

Software Testing - 2

Outline

- Testing process
- Testing automation
- Testing tools

Test Oracles

- A test oracle (预测) is used to determine (确定) an expected (期待的) output for an input
- The oracle can be derived (推导) from software specifications

Test Process

- Prepare test cases
- Write test plan
- Set the testing environment
- Select testing tools

Plan test

- Use test cases as input
- Compare the actual results with expected results

Test execution

- Report the bugs found in the testing (the test cases that make the system to fail)

Report test results

Test plan

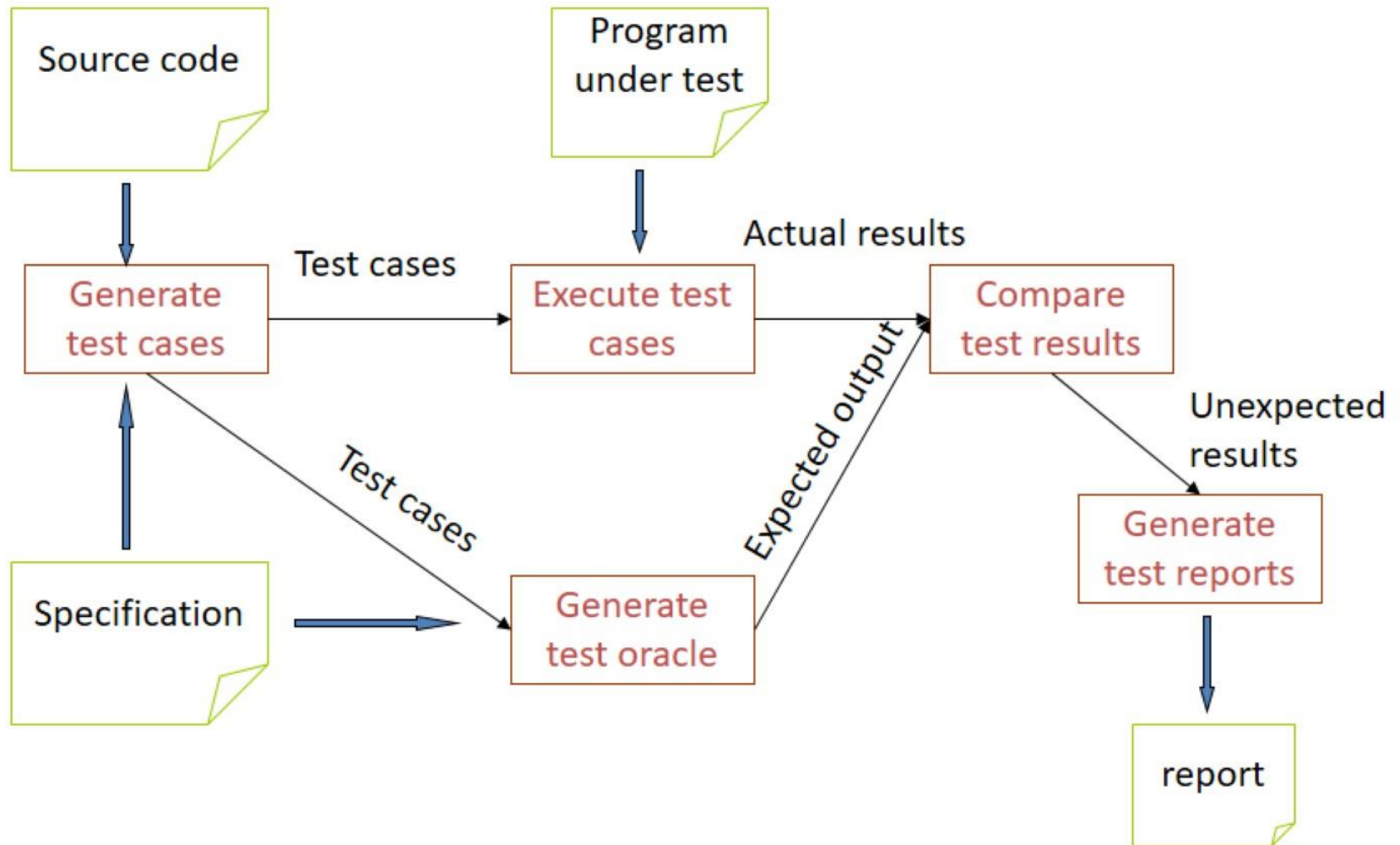
1. Prepared by:
2. Module to test:
3. Test strategies:
4. Test tools:
5. Test cases and expected output from oracle:

