Test and verification approaches in conformance checking

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Overview

1. Why testing
2. Conformance
3. Test and verification approaches
   - Monkey testing
   - Model based testing
   - Model checking
4. Conclusion

Why software testing and verifying is important

National Institute of Standards and Technology (2002)

Software errors cost the U.S. economy $59.5 billion US dollars annually [2]

Cambridge University (2013)

Software errors cost the whole economy $312 billion US dollars annually [3]

Why software testing and verifying is important

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$\rightarrow$ Conformance is hard to express

How to check conformance

Expressing conformance $\rightarrow$ checking conformance

Test vs. verification

Test

You *may* find an error after the execution of a test.

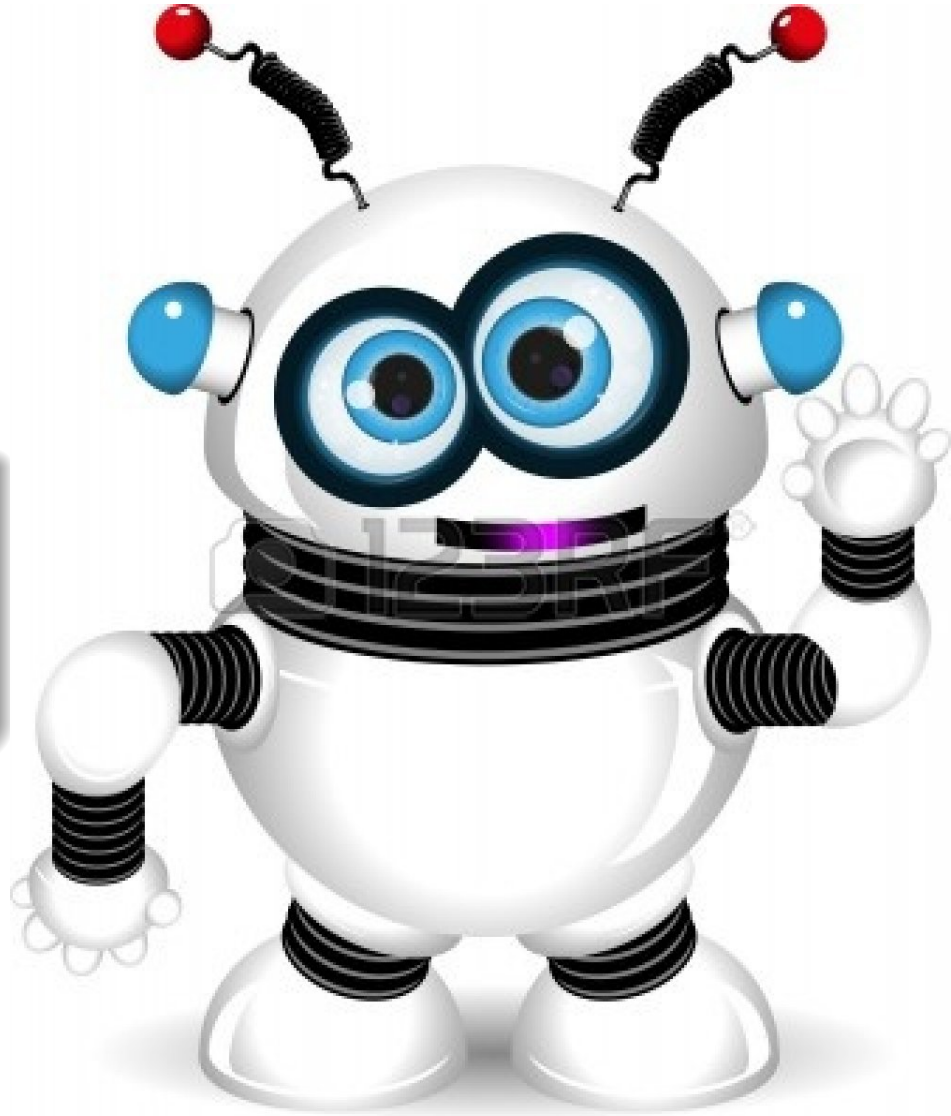
Verification

The evaluation of whether or not something complies with a specified conformance property

Testing a robot

Test "Don't kill me"

