mrstudyr

Retrospective Mutant Reduction

Colton J. McCurdy


McCurdyColton

ICSME 2016

Gregory M. Kapfhammer and Phil McMinn

Motivation

Quality software?

Motivation

Regression Test Suite

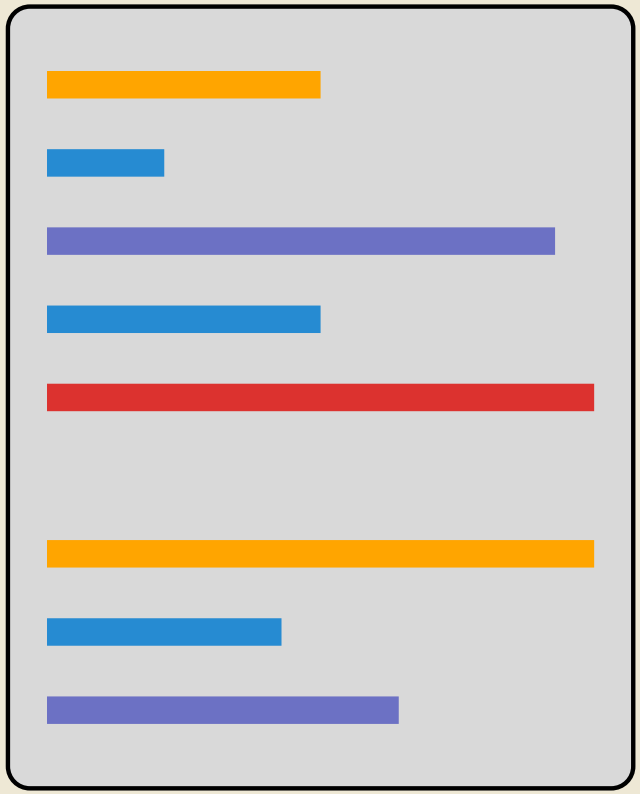
Motivation

Regression Test Suite

$$T = \langle\ t_1, t_2, \ldots, t_n\ \rangle$$

Motivation

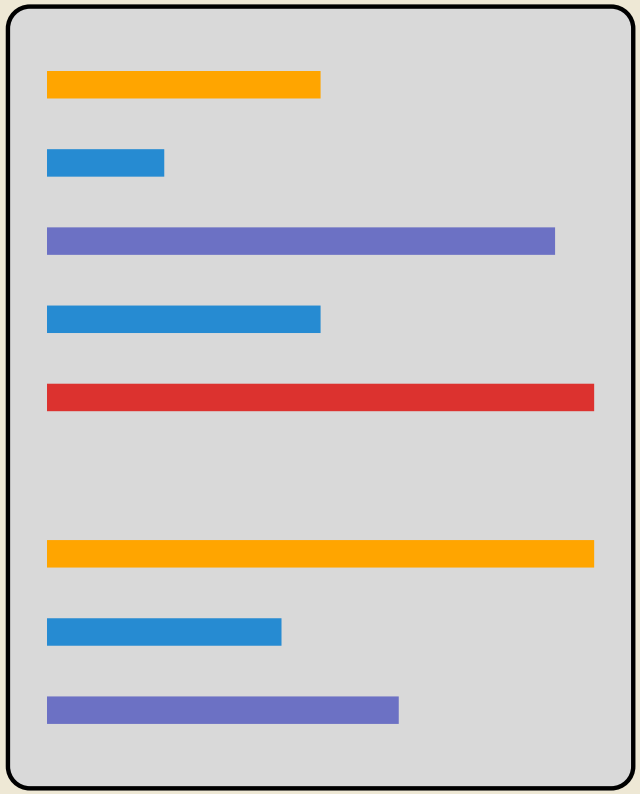
Pass



Fail

Motivation

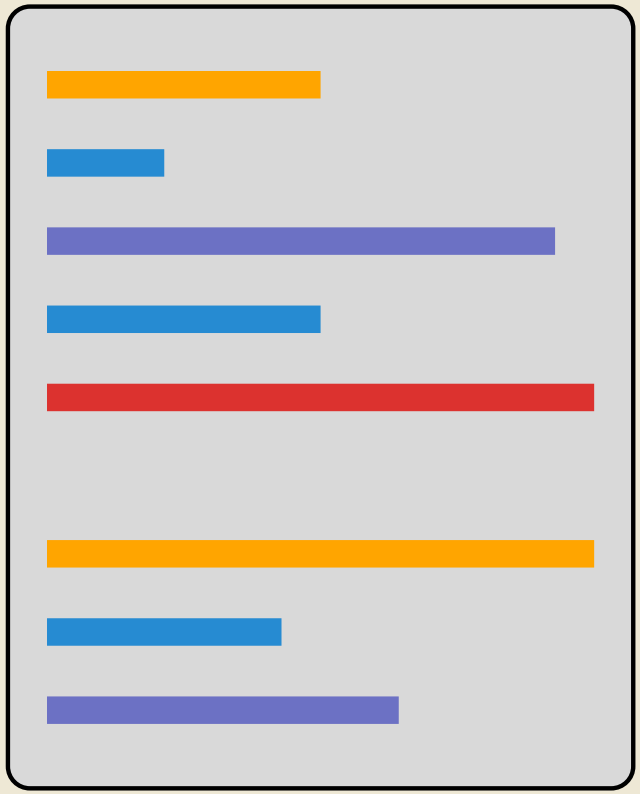
✓Pass



Fail

Motivation

✓Pass



✗Fail

Motivation

Use testing to assess quality?

Motivation

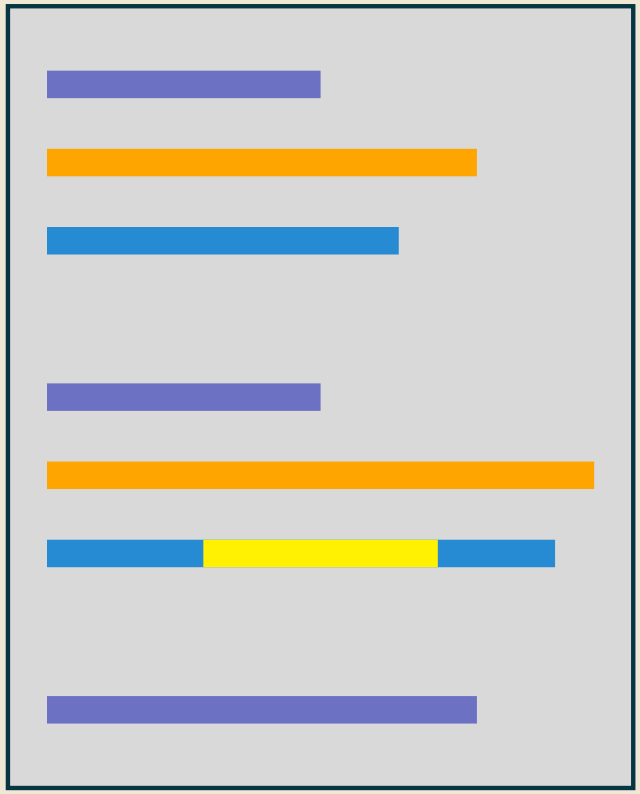
Trivial test suite?

Background

Mutation Testing!