4/19/2023

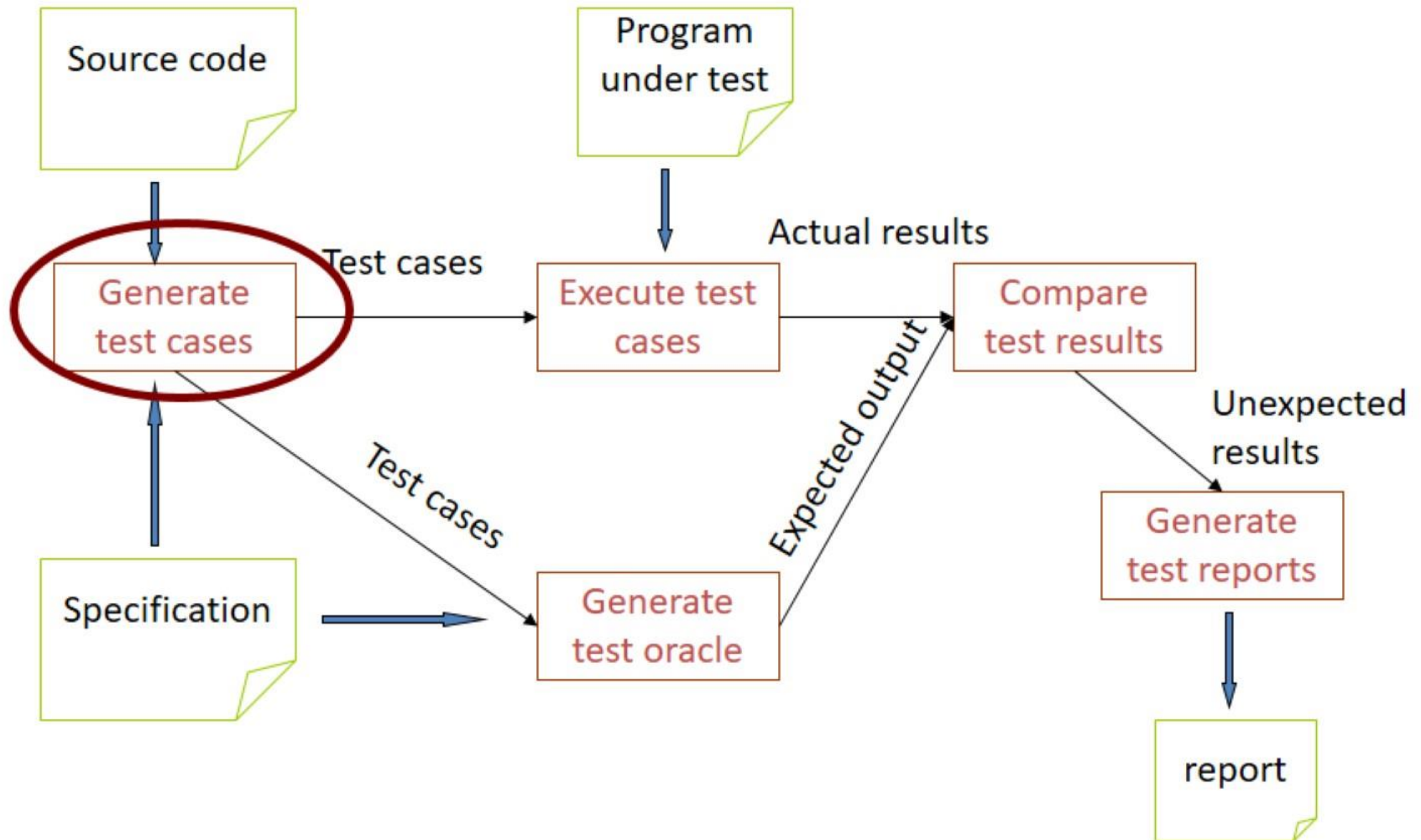
Test report

1. Tester:
2. Test plan:
3. Module under test:
4. Test cases that cause unexpected results:

Test Automation



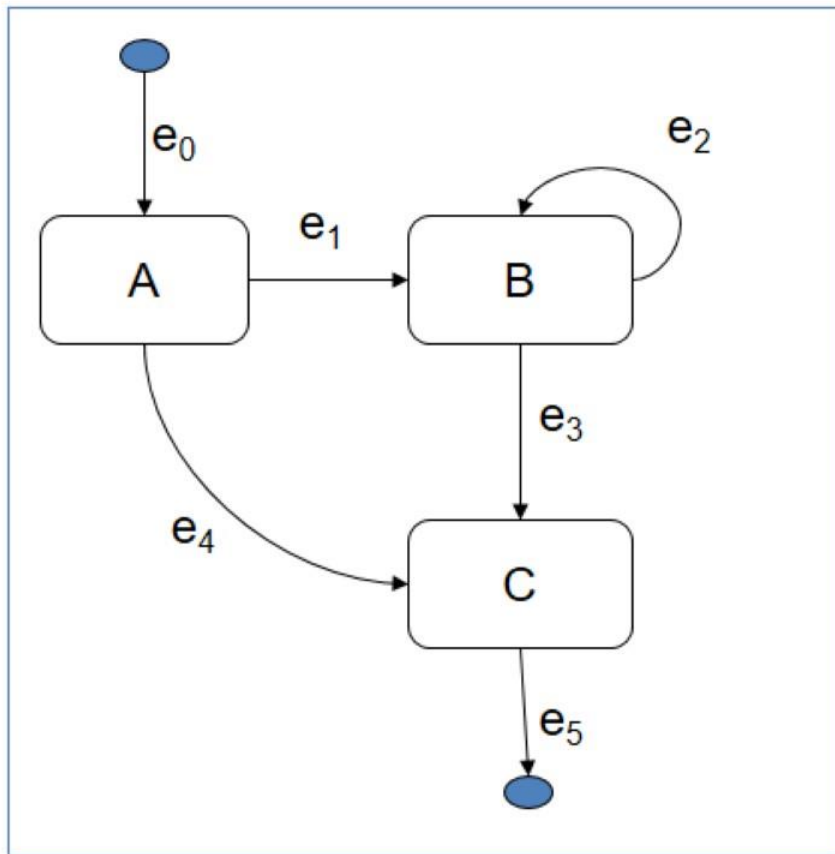
Test Case Generation



Test Case Generation

- Black-Box Testing
 - Generate test cases from specification
 - If the specification is described in natural (自然) language???
 - Specifications should be written in the notation (标识) that can be handled by computers

