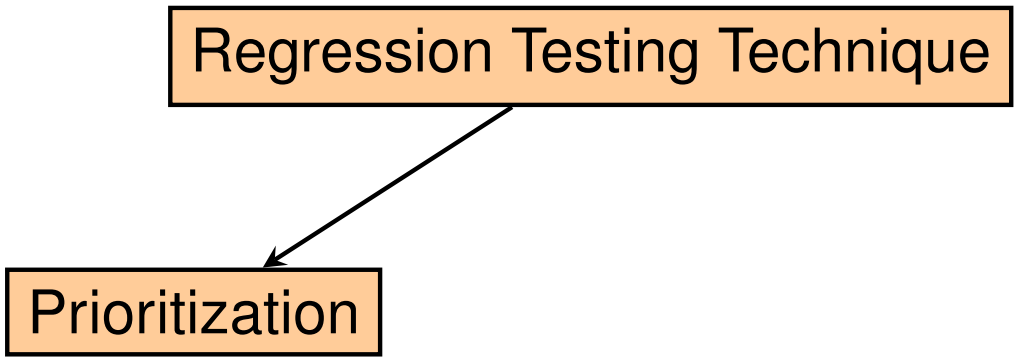




Regression Testing

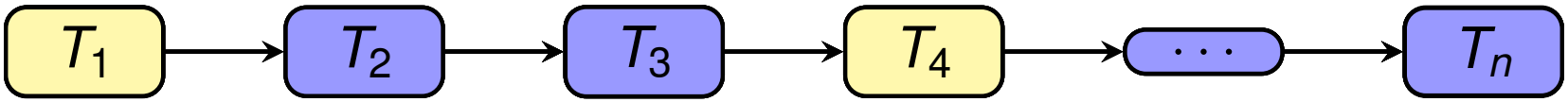
What if Some Test Cases are More Effective?





Regression Testing

What if Some Test Cases are Redundant?

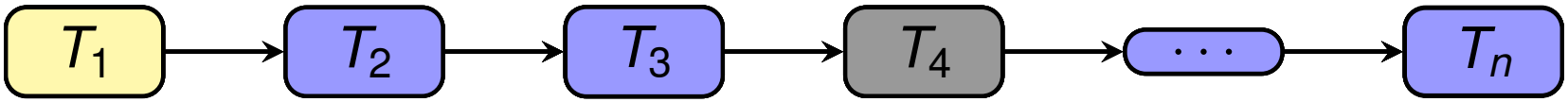


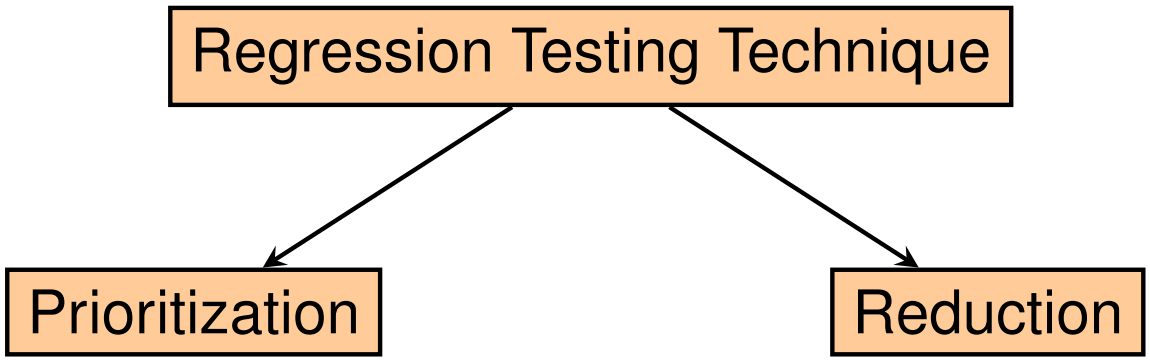
Regression Testing Technique

Prioritization

Regression Testing

What if Some Test Cases are Redundant?





Regression Testing Challenges

Regression Testing Challenges

Research

Regression Testing Challenges

Research

Replication difficult due to unavailability of artifacts

Regression Testing Challenges

Research

Replication difficult due to unavailability of artifacts

Insufficient number of trials and inappropriate statistical analyses

Regression Testing Challenges

Research

Replication difficult due to unavailability of artifacts

Insufficient number of trials and inappropriate statistical analyses

Practice

Regression Testing Challenges

Research

- Replication difficult due to unavailability of artifacts
- Insufficient number of trials and inappropriate statistical analyses

Practice

- Unwilling to adopt techniques due to lack of empirical studies

Regression Testing Challenges

Research

- Replication difficult due to unavailability of artifacts
- Insufficient number of trials and inappropriate statistical analyses

Practice

- Unwilling to adopt techniques due to lack of empirical studies
- Techniques must be usable with minimal configuration

Regression Testing Challenges

Research

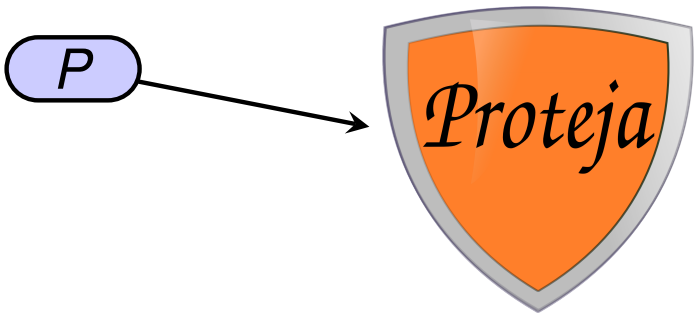
- Replication difficult due to unavailability of artifacts
- Insufficient number of trials and inappropriate statistical analyses

Practice

- Unwilling to adopt techniques due to lack of empirical studies
- Techniques must be usable with minimal configuration
- Address challenges by releasing two open-source tools

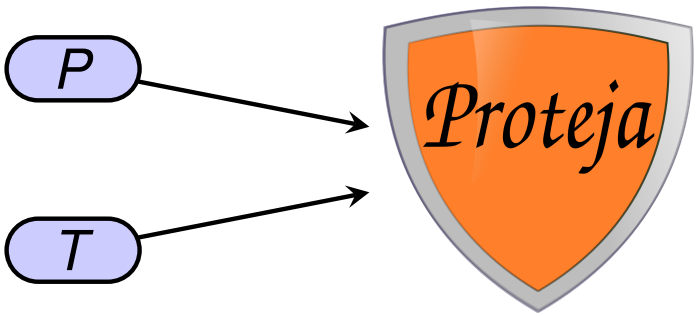
Proteja: Test Suite Executor & Coverage Monitor

Proteja: Test Suite Executor & Coverage Monitor



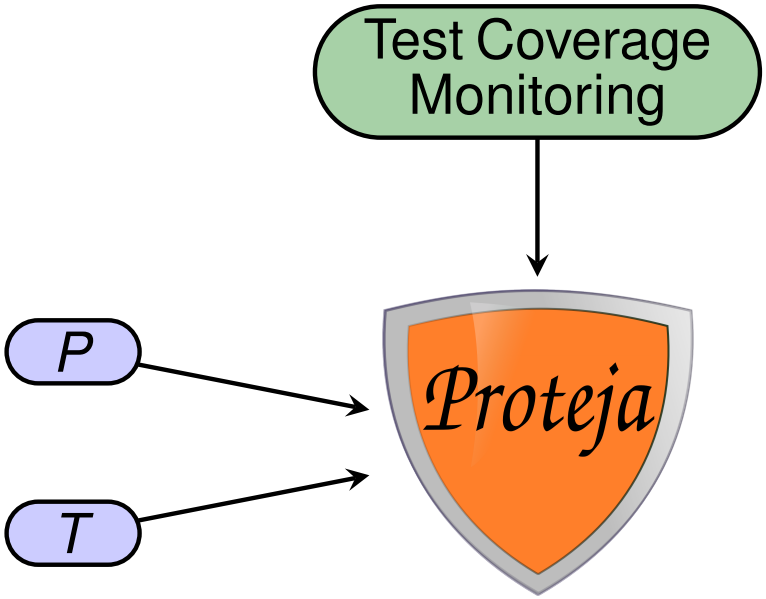
Program written in the Java programming language

Proteja: Test Suite Executor & Coverage Monitor



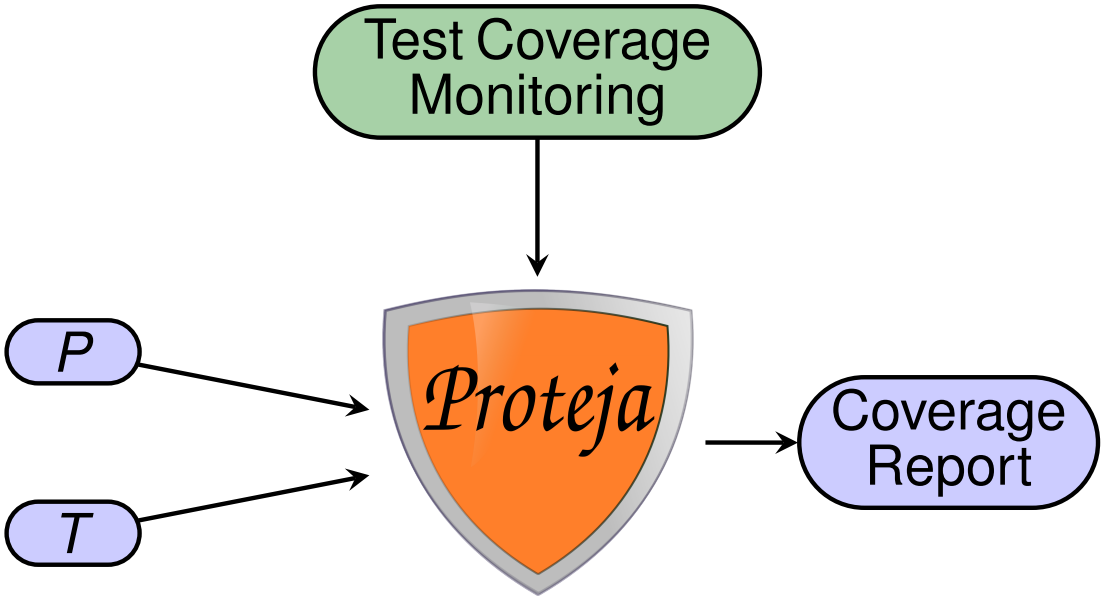
JUnit test suite that exercizes program *P*