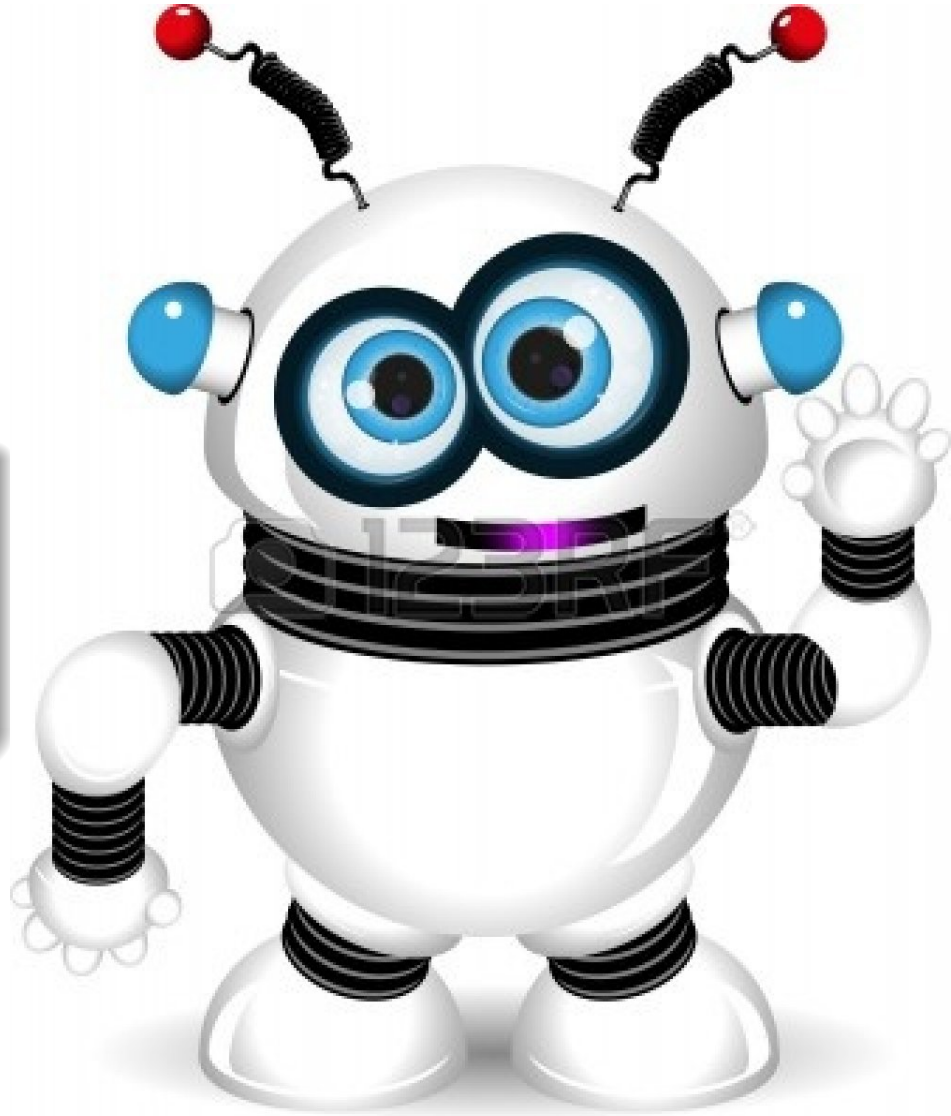
- If the robot kills you, you can be sure that the property is not fulfilled.



Verifying a robot

Test "Don't kill me"

- After verifying that a robot won't kill you, he won't kill you ;)



Monkey testing

Infinite monkey theorem

The **infinite monkey theorem** states that a monkey hitting keys at random on a typewriter keyboard for an infinite amount of time will almost surely type a given text, such as the complete works of William Shakespeare.[1]

