CMPT 473
Software Quality Assurance

Making Unit Tests More Powerful

Nick Sumner

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What is a test?

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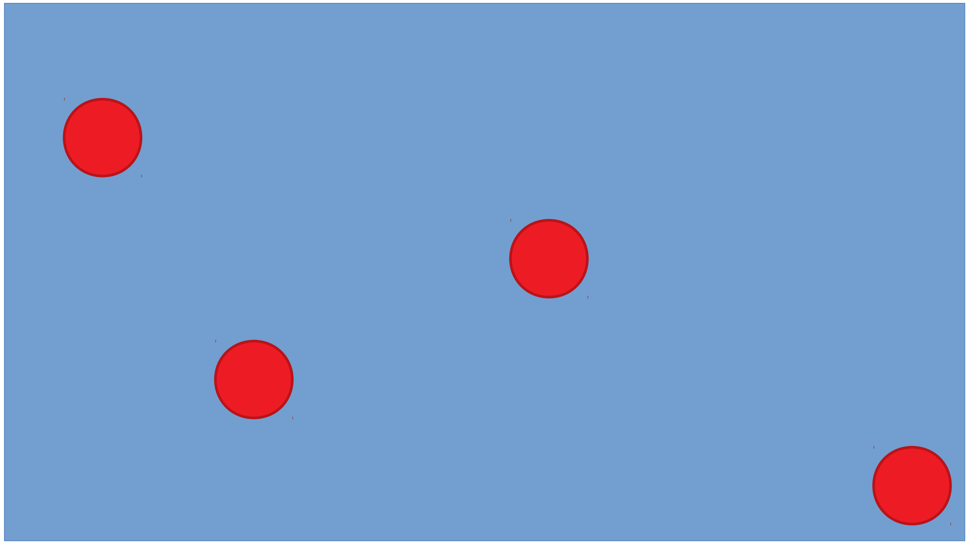

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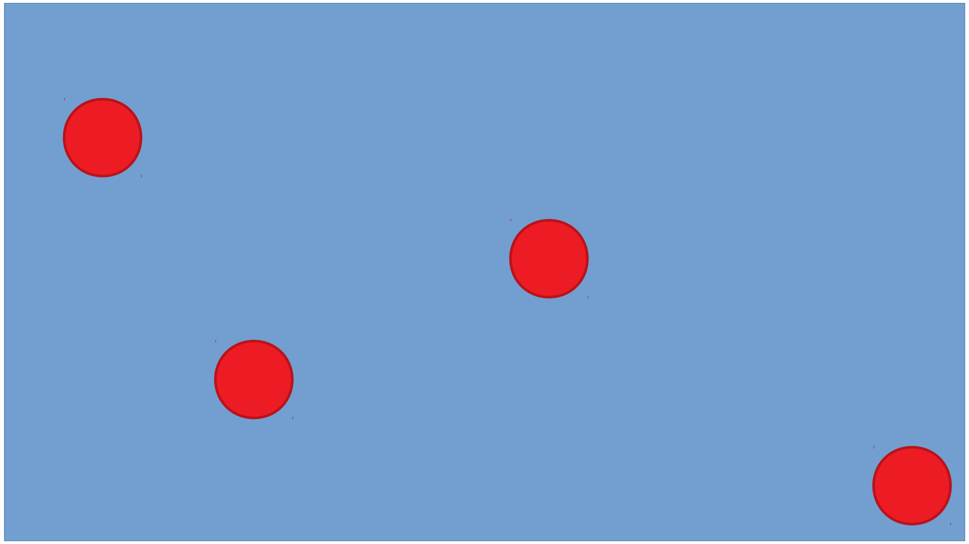
Did we have ways of getting more information from each test?