Proteja: Test Suite Executor & Coverage Monitor



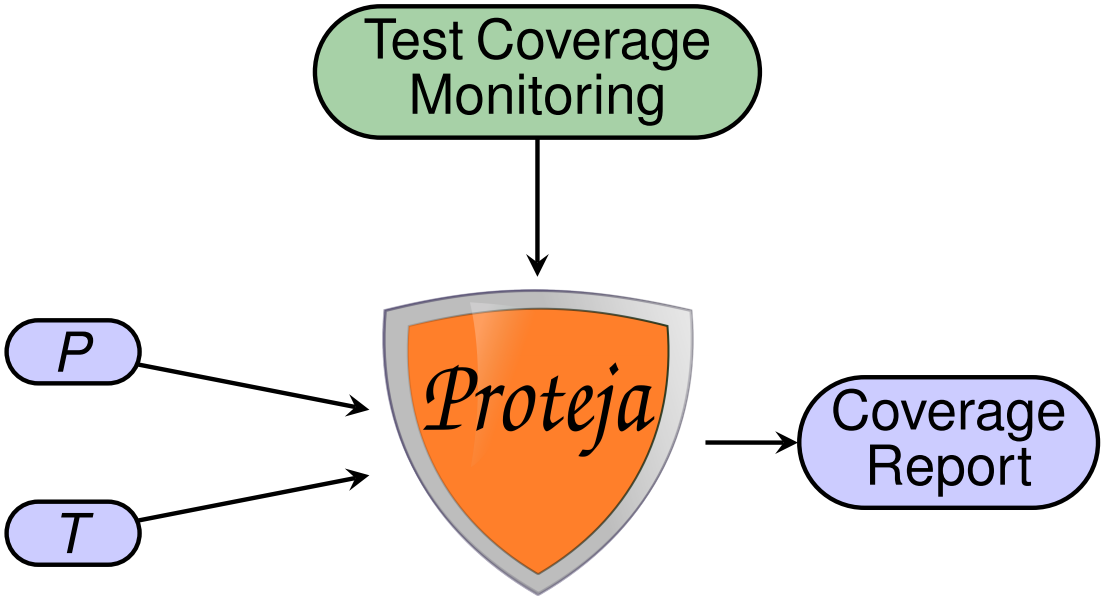
Controls test case execution and coverage monitoring

Proteja: Test Suite Executor & Coverage Monitor



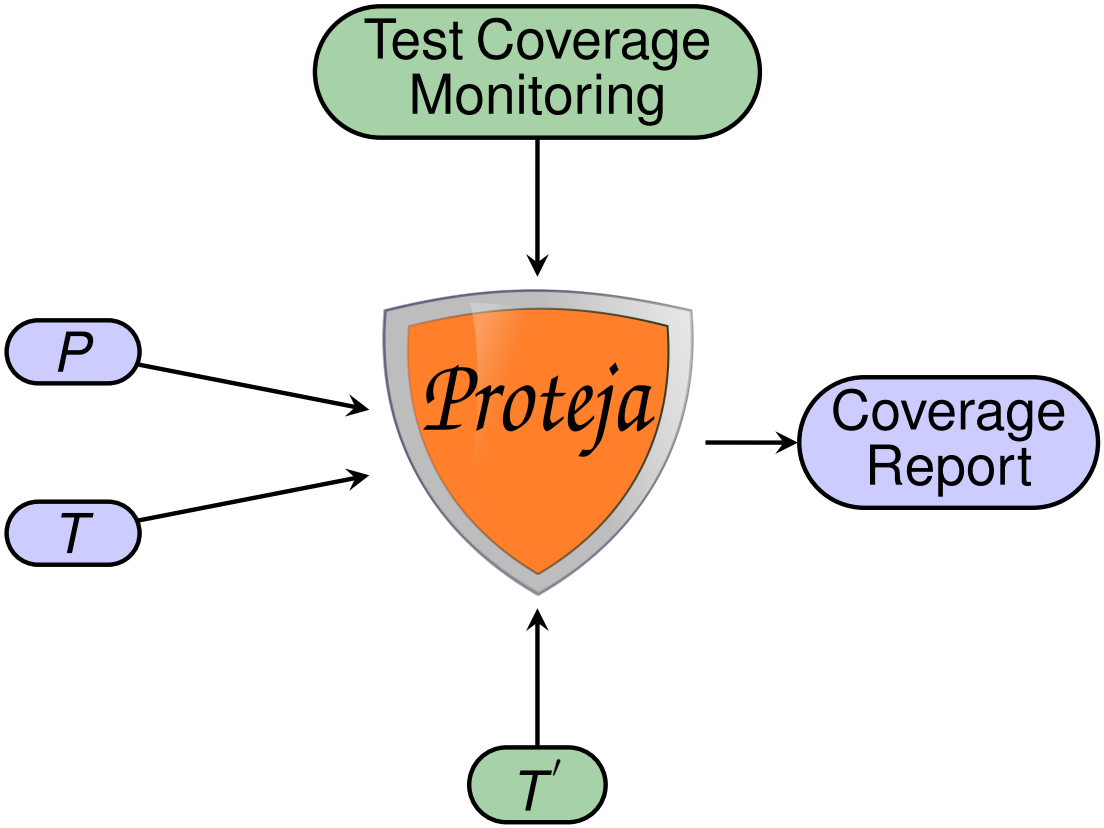
Identifies the program entities executed by each test case

Proteja: Test Suite Executor & Coverage Monitor



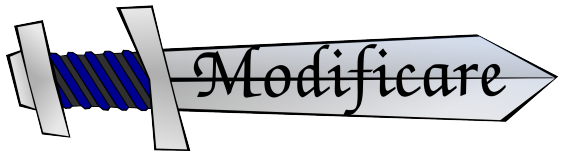
Coverage criteria: Statement, method, and class

Proteja: Test Suite Executor & Coverage Monitor

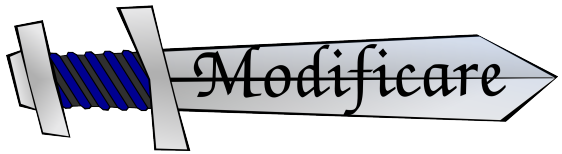


Run test suite according to a reduction or prioritization

Modificare: Test Suite Management & Experimentation

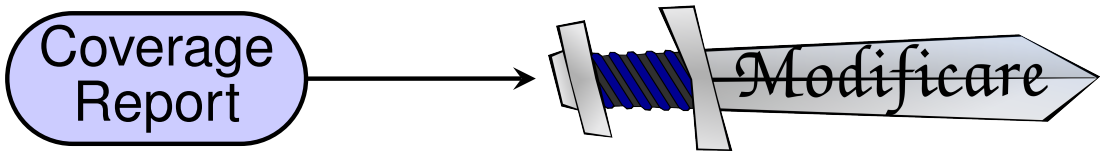


Modificare: Test Suite Management & Experimentation



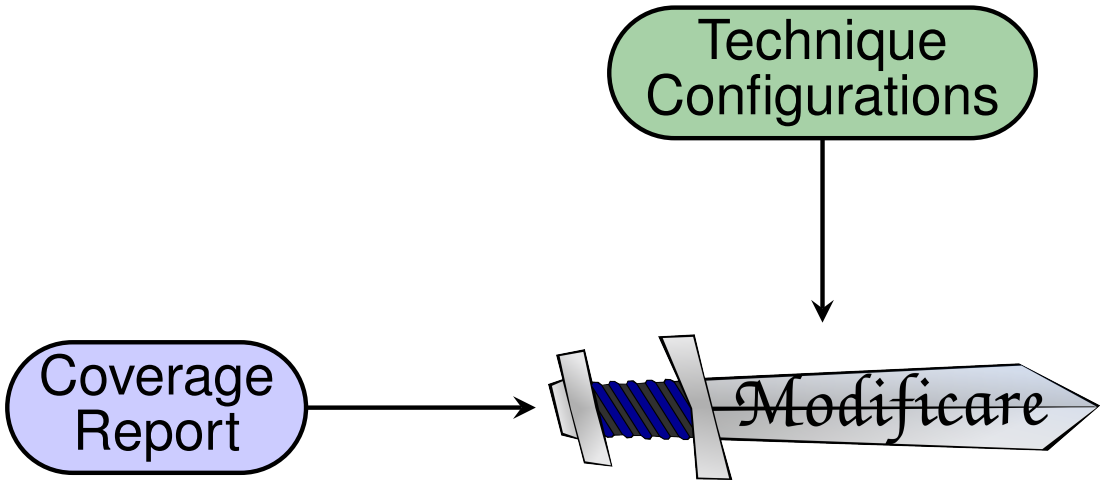
Algorithms: Greedy, Hill Climbing, Random, Adaptive Random, Simulated Annealing, Genetic

Modificare: Test Suite Management & Experimentation



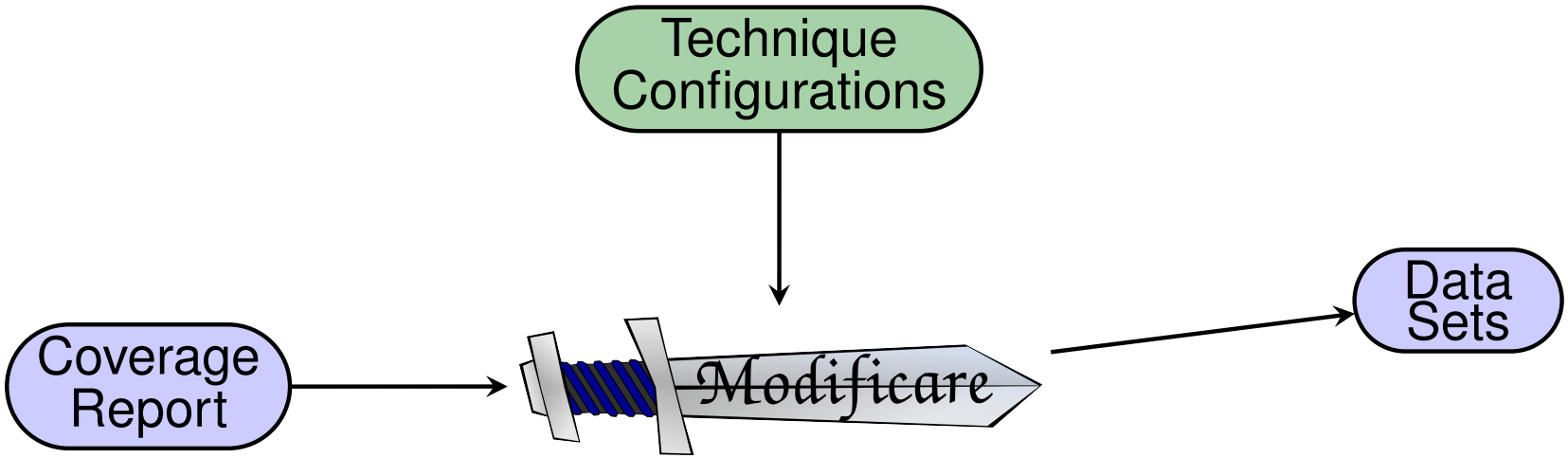
Per-test coverage information produced by Proteja

