

mrstudyr

Retrospective Mutant Reduction

Colton J. McCurdy

 [McCurdyColton](#)

ICSME 2016

October 6, 2016

Motivation

Quality
software?

Motivation

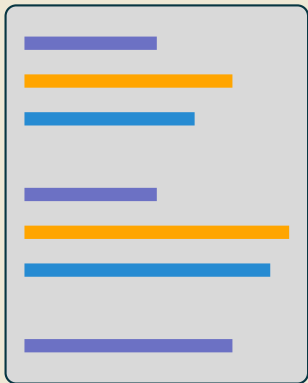
Regression Test Suite

Motivation

Regression Test Suite

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

Motivation



Pass

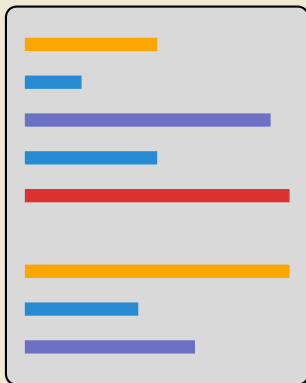


Fail

Motivation



✓ Pass

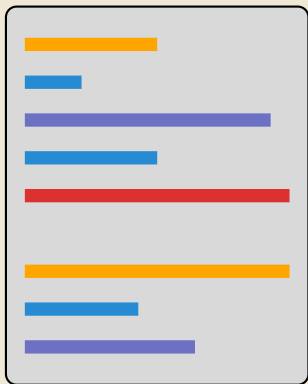


Fail

Motivation



✓ Pass



✗ Fail

Motivation

Use testing
to assess
quality?

Motivation

Trivial test
suite?

Background

Mutation Testing!

Mutation Testing



Original

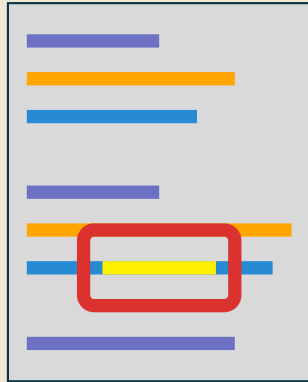


Mutant

Mutation Testing



Original



Mutant

Mutation Testing

$a > b$

Mutation Testing

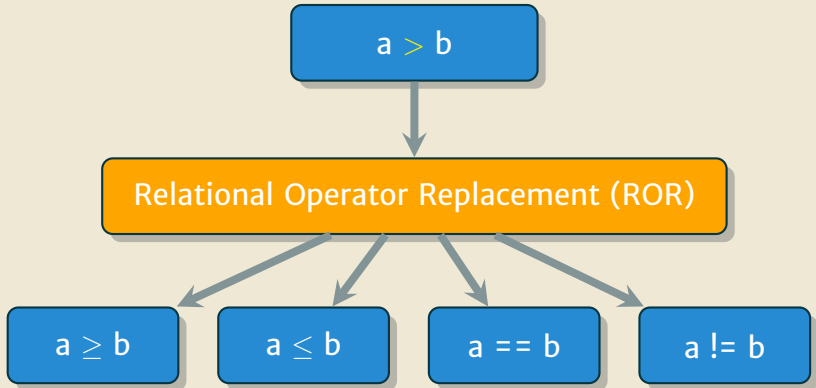
$a > b$



```
graph TD; A[a > b] --> B[Relational Operator Replacement (ROR)]
```

Relational Operator Replacement (ROR)