Mutation Testing

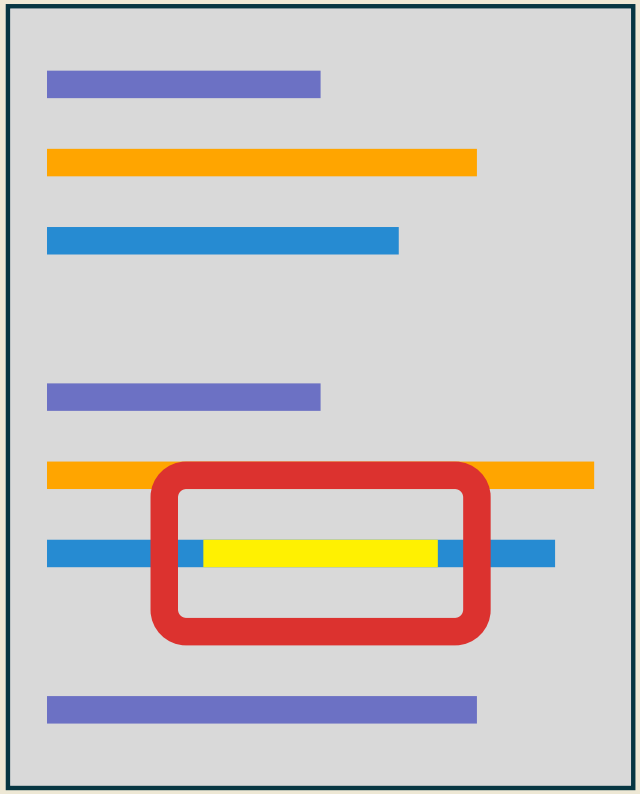
Original



Mutant

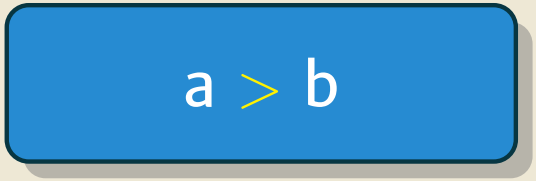
Mutation Testing

Original

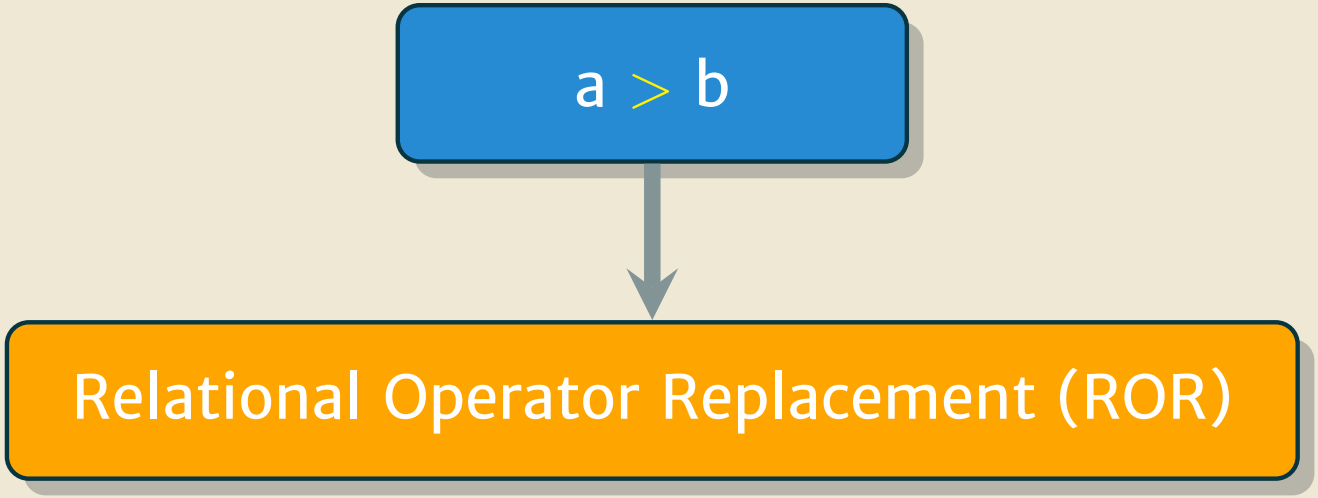


Mutant

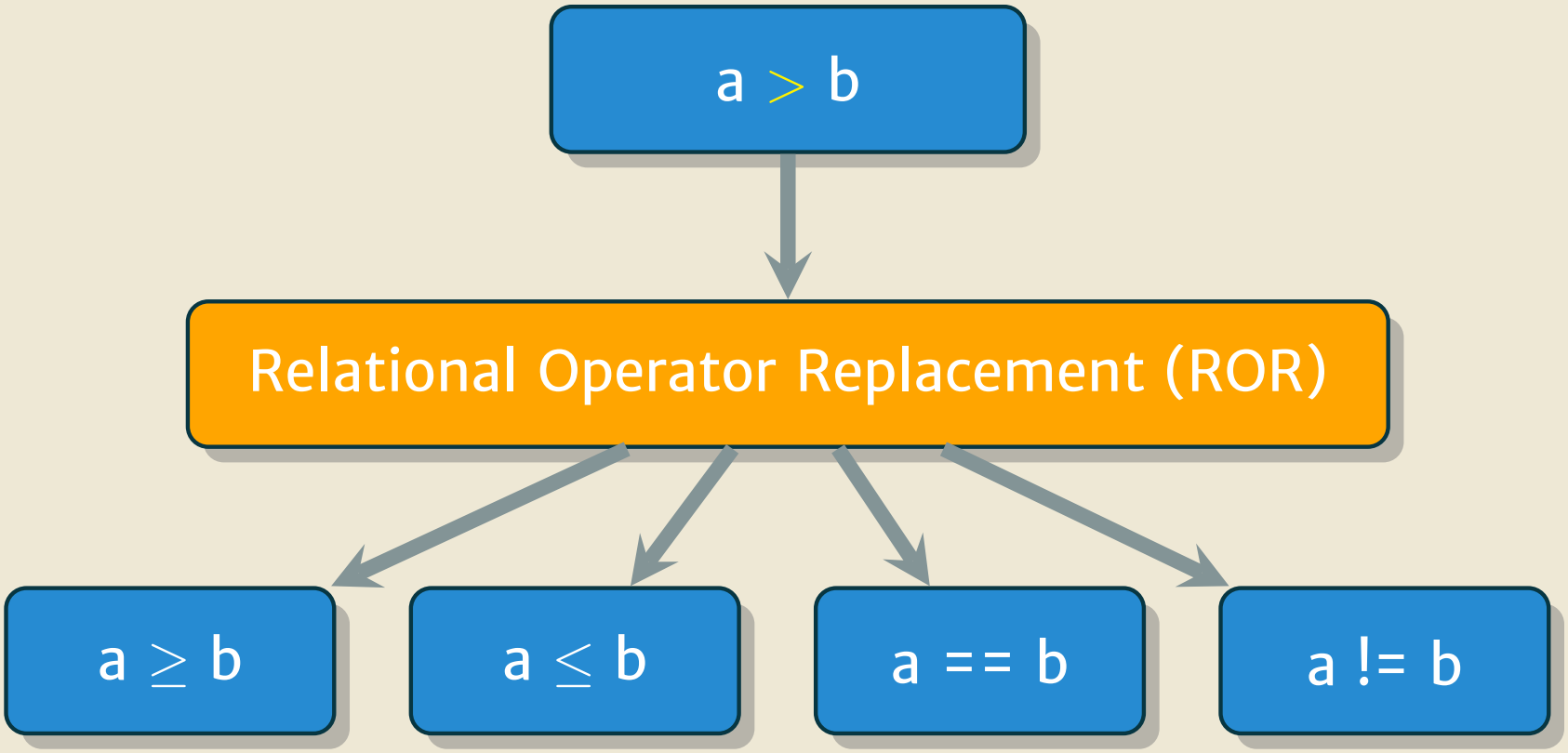
Mutation Testing



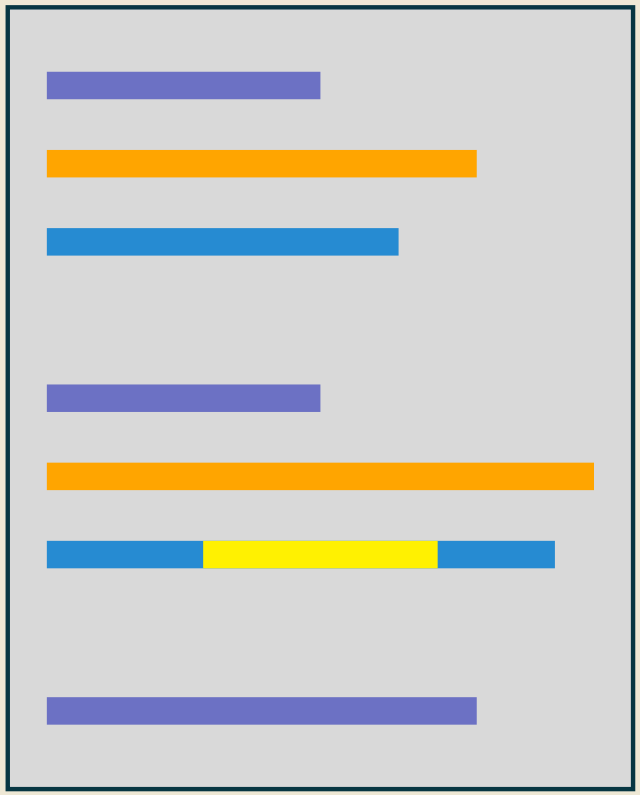
Mutation Testing



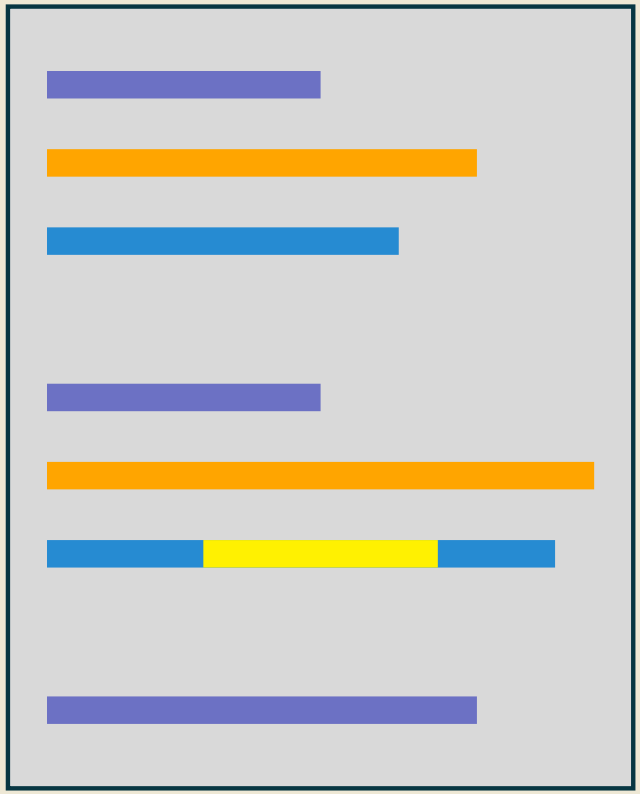
Mutation Testing