Model based testing

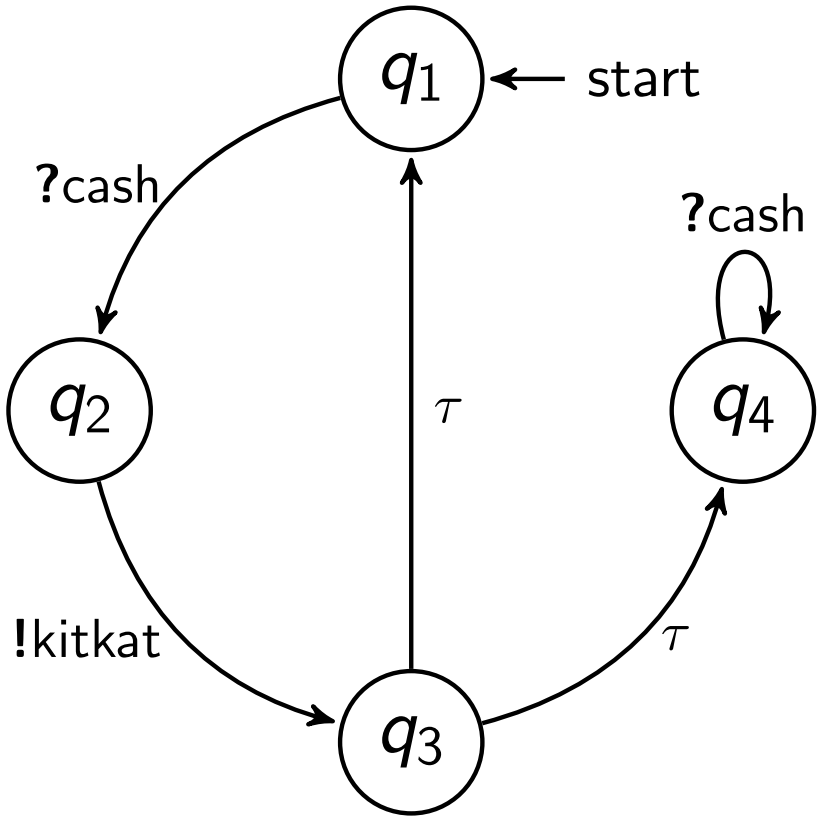
Idea

1. Create Specification
2. Derive test cases
3. Test against software
4. If all tests succeed: Unit under test conforms

Pros and cons

+ Minimizes human error
+ Test cases are derived automatically
- Evolving topic
- Complicated

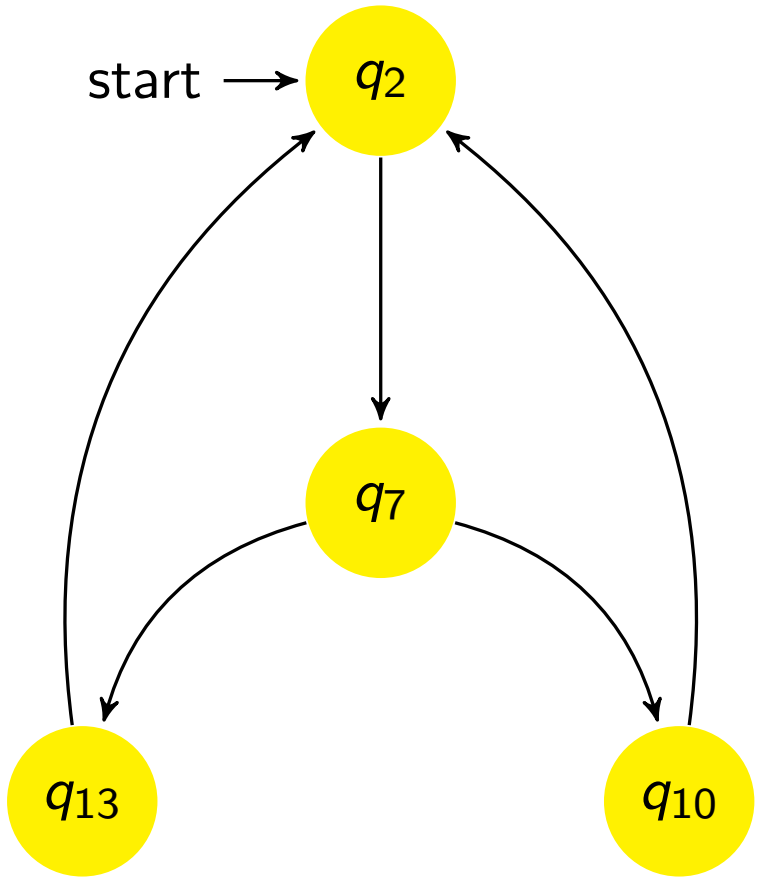
Figure: Candy machine specification



Model checking

```
1  main = do
2    putStrLn $
3          "What is the the"
4      ++ "answer to life"
5      ++ "the universe"
6      ++ "and everything?"
7    answer <- getLine
8    case answer of
9      "42" ->
10       putStrLn
11           "You're right"
12     _  ->
13       putStrLn
14           "Nope"
15   main
```

Figure: Simple transition system



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Number of atoms in the entire observable universe		$\approx 10^{80}$

Which approaches do software developer use to test software

References

Infinite monkey effect.

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Software errors cost u.s. economy $59.5 billion annually, June 2002.
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Cambridge University.
Cambridge university study states software bugs cost economy $312 billion per year, 2013.
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That's it: Questions?