Test Case Generation



A state transition diagram

$C_1 = \{e_0, e_1, e_2, e_3, e_5\}$

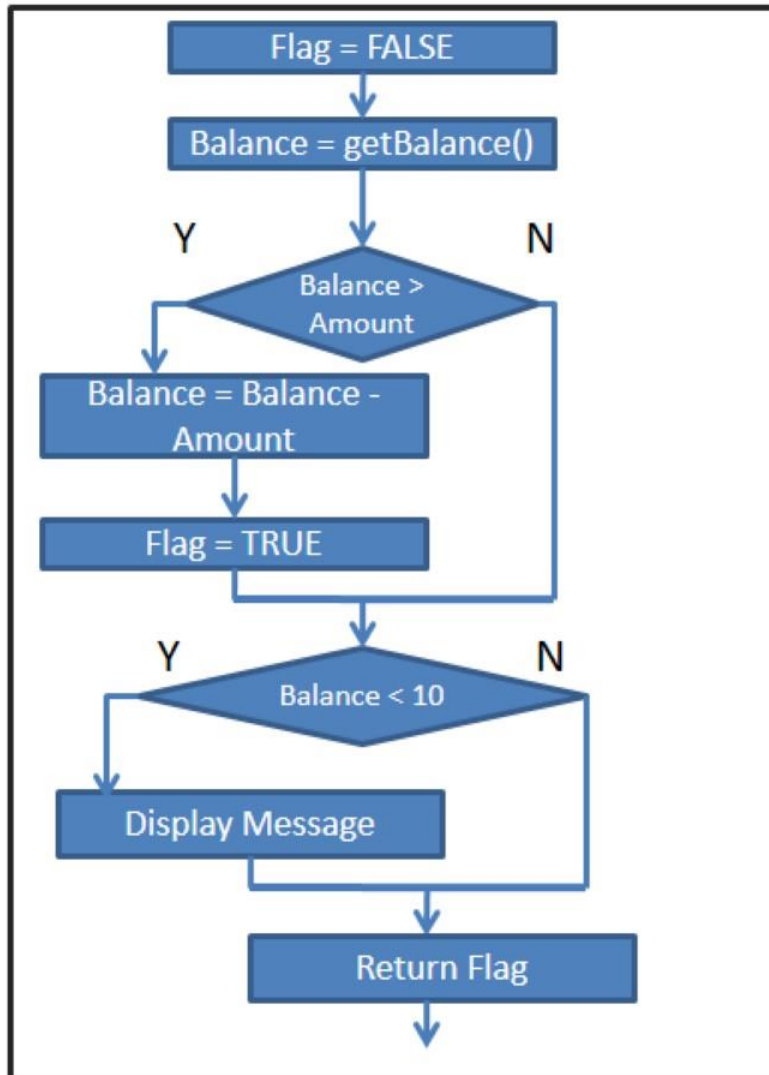
$C_2 = \{e_0, e_1, e_3, e_5\}$

$C_3 = \{e_0, e_4, e_5\}$

Test Case Generation

- White-Box Testing
 - Generate test cases from source code
 - The source code is analyzed
 - The test cases that satisfy certain conditions should be found

Test Case Generation



If we want to use **ONE** test case to satisfy **Statement Testing**, what condition should be satisfied?