Mutation Testing

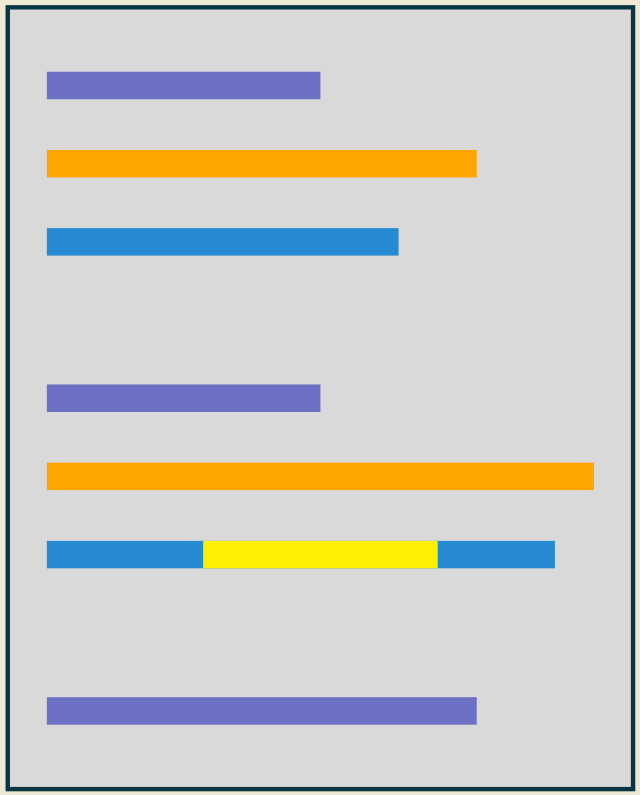


Alive

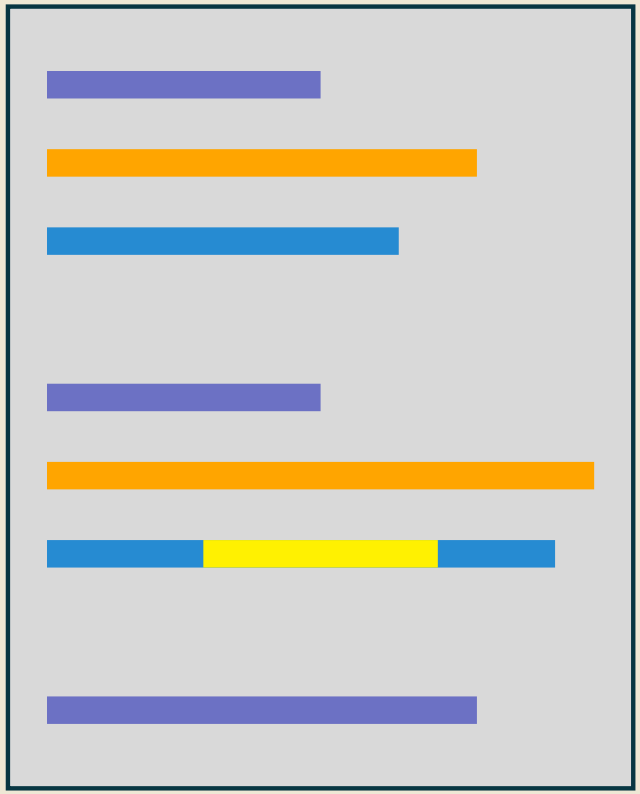


Killed

Mutation Testing

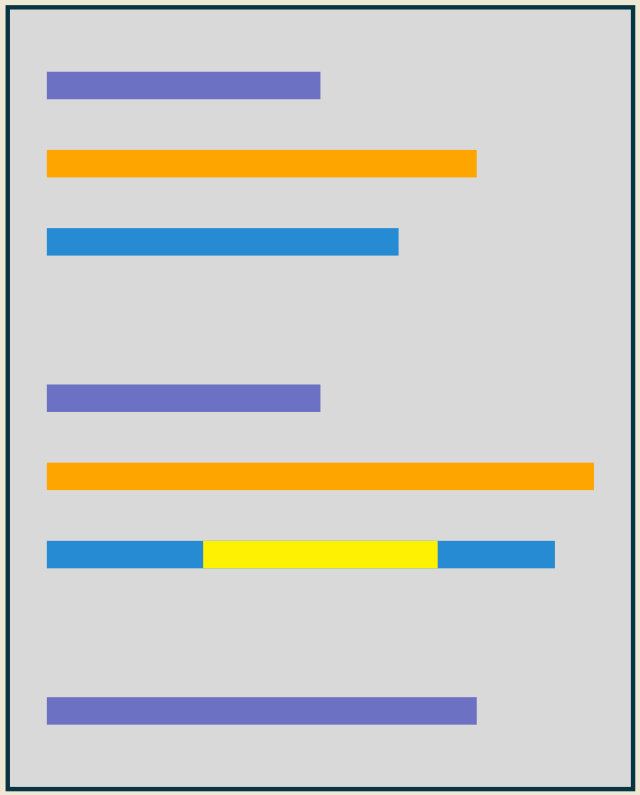


✓Alive

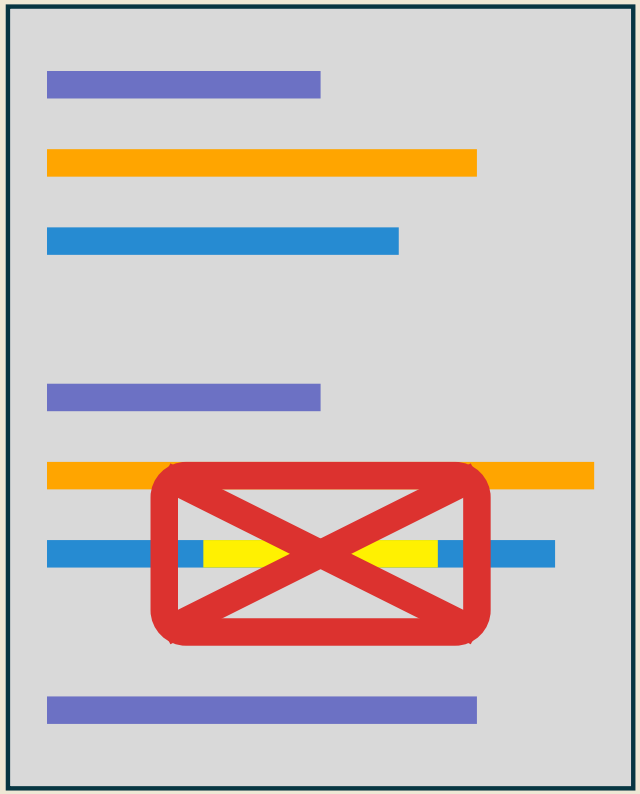


Killed

Mutation Testing



✓Alive



✗Killed

Mutation Testing

$$MS_T = \frac{Killed}{Total}$$

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$MS_T \in [0, 1]$

