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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→ Conformance is hard to express

How to check conformance

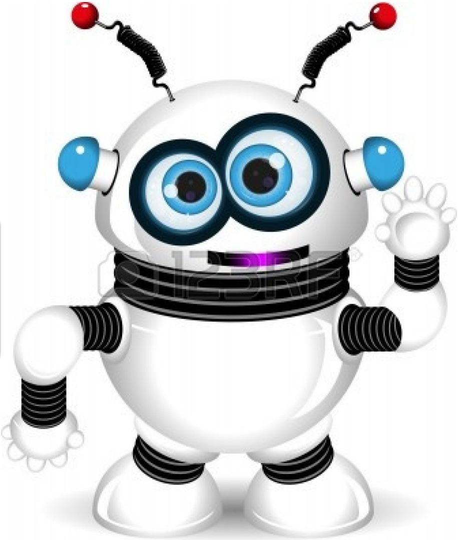
Expressing conformance → checking conformance

Test vs. verification

Testing a robot

Test “Don’t kill me”

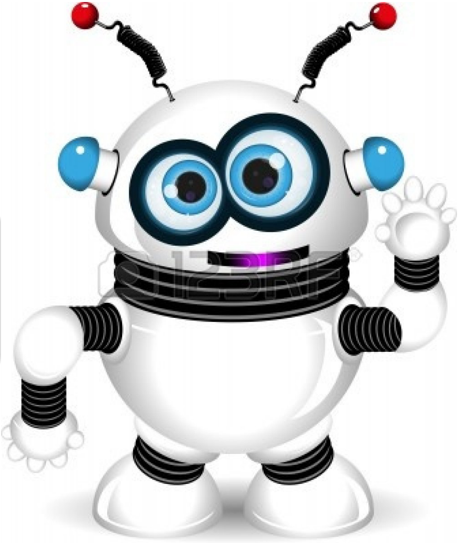
- If the robot kills you, you can be sure that the property is not fulfilled.



Verifying a robot

Verify "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

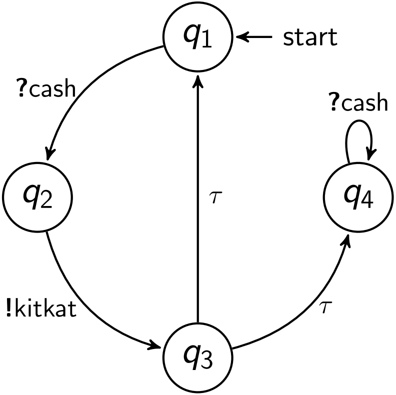
Idea

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

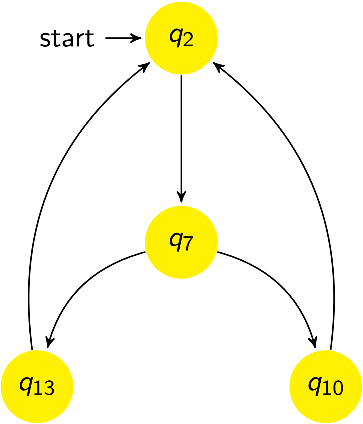
Figure: Candy machine specification



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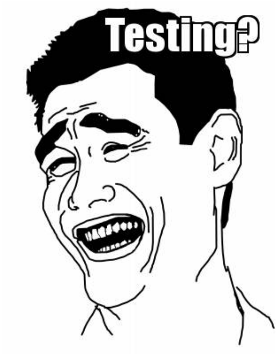
Number of atoms in the entire observable universe		$\approx 10^{80}$

Which approaches do software companies use to test software



References

- Infinite monkey effect.

- Department ofg Commerce's National Institute of Standards and Technology (NIST).
  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.
  URL: http://markets.financialcontent.com/stocks/news/read/23147130/Cambridge_University_Study_States_Software_Bugs_Cost_Economy_$312_Billion_Per_Year.

That's it: Questions?