Modificare: Test Suite Management & Experimentation



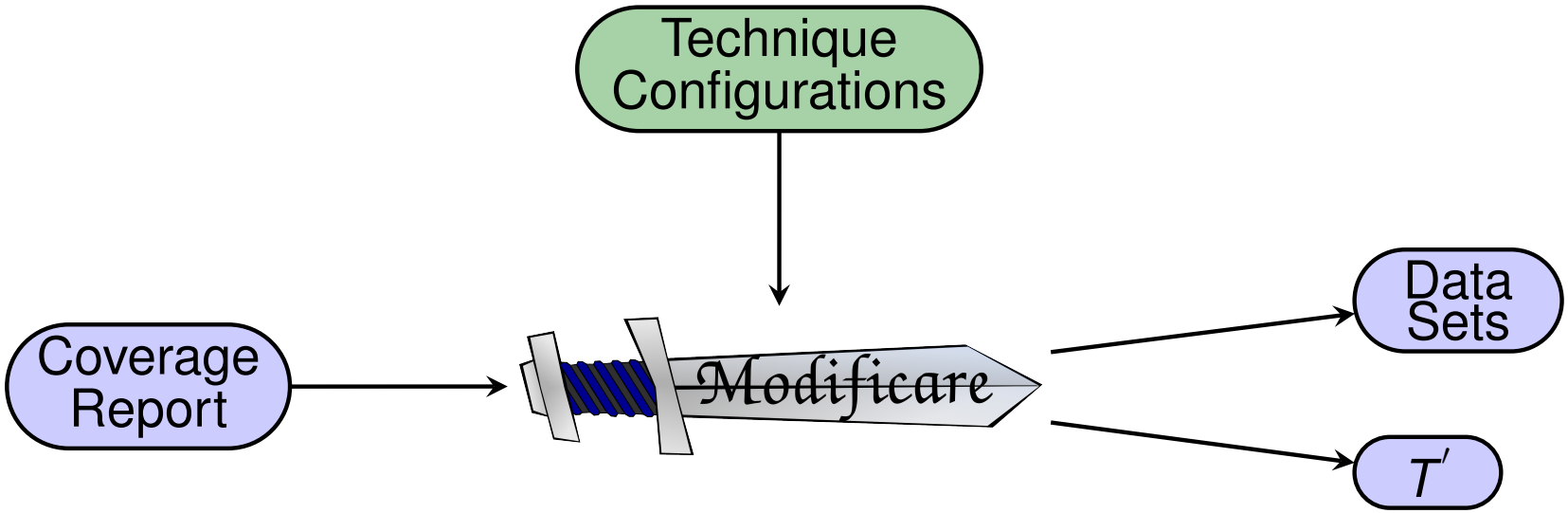
Controls the execution of the reduction and prioritization algorithms

Modificare: Test Suite Management & Experimentation



Visualized and statistically analyzed to identify trends

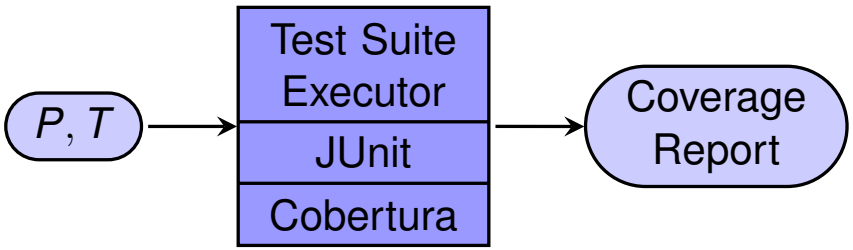
Modificare: Test Suite Management & Experimentation



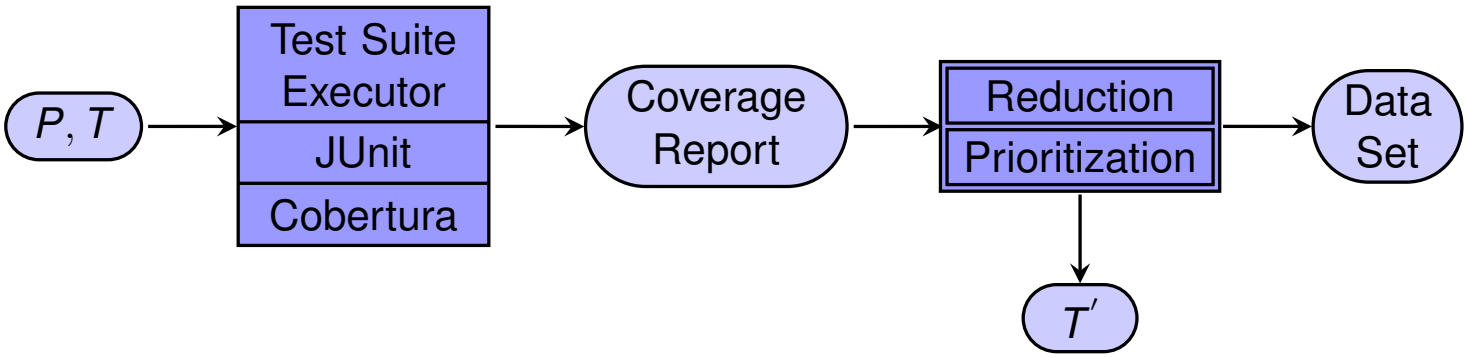
Description of the reduced or prioritized test suite

Integrating Proteja and Modificare

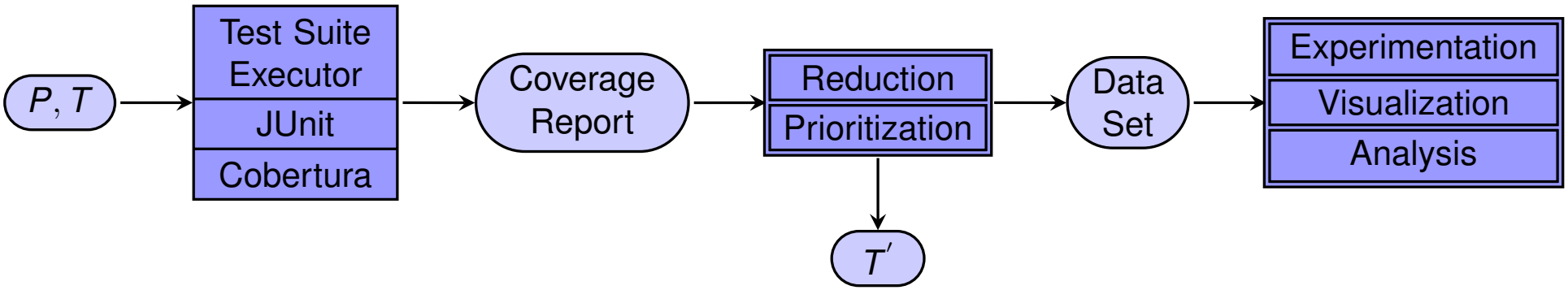
Integrating Proteja and Modificare



Integrating Proteja and Modificare

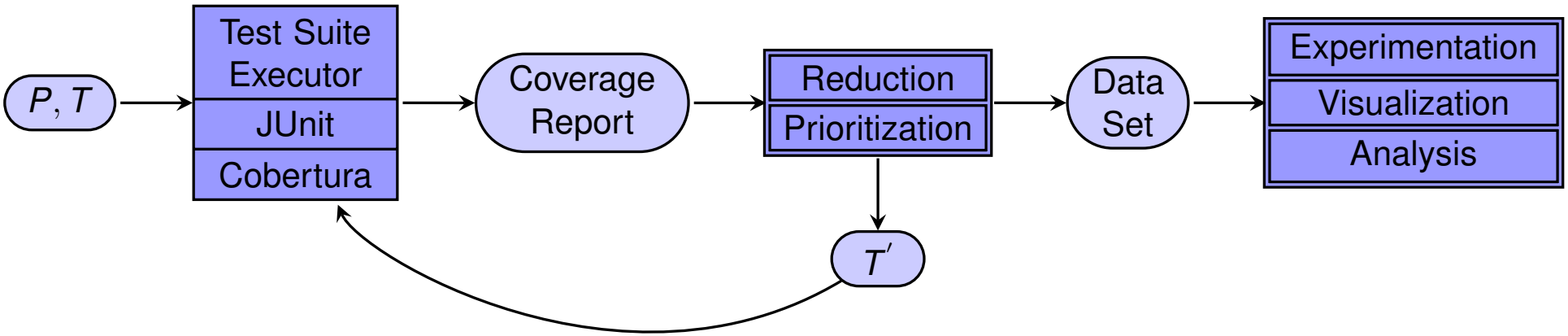


Integrating Proteja and Modificare



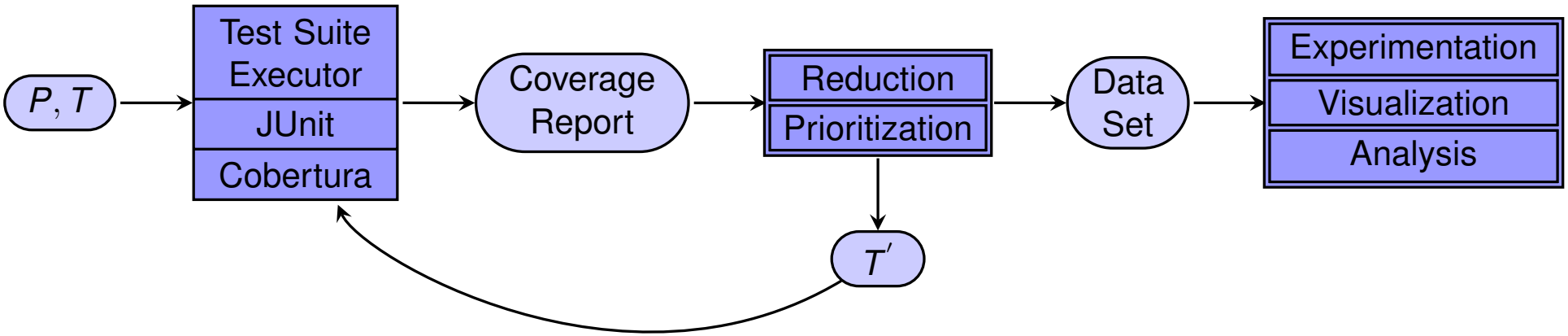
Visualization and analysis used to identify trends