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$MS_T \in [0, 1]$

HIB

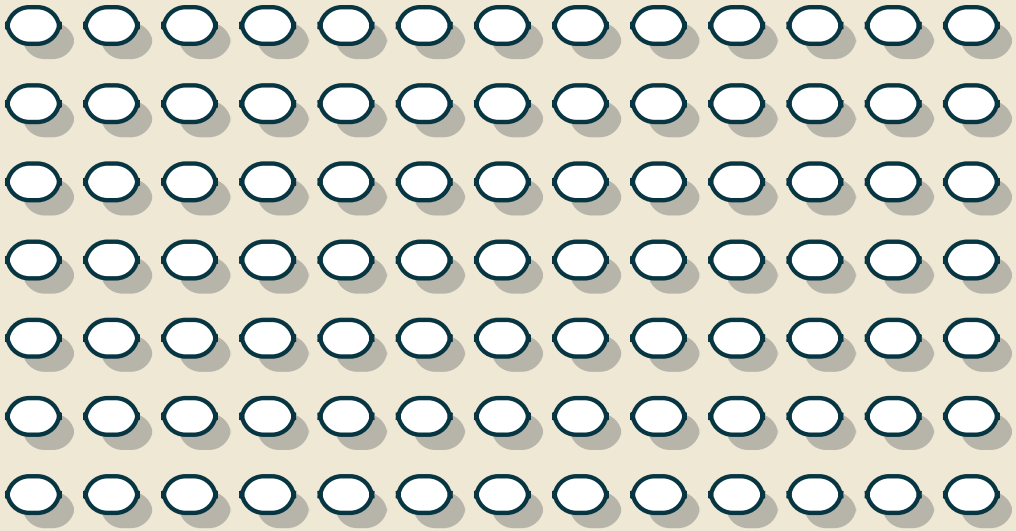
Mutation Testing

Silver Bullet?

Mutation Testing

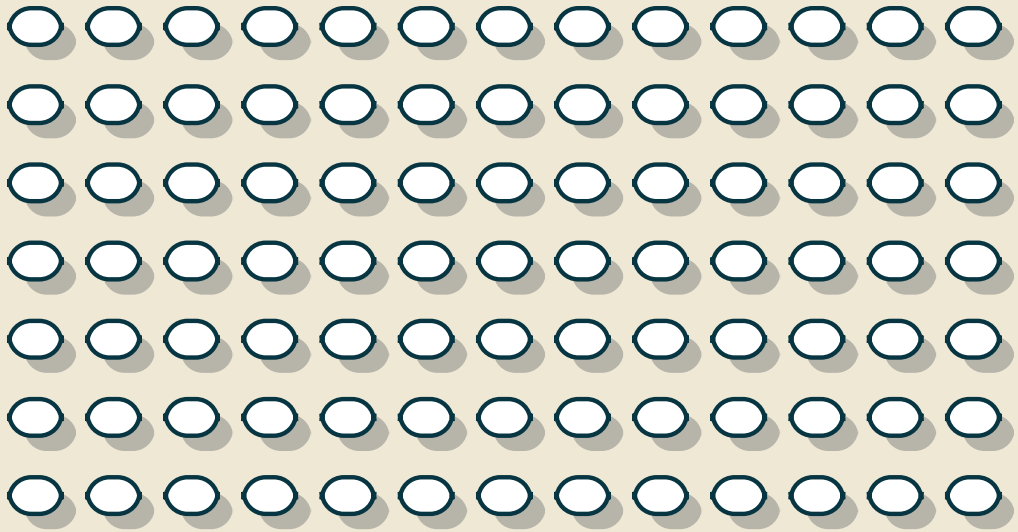
Limitations

Mutation Testing



Mutation Testing

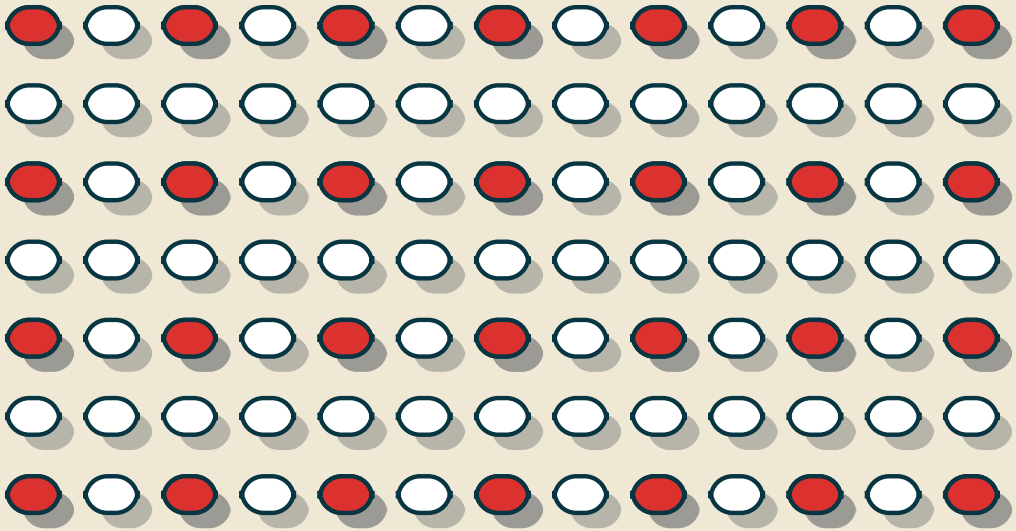
$$T = \langle t_1, t_2, \ldots, t_n \rangle$$