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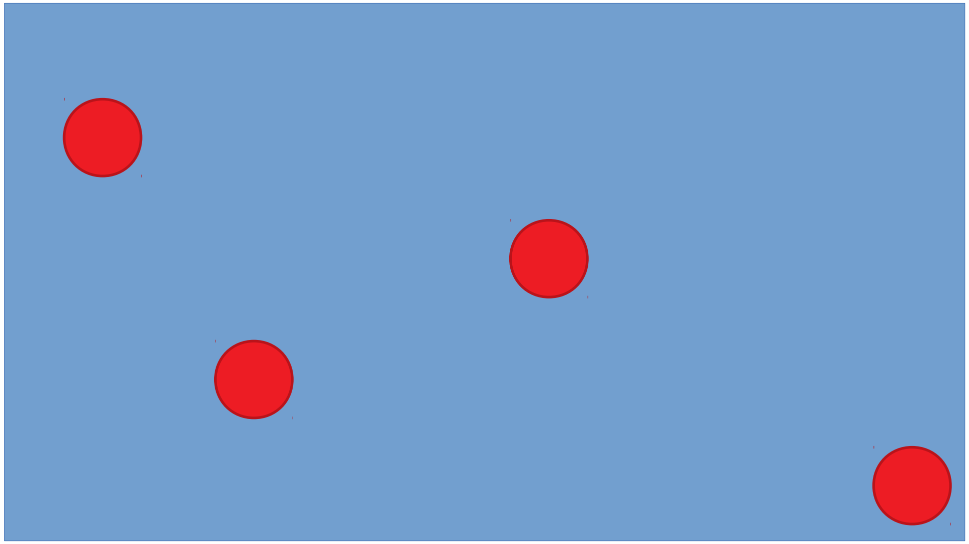

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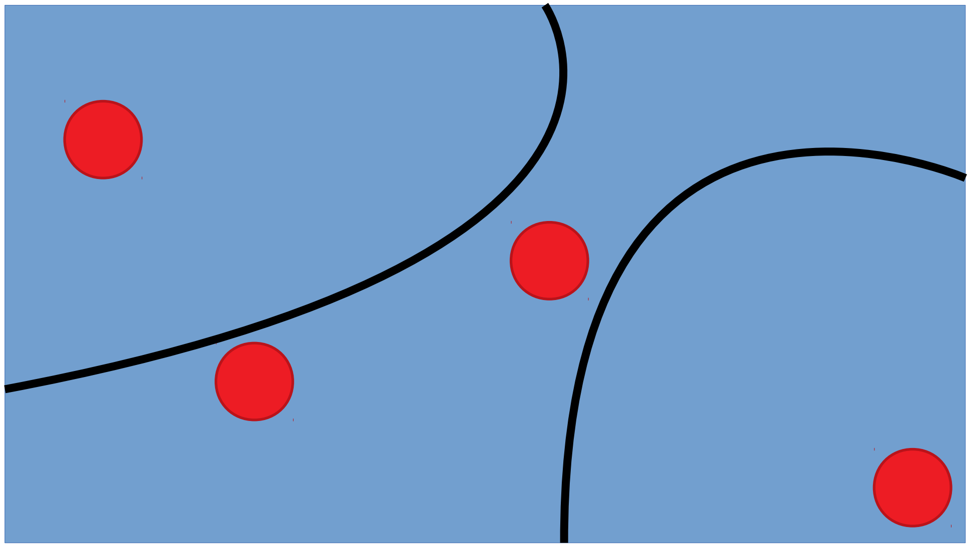

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Do these completely solve the problem?

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  - Property based testing

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How can we generate tests?

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- 2 approaches we have already seen can be used

  1) Random testing
  2) Symbolic execution

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What is x and how does it fit into testing?

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  - Substantial effort to create generator infrastructure initially

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What else might we check here?

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Random testing often gives these in practice.
Is that a guarantee?

In Practice: Hypothesis

- Hypothesis (https://hypothesis.works/)
  - Python, Java, (speculative C, C++)
  - Random testing approach (maybe SymEx in future)
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from hypothesis import given
from hypothesis.strategies import text

@given(text())
@example('')
def test_decode_inverts_encode(s):
    assert decode(encode(s)) == s
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```
@composite
def distinct_strings_with_common_characters(draw):
    x = draw(text(), min_size=1)
    y = draw(text(alphabet=x))
    assume(x != y)
    return (x, y)
```

- A rich set of primitives is available for more complex generator needs

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  - C and C++ focused
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```
TEST(PrimePolynomial, OnlyGeneratesPrimes_NoStreaming) {
  symbolic_unsigned x, y, z;
  DeepState_Assume(x > 0);
  unsigned poly = (x * x) + x + 41;
  DeepState_Assume(y > 1);
  DeepState_Assume(z > 1);
  DeepState_Assume(y < poly);
  DeepState_Assume(z < poly);
  DeepState_Assert(poly != (y * z));
  DeepState_Assert(IsPrime(Pump(poly)));
}
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- Still tries to cover the behaviors of the implementation as well
- Availability improves every year