Integrating Proteja and Modificare



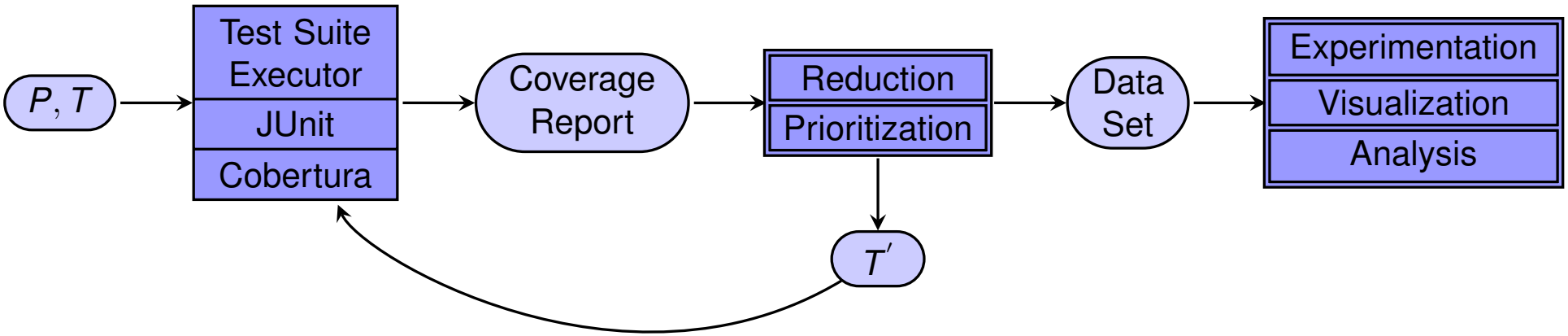
T' executed using Proteja

Integrating Proteja and Modificare



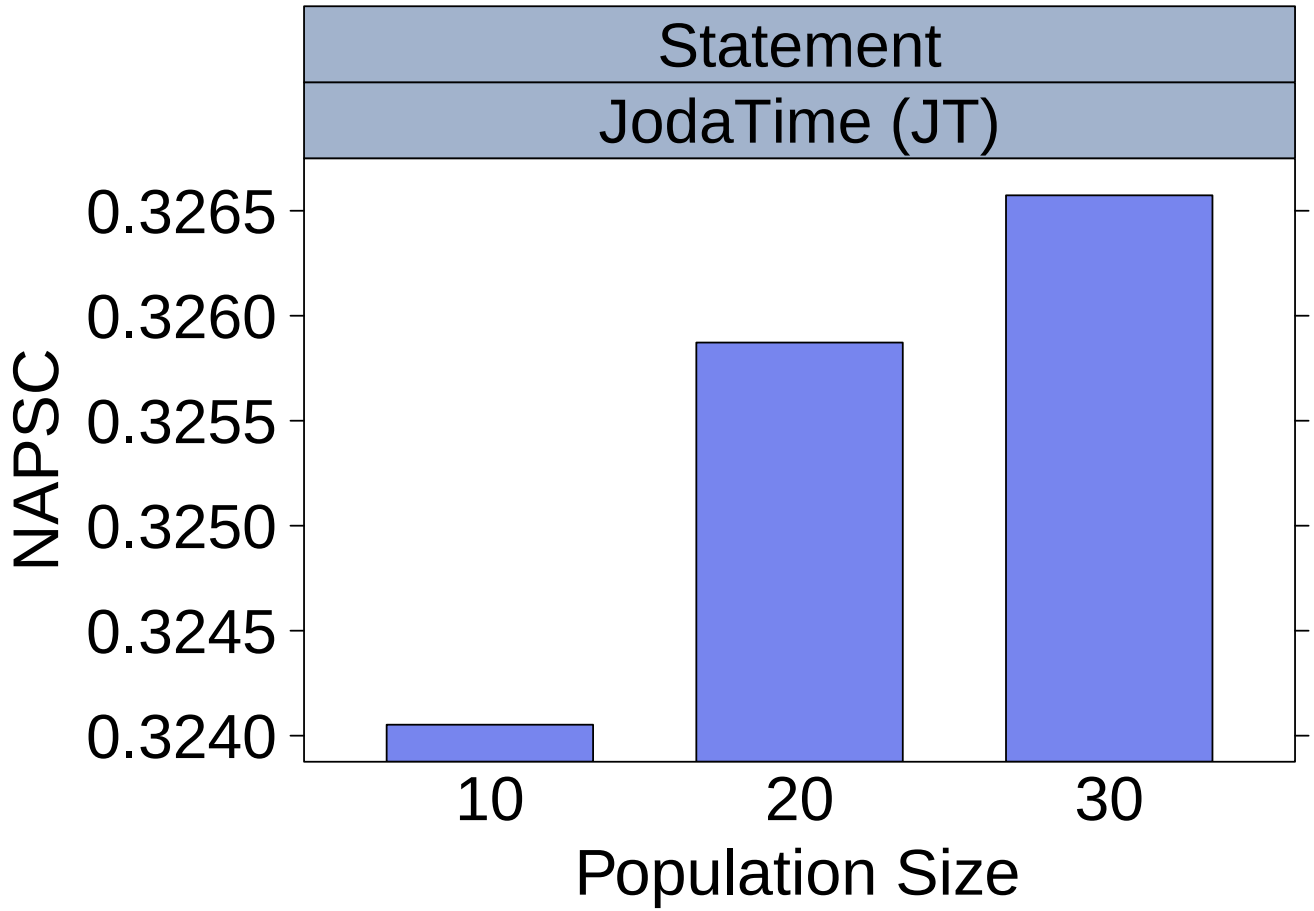
Use any tool that produces data in the correct format

Integrating Proteja and Modificare



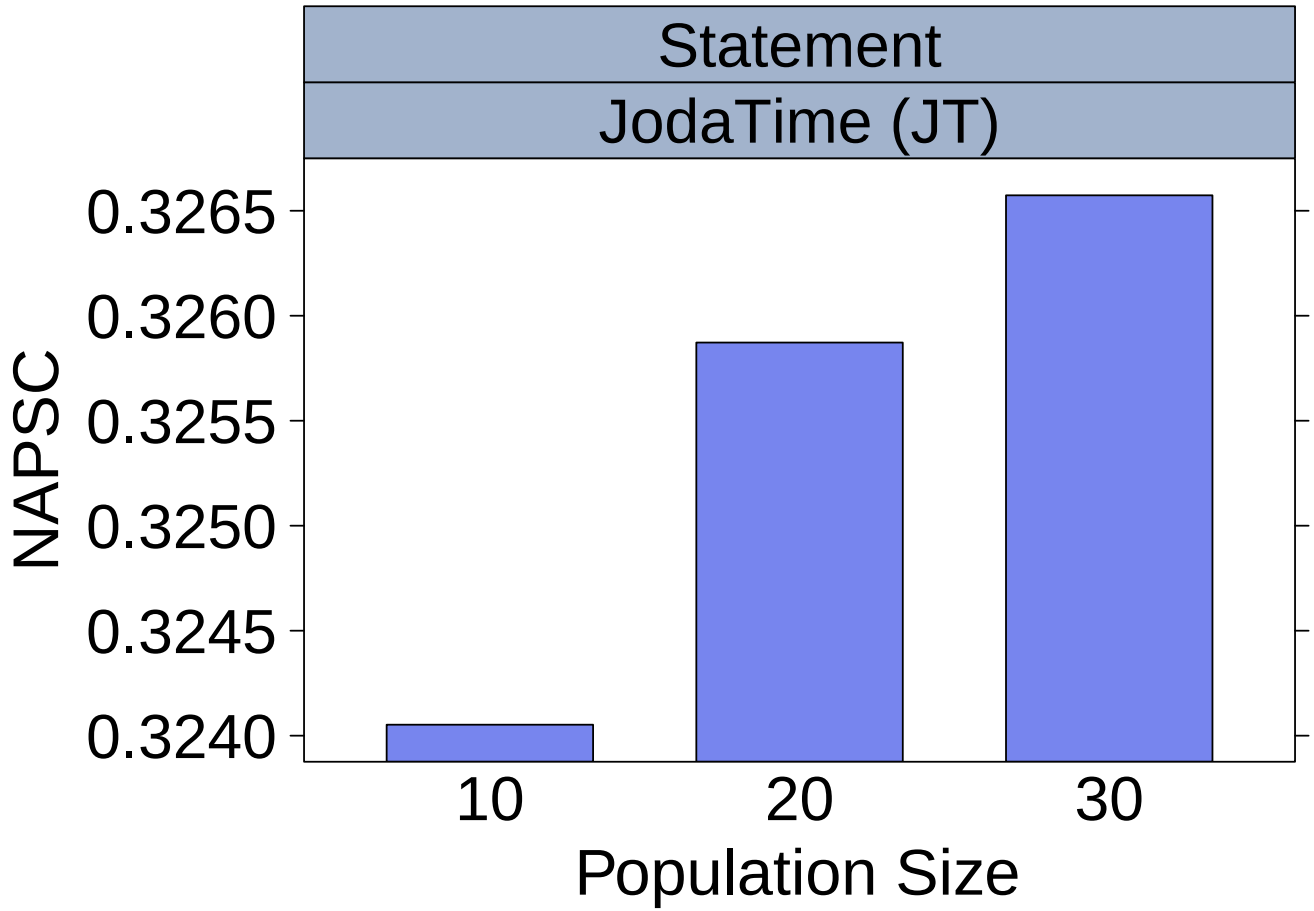
However, greatest benefits realized when tools used together