Mutation Testing

$$T = \langle t_1, t_2, \ldots, t_n \rangle$$

Weak

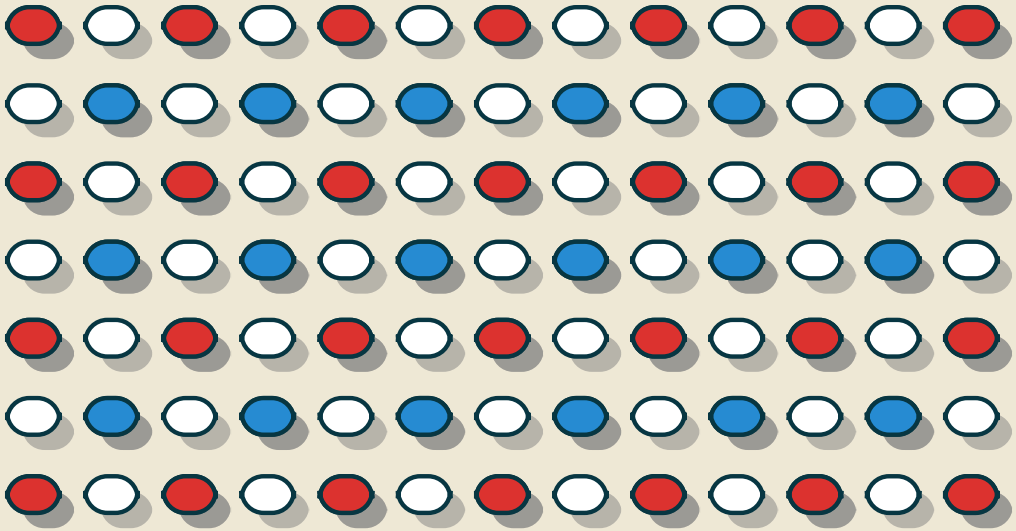


Mutation Testing

$$T = \langle t_1, t_2, \ldots, t_n \rangle$$

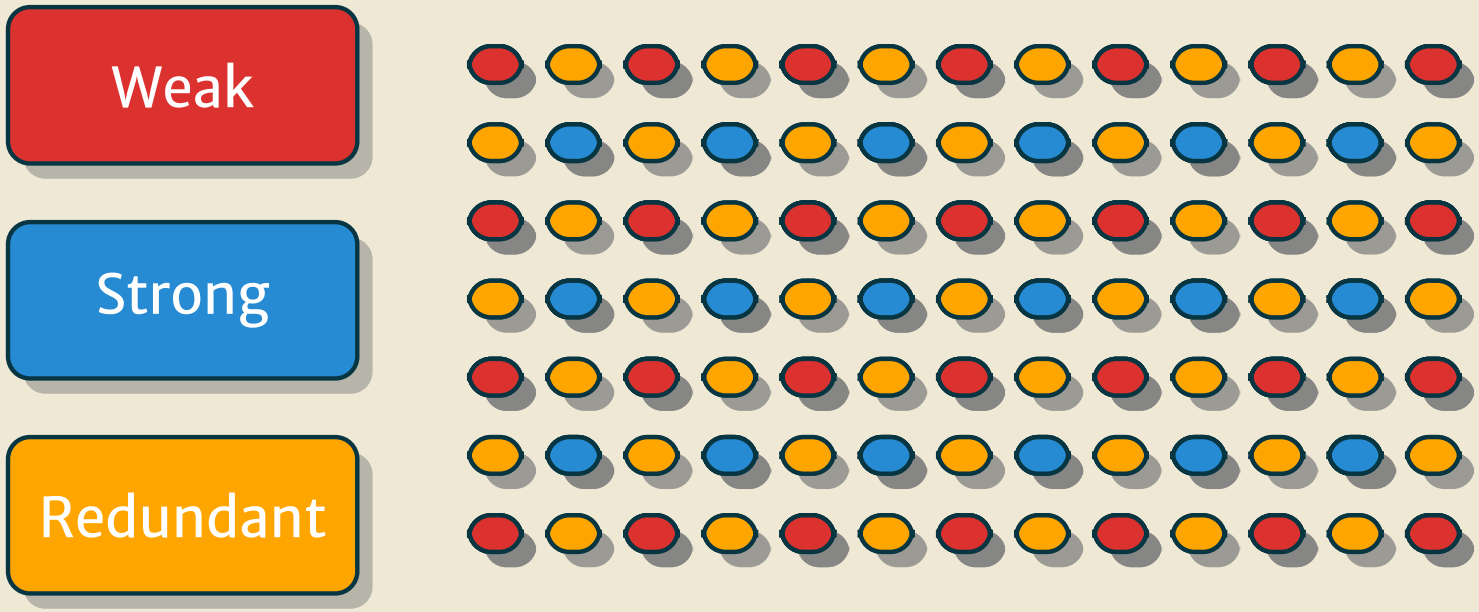
Weak

Strong



Mutation Testing

$$T = \langle t_1, t_2, \ldots, t_n \rangle$$



Mutation Testing

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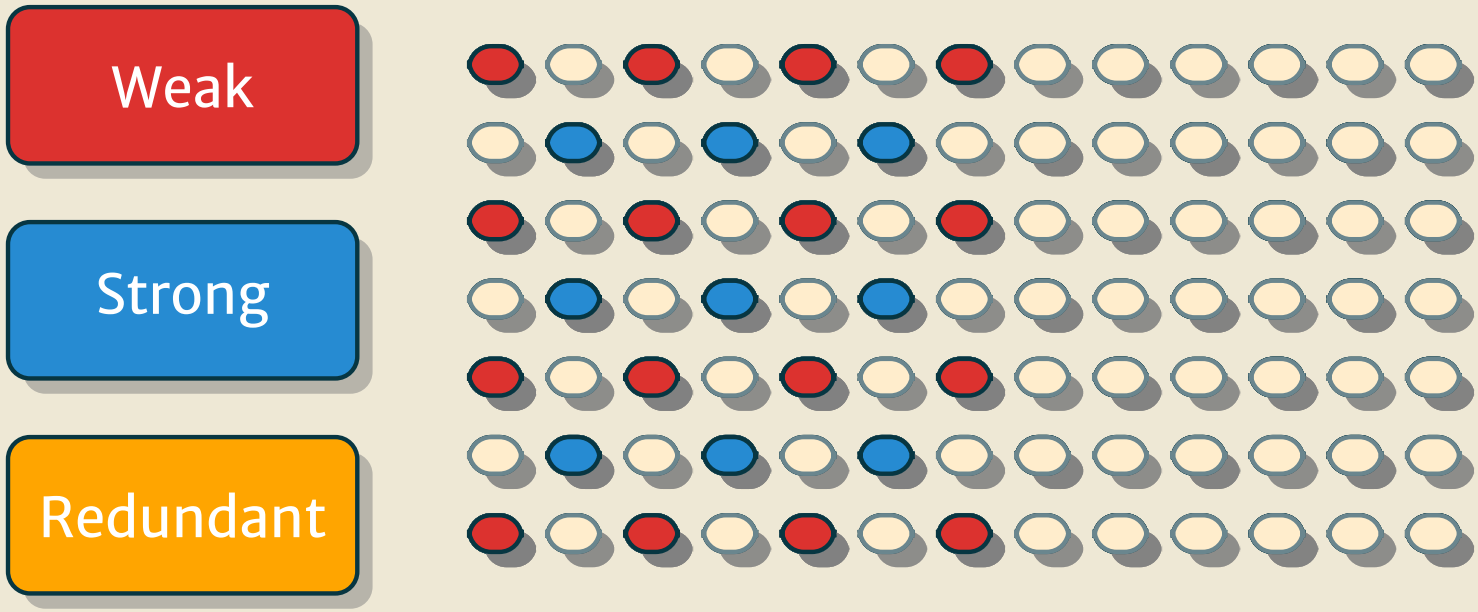