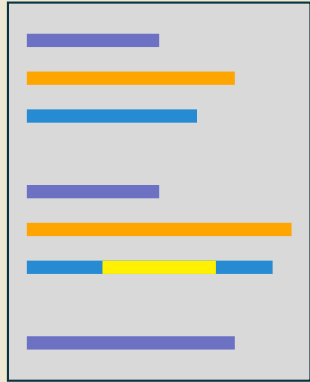
Mutation Testing



Mutation Testing



Alive

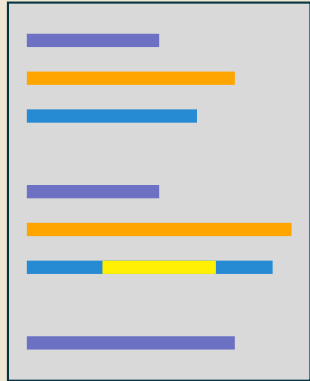


Killed

Mutation Testing

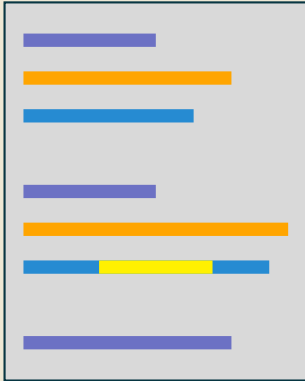


✓ Alive

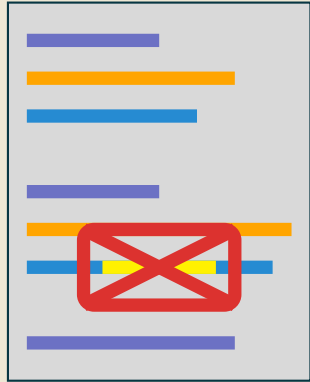


Killed

Mutation Testing



✓ Alive



✗ Killed

Mutation Testing

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

Mutation Testing

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Mutation Testing

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$$MS_T \in [0, 1]$$

Mutation Testing

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

$MS_T \in [0, 1]$

HIB

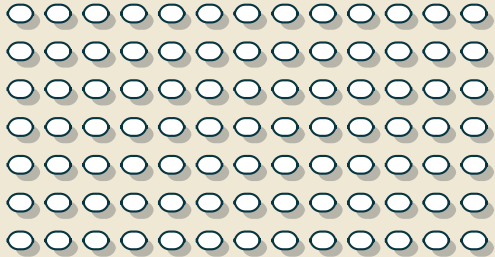
Mutation Testing

Silver
Bullet?

Mutation Testing

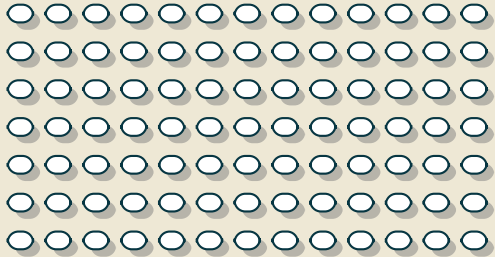
Limitations

Mutation Testing



Mutation Testing

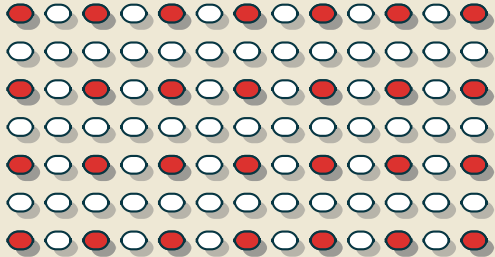
$$T = \langle t_1, t_2, \dots, t_n \rangle$$



Mutation Testing

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

Weak

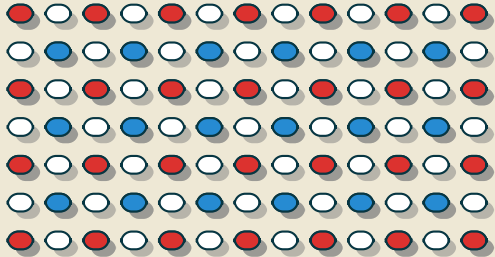


Mutation Testing

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

Weak

Strong



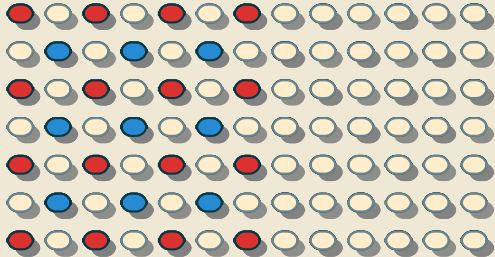
Mutation Testing

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

Weak

Strong

Redundant



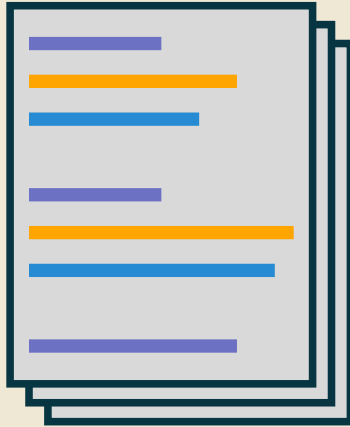
Mutation Testing

Still ...

Mutation Testing

Still ...
limitations

Mutation Testing



Mutation Testing



Understand system intricacies

Mutation Testing



Understand system intricacies

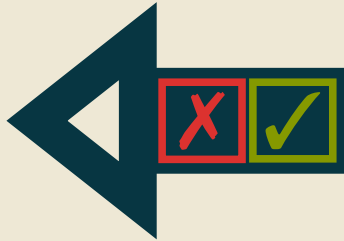
Mutation Testing

Retrospective
Mutant
Reduction

Mutation Testing

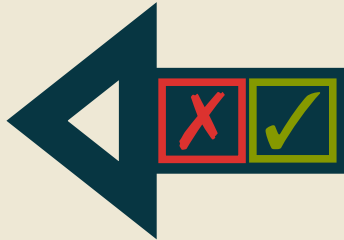
Retrospective
Mutant
Reduction

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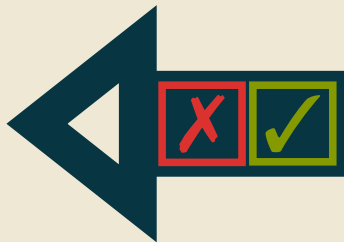
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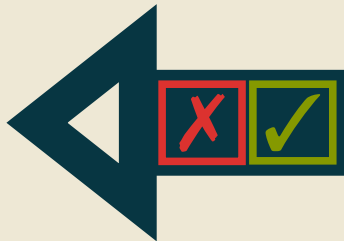
 mccurdyc/mrstudyr