Empirical Results



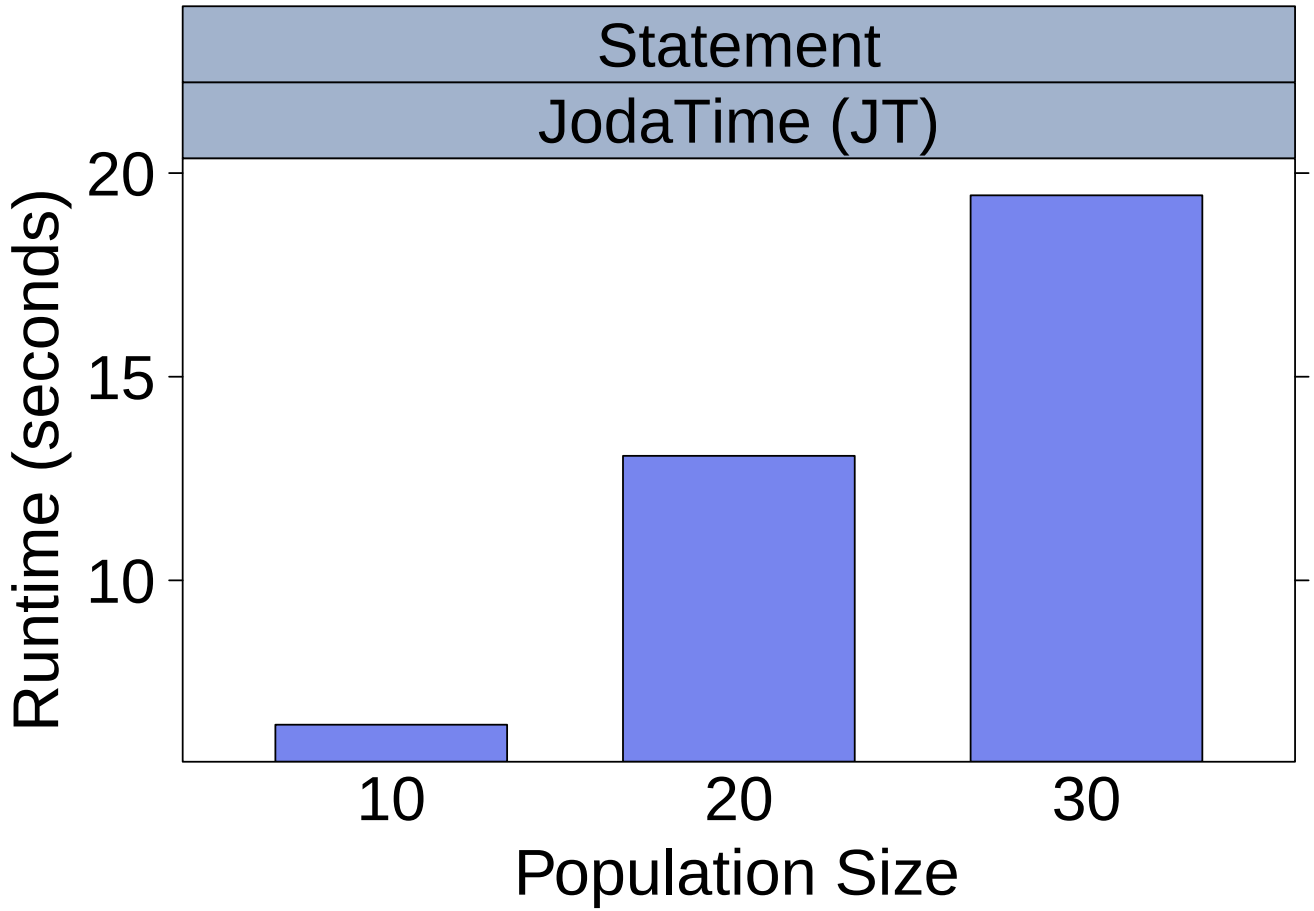
Original NAPSC Score: 0.2784

Empirical Results



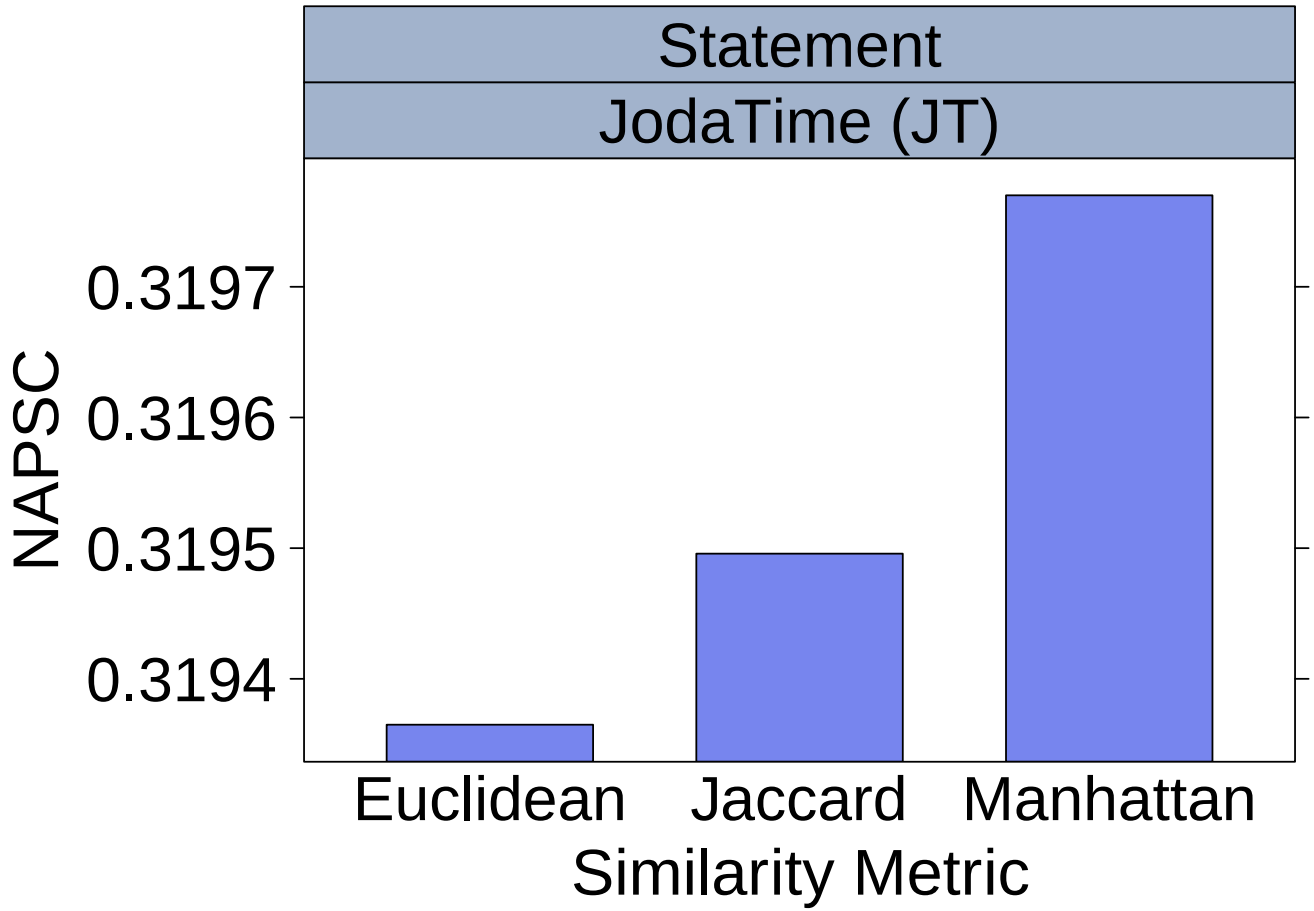
Negligible NAPSC increase as population size increases