Mutation Testing

Still . . .

Mutation Testing

Still . . .

limitations

Mutation Testing

Mutation Testing

Understand system intricacies

Mutation Testing

Understand system intricacies

Mutation Testing

Retrospective

Mutant Reduction

Mutation Testing

Retrospective

Mutant Reduction

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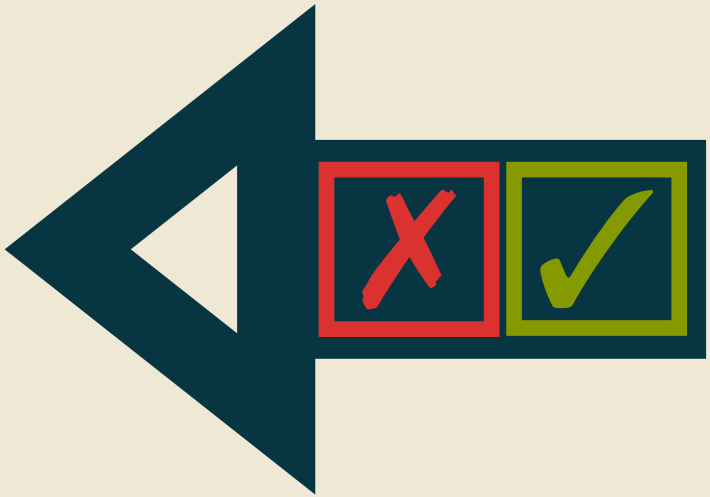

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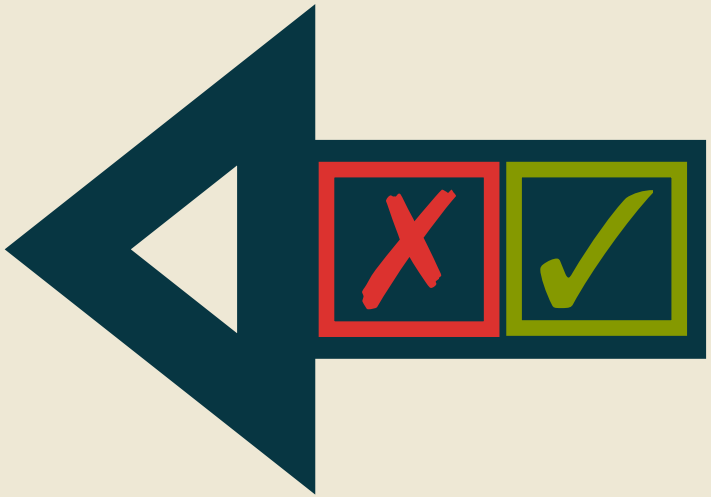
mccurdyc/mrstudyr



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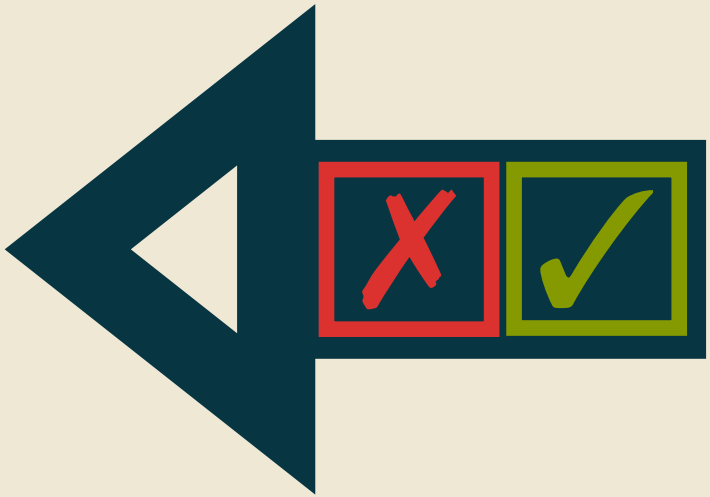

Data

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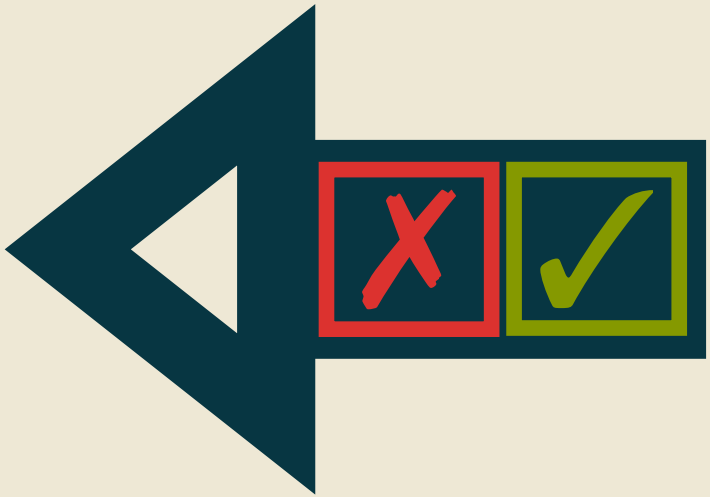

Data → Reduce

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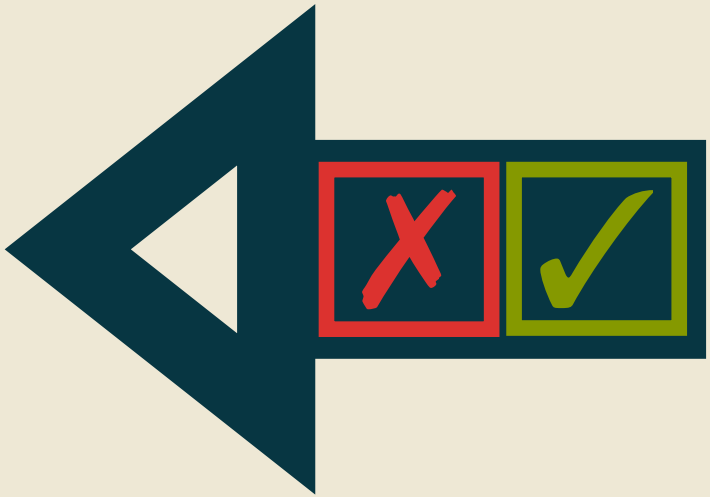
mccurdyc/mrstudyr



Data → Reduce → Remove

Input

Database Schema Mutants

Demonstration

Demonstration!

