# Terms: Test (Case) vs. Test Suite

- **Test (case)**: one execution of the program, that may expose a bug

- **Test suite**: a *set* of executions of a program, grouped together
  - A test suite is made of test cases

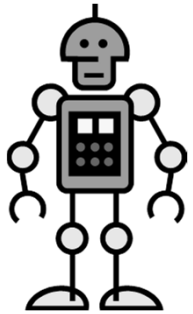
suite::tests flock:sheep

# Kinds of Testing

- **Manual testing:**
  - A human being sits at a program and enters inputs into a program to test it
  - Often employees non CS people
  - Beta testing, user testing obviously

  - Sometimes means a human writes out tests that run automatically, but usually means a person *does the testing*

# Kinds of Testing



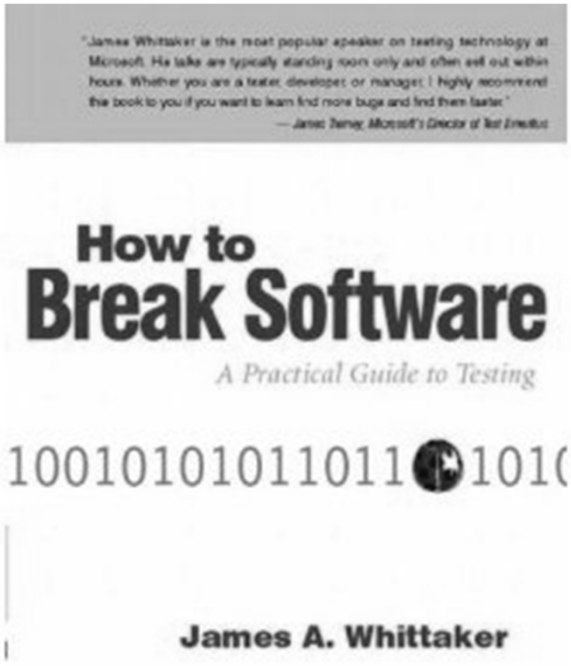
- **Automated testing:**
  - One meaning is that humans design tests, but use scripts or other methods to have the computer execute the tests without help
  - Another meaning is that humans write programs that produce tests
  - Essential for speed, automatic checks when a program is compiled, etc.

# Kinds of Testing

- **Which is better**?
  - Some academics will say that manual testing is ineffective and slow, often poorly thought out
  - Some folks in industry will say that automated testing is often a waste of time/money and humans find more bugs more cheaply
  - Both are right, both are wrong
  - Neither kind of testing is superior, and a good test engineer knows when to use each

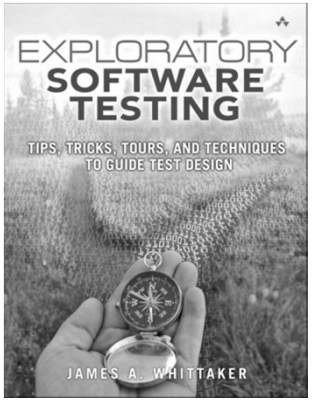
# Kinds of Testing

- **For more information on good manual testing:**
  - Books by James Whittaker
    - Originally academic, then at MS, then google, then back to MS
  - Whittaker's ideas bring us to next distinction, two kinds of manual testing



# Kinds of Testing

- **Scripted testing vs. exploratory testing**
  - In scripted manual testing, a tester follows a fixed script: "first open this file using this dialog, then click here, then resize the font…"
  - In exploratory testing, the tester may have some general guidelines "try all the choices in the File dialog" or an area to focus on but is free to explore
  - Whittaker's book covers the value of guided exploratory manual testing



# Unit, Integration, System Testing

- Stages of testing
  - **Unit testing** is the first phase, done by developers of modules
  - **Integration testing** combines unit tested modules and tests how they interact
  - **System testing** tests a whole program to make sure it meets requirements

  - **“Design testing”** is testing prototypes or very abstract models *before implementation*

# Terms: Black Box Testing

- **Black box testing**
  - Treats a program or system as opaque
  - That is, testing that does *not* look at source code or internal structure of the system
  - Send a program a stream of inputs, observe the outputs, decide if the system passed or failed the test
  - Abstracts away the internals – a useful perspective for integration and system testing
  - Sometimes you don't have access to source code, and can make little use of object code
    - True black box? Access only over a network

# Terms: White Box Testing

- **White box testing**
  - Opens up the box!
    - (also known as glass box, clear box, or structural testing)
  - Use source code (or other structure beyond the input/output spec.) to design test cases
  - Brings us to the idea of *coverage*

# Regression Testing

- **Regression testing**
  - Changes can break code, reintroduce old bugs
    - Things that used to work may stop working (e.g., because of another “fix”) – software **regresses**
  - Usually a set of cases that have failed (& then succeeded) in the past
  - Finding small regressions is an ongoing research area – analyze dependencies

**“. . . as a consequence of the introduction of new bugs, program maintenance requires far more system testing. . . . Theoretically, after each fix one must run the entire batch of test cases previously run against the system, to ensure that it has not been damaged in an obscure way. In practice, such *regression testing* must indeed approximate this theoretical idea, and it is very costly."** - Brooks, *The Mythical Man-Month*