Empirical Results



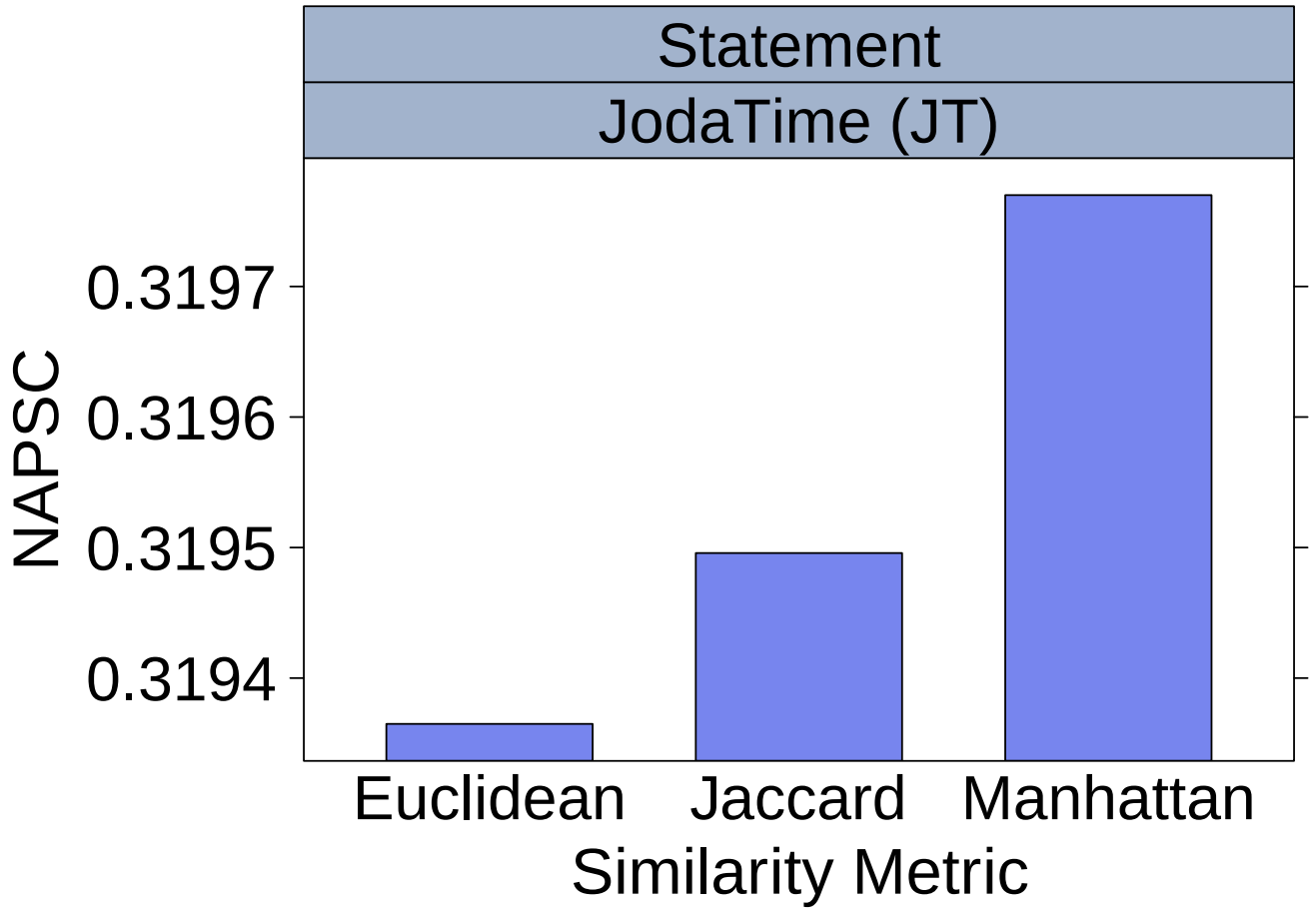
Increases in runtime are more marked

Empirical Results



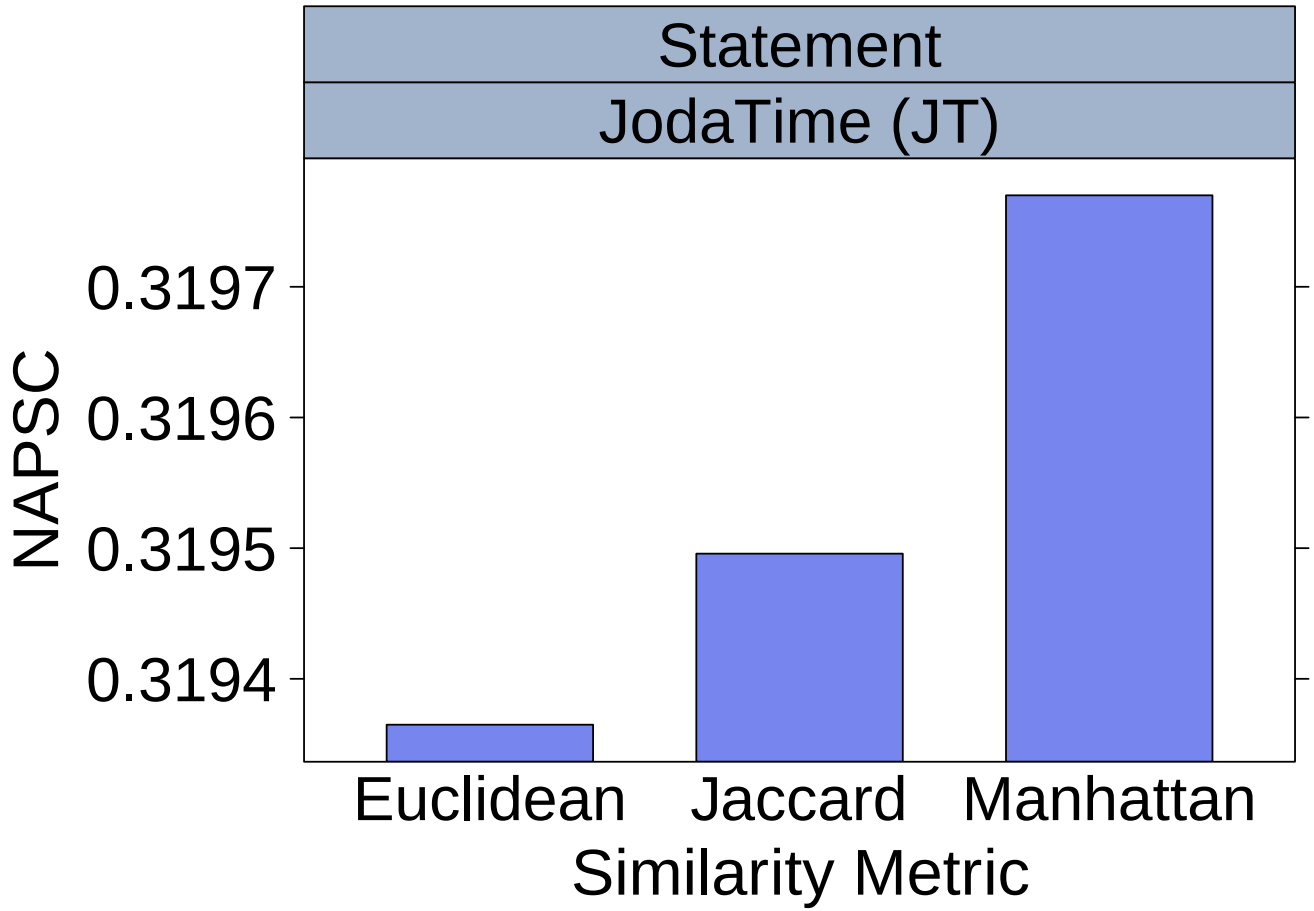
Original NAPSC Score: 0.2784

Empirical Results



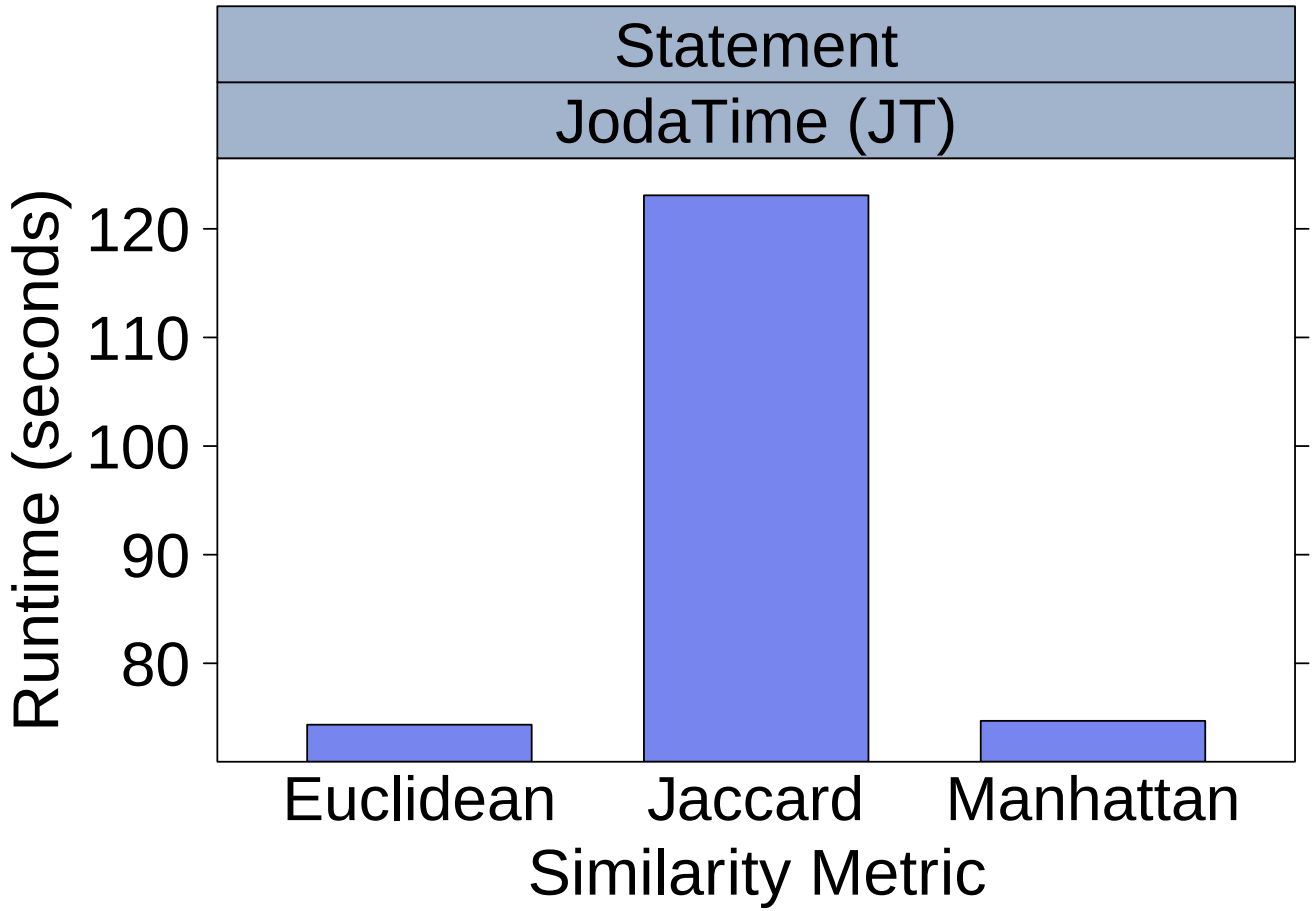
NAPSC changes little as similarity metric is varied

Empirical Results



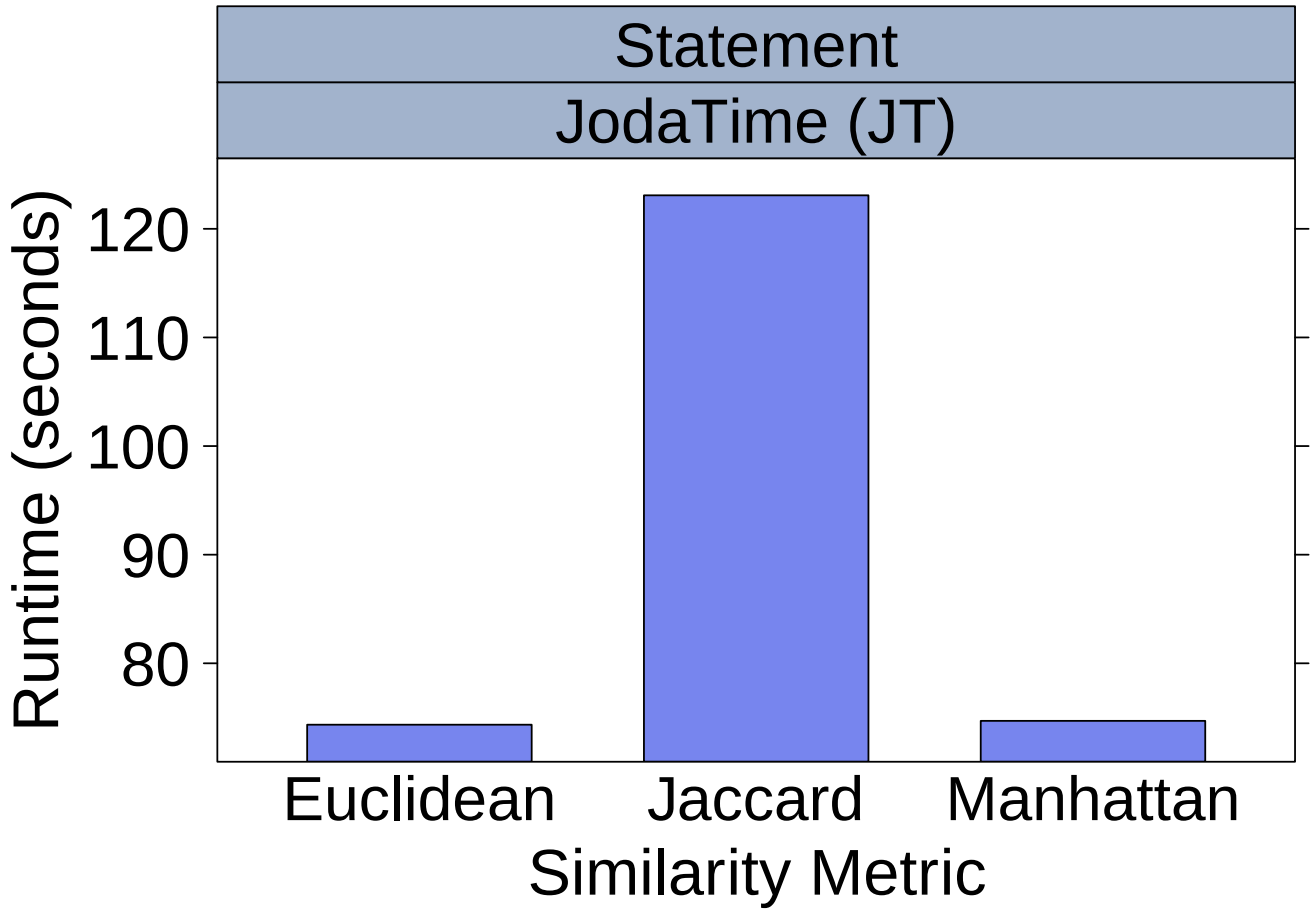
Scores are comparable to those produced by random (0.3240 - 0.3265)