Motivation

Random Sampling

Output

	Percent	Correlation	MAE	RMSE
1	1.00	0.36	9.20	11.90
2	10.00	0.68	2.96	4.27
3	20.00	0.76	2.02	2.91
4	30.00	0.82	1.35	2.00
5	40.00	0.82	1.19	1.70
6	50.00	0.85	1.07	1.48
7	60.00	0.88	0.75	1.02
8	70.00	0.90	0.59	0.84
9	80.00	0.90	0.47	0.66
10	90.00	0.92	0.34	0.49
11	100.00	1.00	0.00	0.00

Output

	Percent	Correlation	MAE	RMSE
1	1.00	0.36	9.20	11.90
2	10.00	0.68	2.96	4.27
3	20.00	0.76	2.02	2.91
4	30.00	0.82	1.35	2.00
5	40.00	0.82	1.19	1.70
6	50.00	0.85	1.07	1.48
7	60.00	0.88	0.75	1.02
8	70.00	0.90	0.59	0.84
9	80.00	0.90	0.47	0.66
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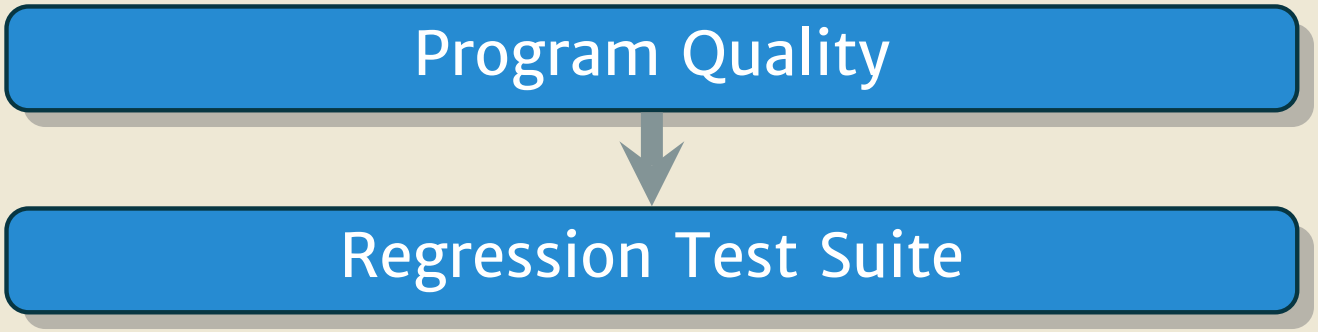
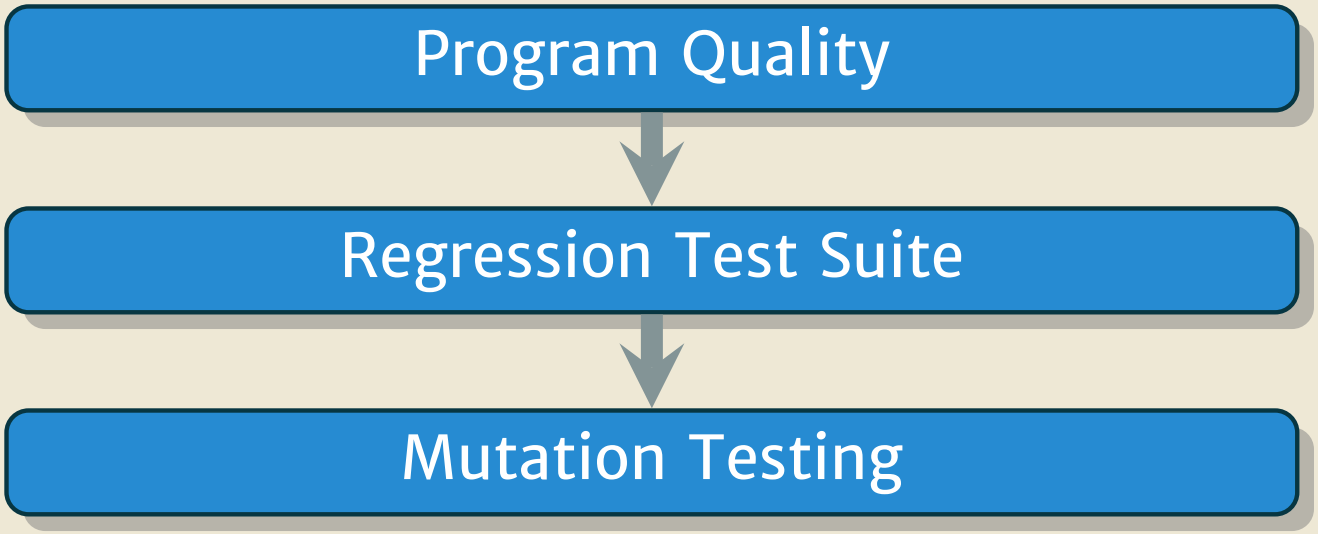
Conclusion