Data

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 mccurdyc/mrstudyr



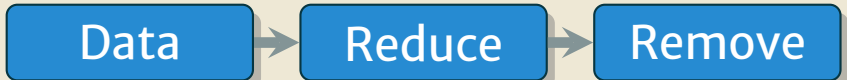
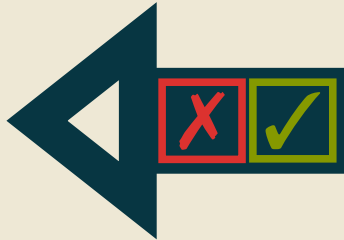
Data



Reduce

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 mcurdyc/mrstudyr



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

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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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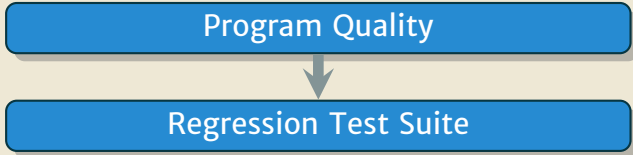
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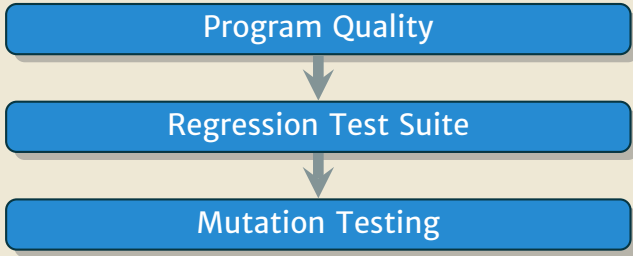
Conclusion

Program Quality

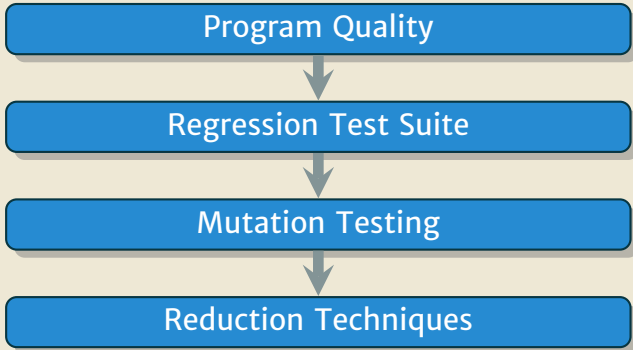
Conclusion



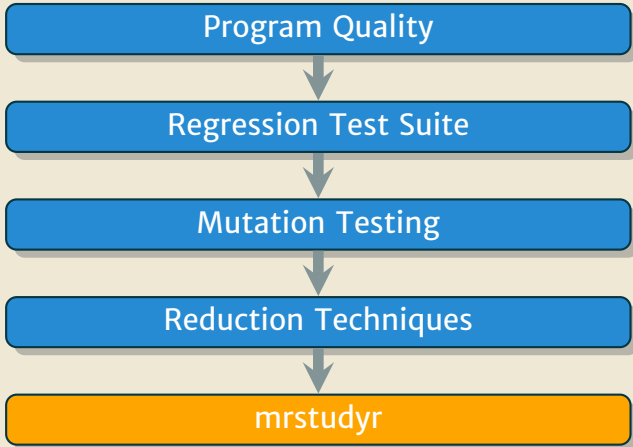
Conclusion



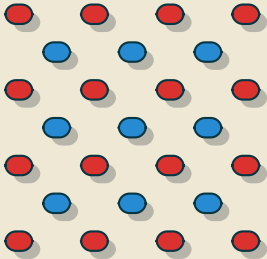
Conclusion



Conclusion

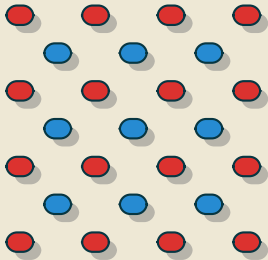


Conclusion



Reduced

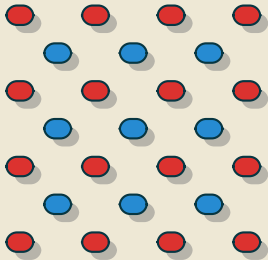
Conclusion



100%

Reduced

Conclusion



100%

Reduced