Empirical Results



Adaptive random executes more slowly than random

Empirical Results



Choose random because it produces comparable NAPSC scores in less time

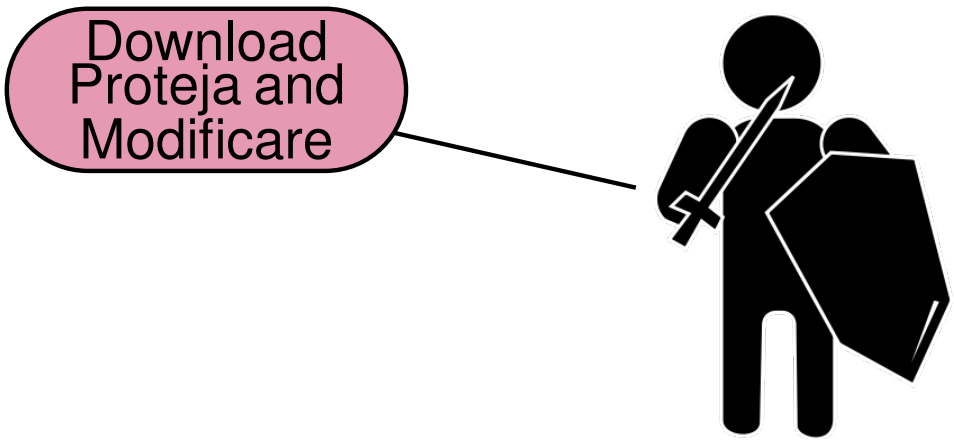
Getting Involved

Getting Involved

How can you “battle” research and practice challenges?

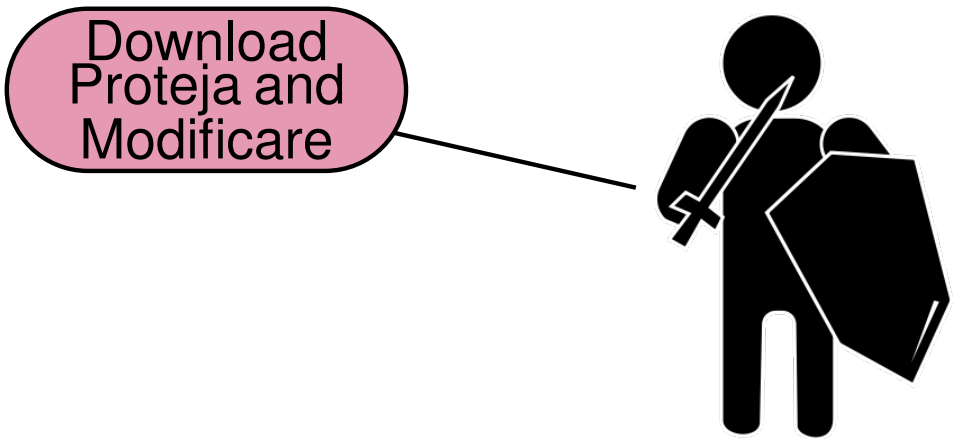
Getting Involved

How can you “battle” research and practice challenges?



Getting Involved

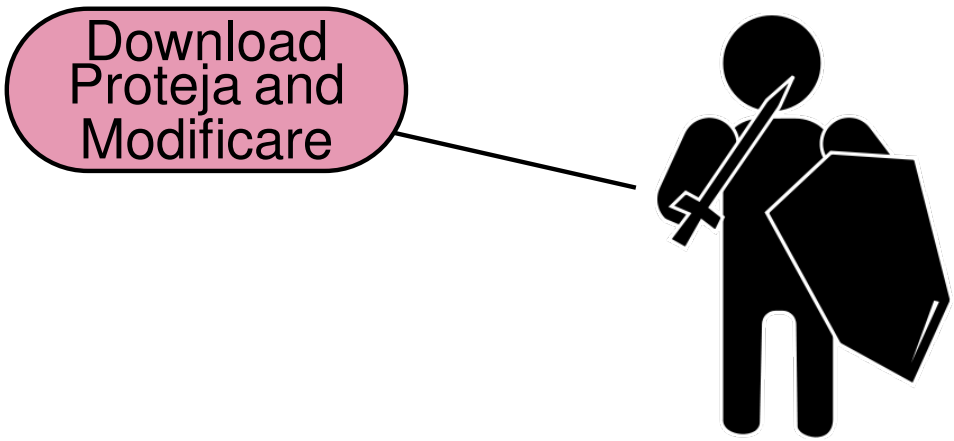
How can you “battle” research and practice challenges?



Proteja: http://proteja.googlecode.com

Getting Involved

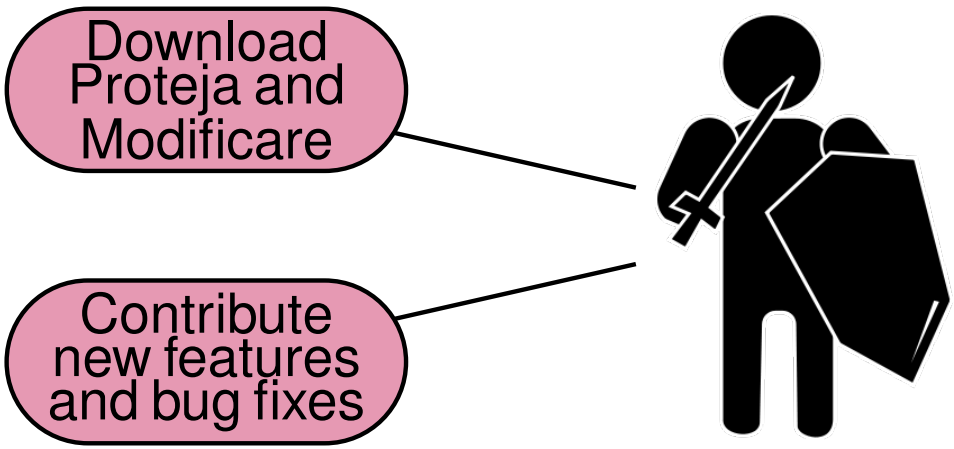
How can you “battle” research and practice challenges?



Modificare: http://modificare.googlecode.com

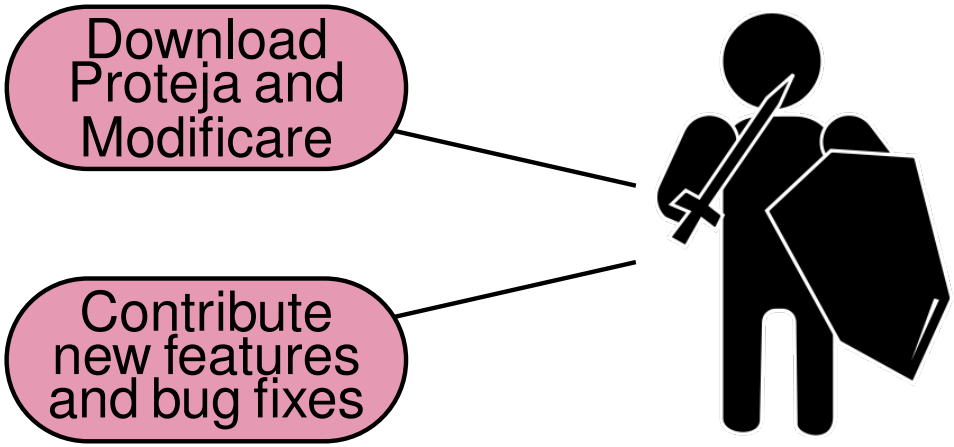
Getting Involved

How can you “battle” research and practice challenges?



Getting Involved

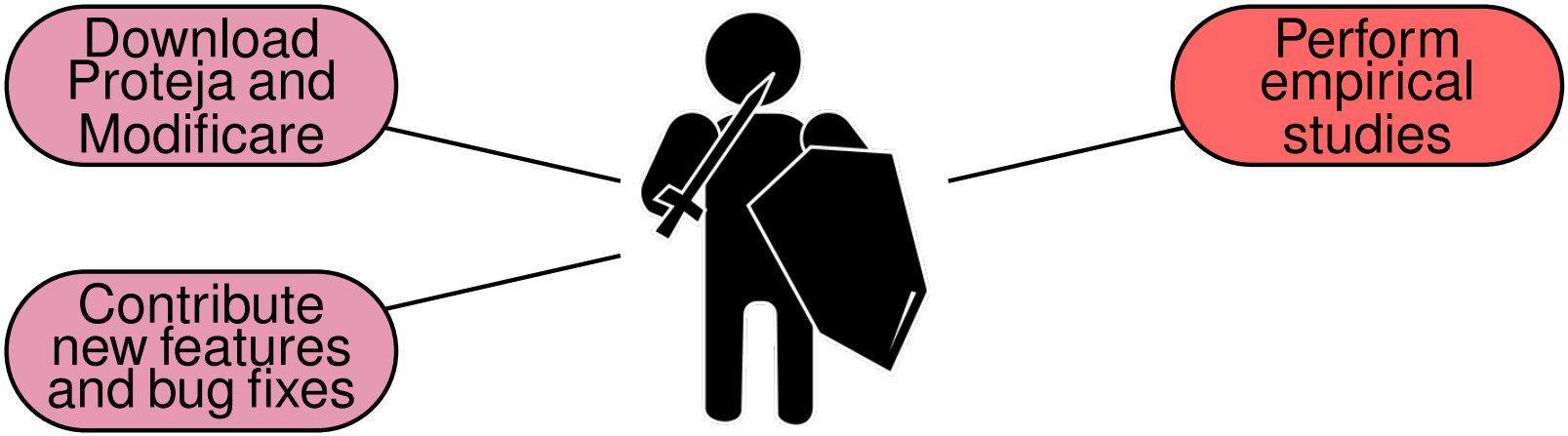
How can you “battle” research and practice challenges?