Program Quality

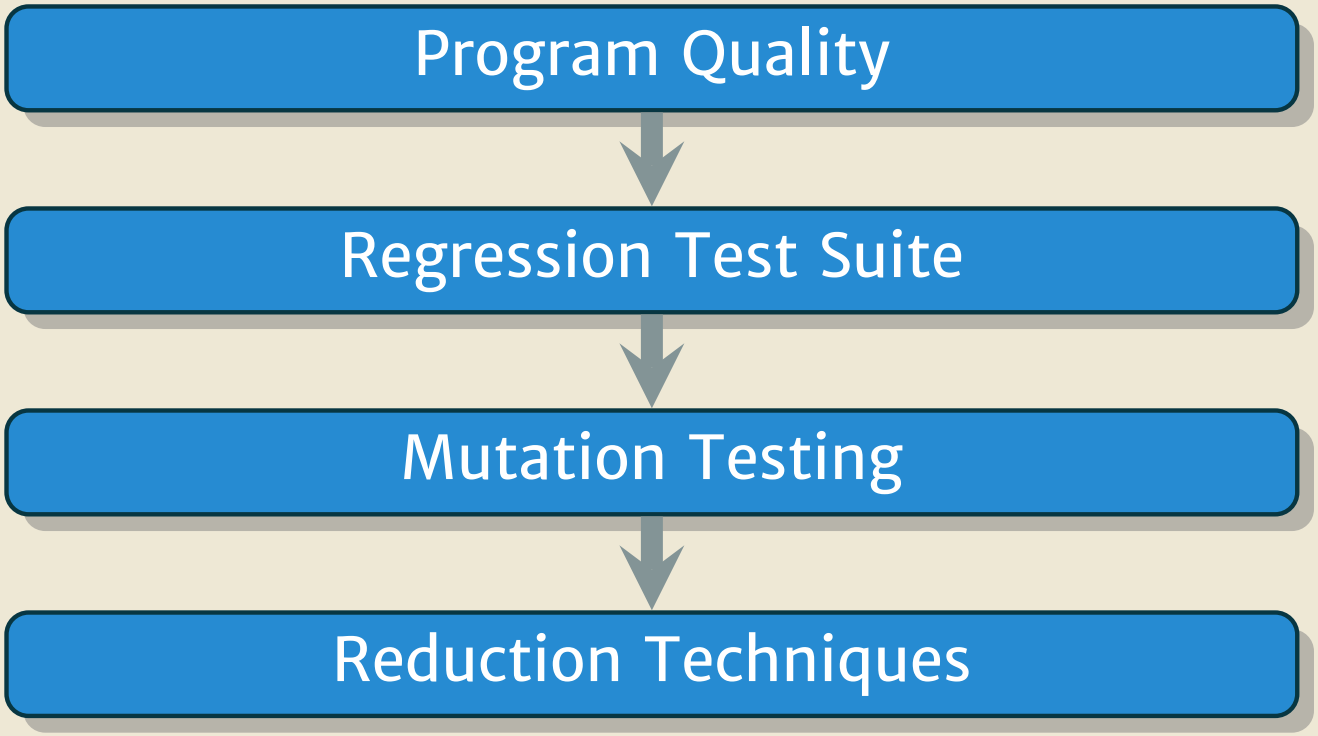
Conclusion



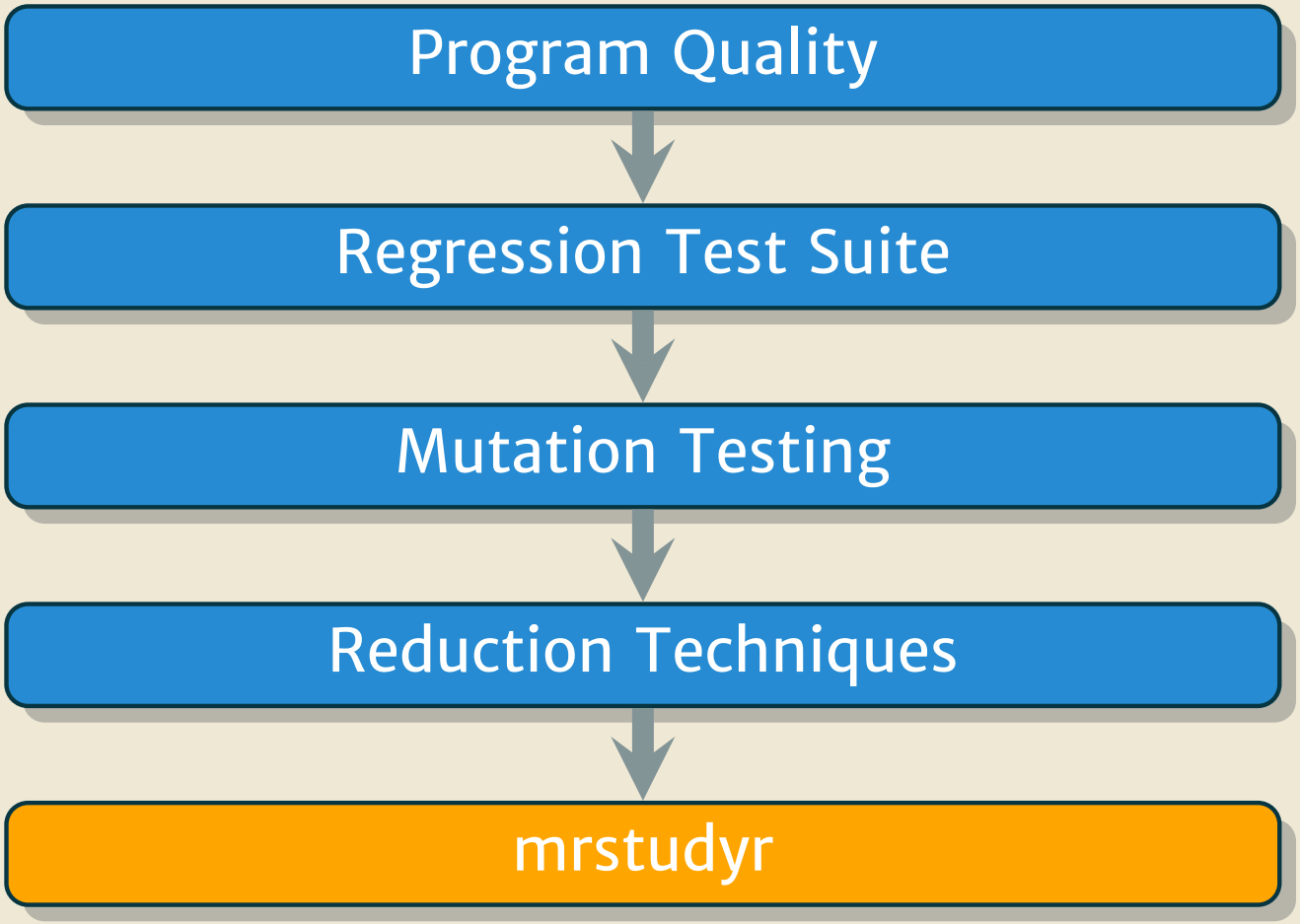
Conclusion



Conclusion


Program Quality
Regression Test Suite
Mutation Testing
Reduction Techniques

Conclusion


Program Quality
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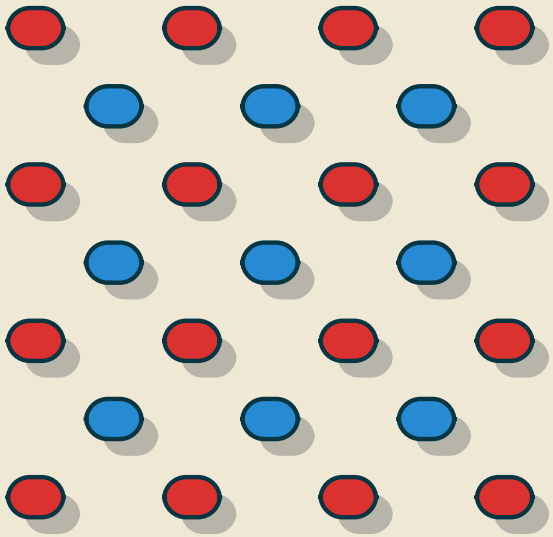
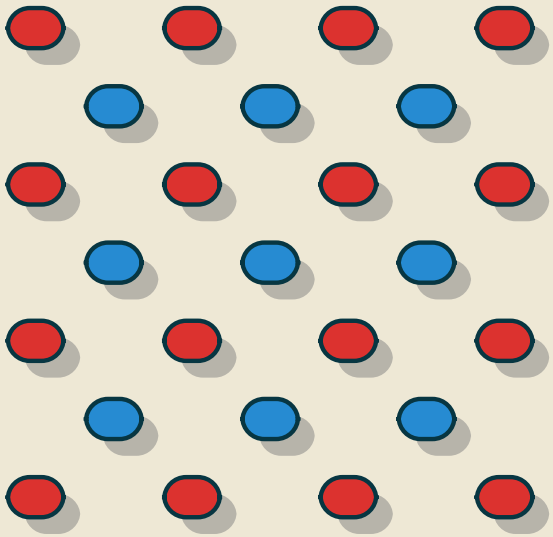


Reduced

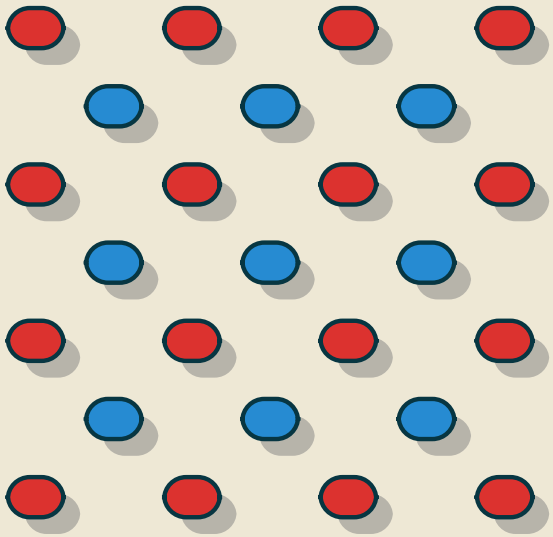
Conclusion



10%

Reduced

Conclusion



10%

Reduced