All contributions will be recognized

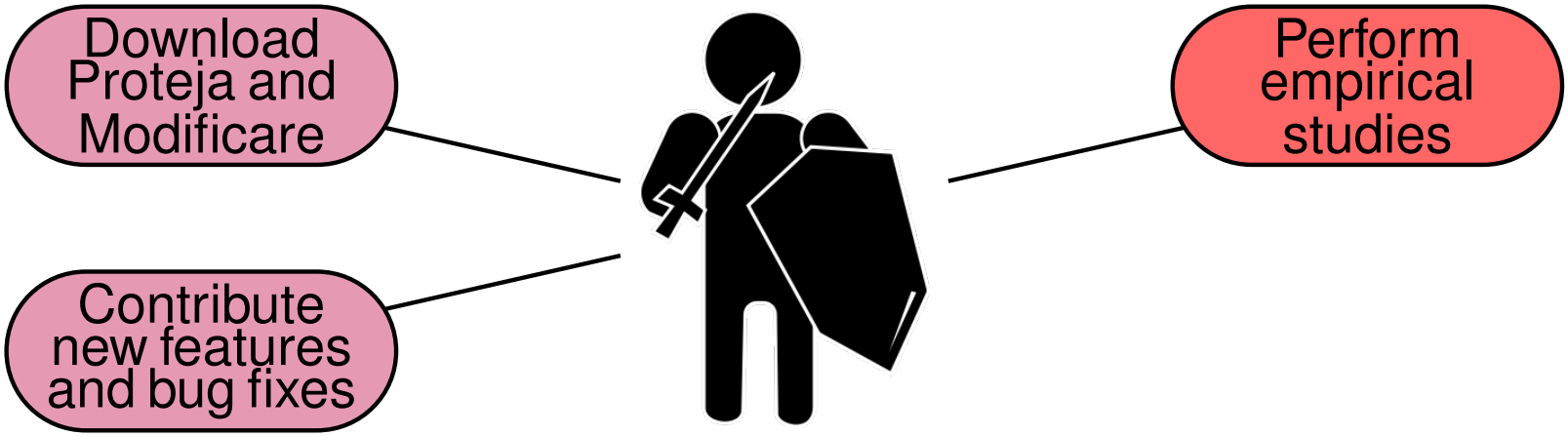
Getting Involved

How can you “battle” research and practice challenges?



Getting Involved

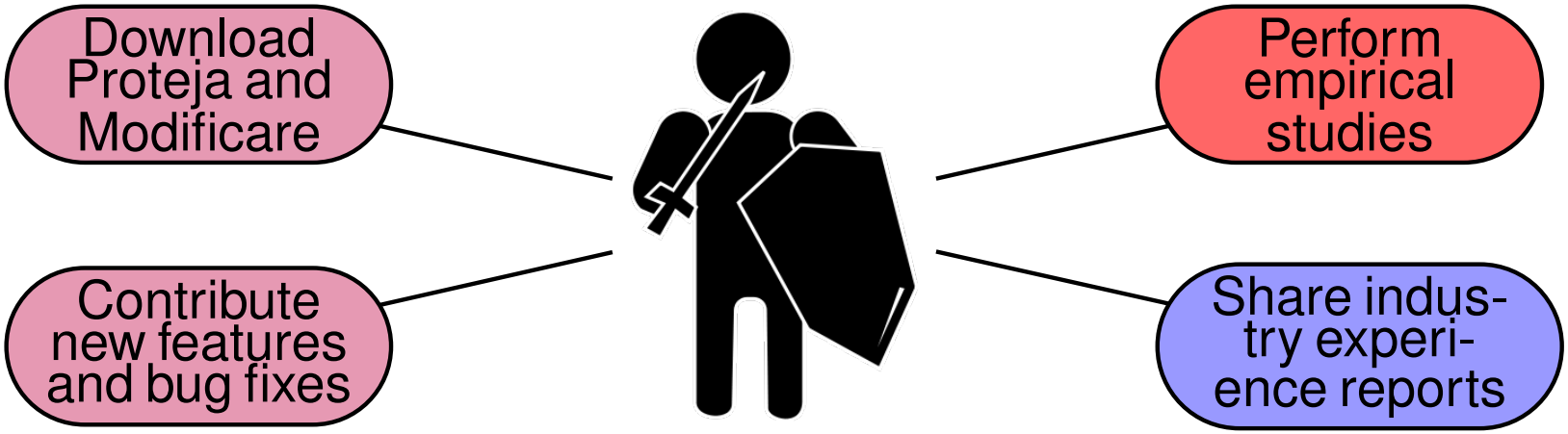
How can you “battle” research and practice challenges?



Study more algorithms or configurations of individual algorithms

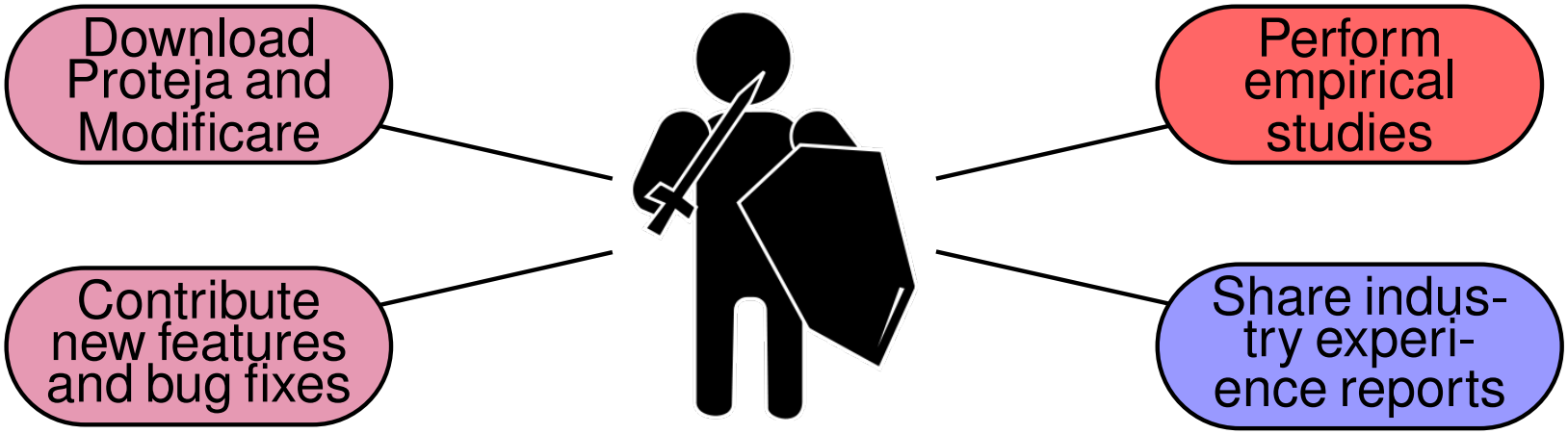
Getting Involved

How can you “battle” research and practice challenges?



Getting Involved

How can you “battle” research and practice challenges?



How well do these tools work in practice?

Conclusions and Future Work

Conclusions and Future Work

Conclusions and Future Work

Test Suite Executor
& Coverage Monitor

Conclusions and Future Work

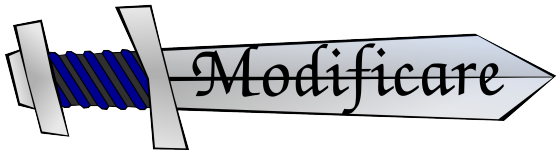
Test Suite Executor
& Coverage Monitor

http://proteja.googlecode.com

Conclusions and Future Work

Test Suite Executor
& Coverage Monitor

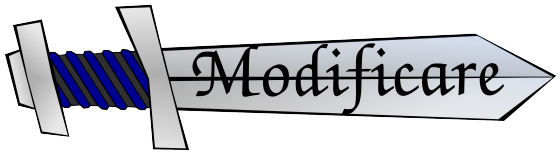
http://proteja.googlecode.com



Conclusions and Future Work

Test Suite Executor
& Coverage Monitor

http://proteja.googlecode.com

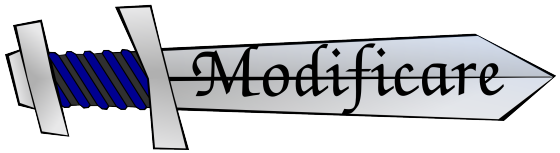


Test Suite Manage-
ment & Experimentation

Conclusions and Future Work

Test Suite Executor
& Coverage Monitor

http://proteja.googlecode.com



Test Suite Manage-
ment & Experimentation

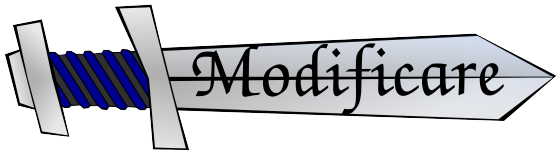
http://modificare.googlecode.com

Conclusions and Future Work

Choose algorithm based on efficiency instead of effectiveness

Test Suite Executor
& Coverage Monitor

http://proteja.googlecode.com



Test Suite Manage-
ment & Experimentation

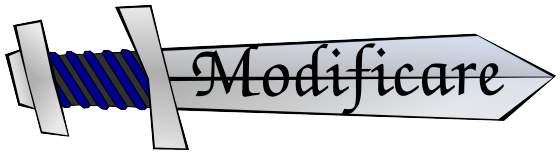
http://modificare.googlecode.com

Conclusions and Future Work

Choose algorithm based on efficiency instead of effectiveness

Test Suite Executor
& Coverage Monitor

http://proteja.googlecode.com



Test Suite Manage-
ment & Experimentation

http://modificare.googlecode.com

Extend and enhance tools and perform additional empirical studies

A Framework to Support Research in and Encourage Industrial Adoption of Regression Testing Techniques

Jonathan Miller Kauffman and Gregory M. Kapfhammer

Thank you for your attention!
Questions?

ALLEGHENY COLLEGE