`Balance > Amount` && `Balance < 10`

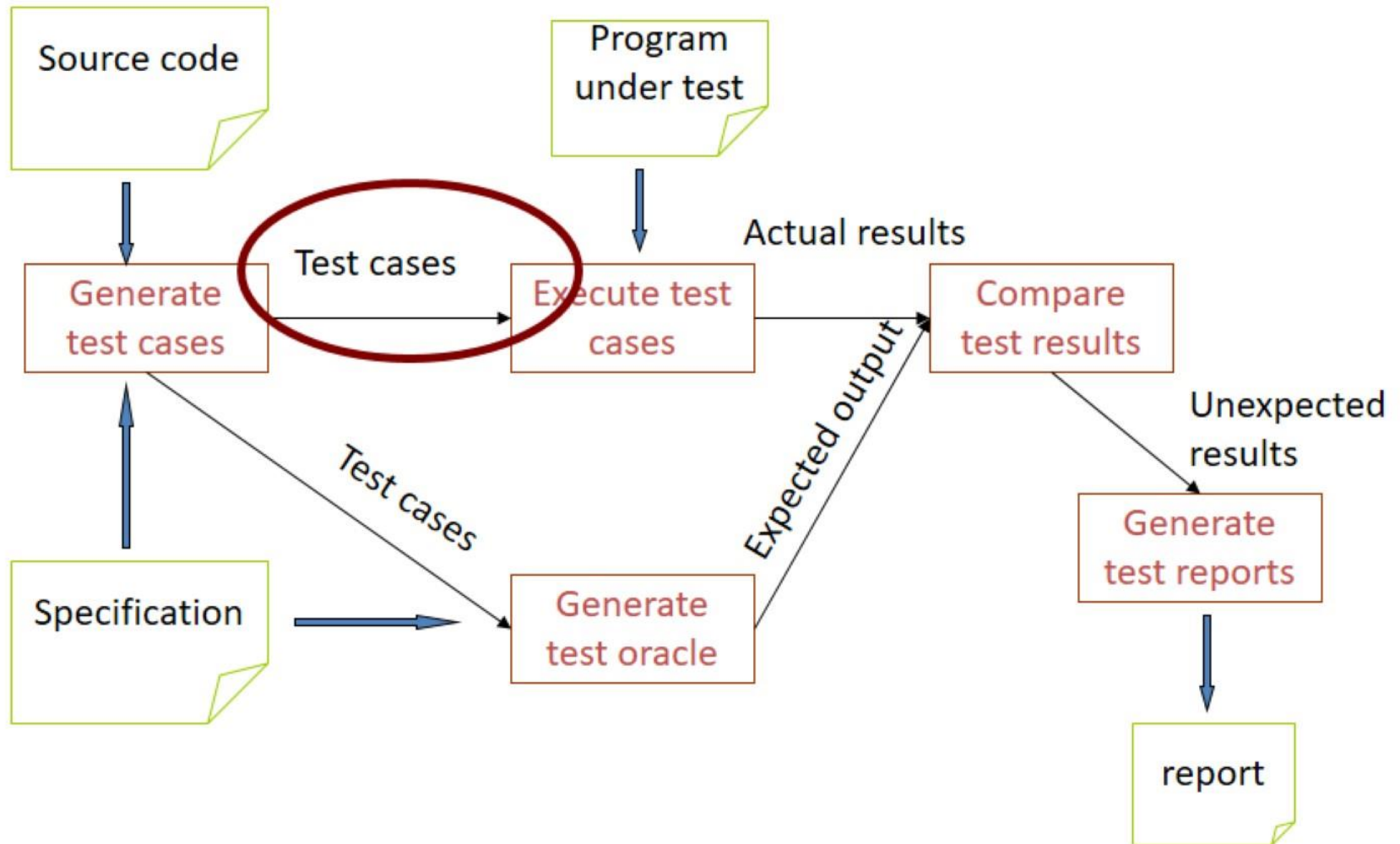
`Balance = Balance - Amount`

What data satisfy this condition?

Test Case Generation

- Automating (使自动化) test case generation (建立) is the most difficult job in automatic software testing
- That is why many testers use Random (随机) Testing Method
- Some tools are available in market to support boundary value testing.

Test Case Management



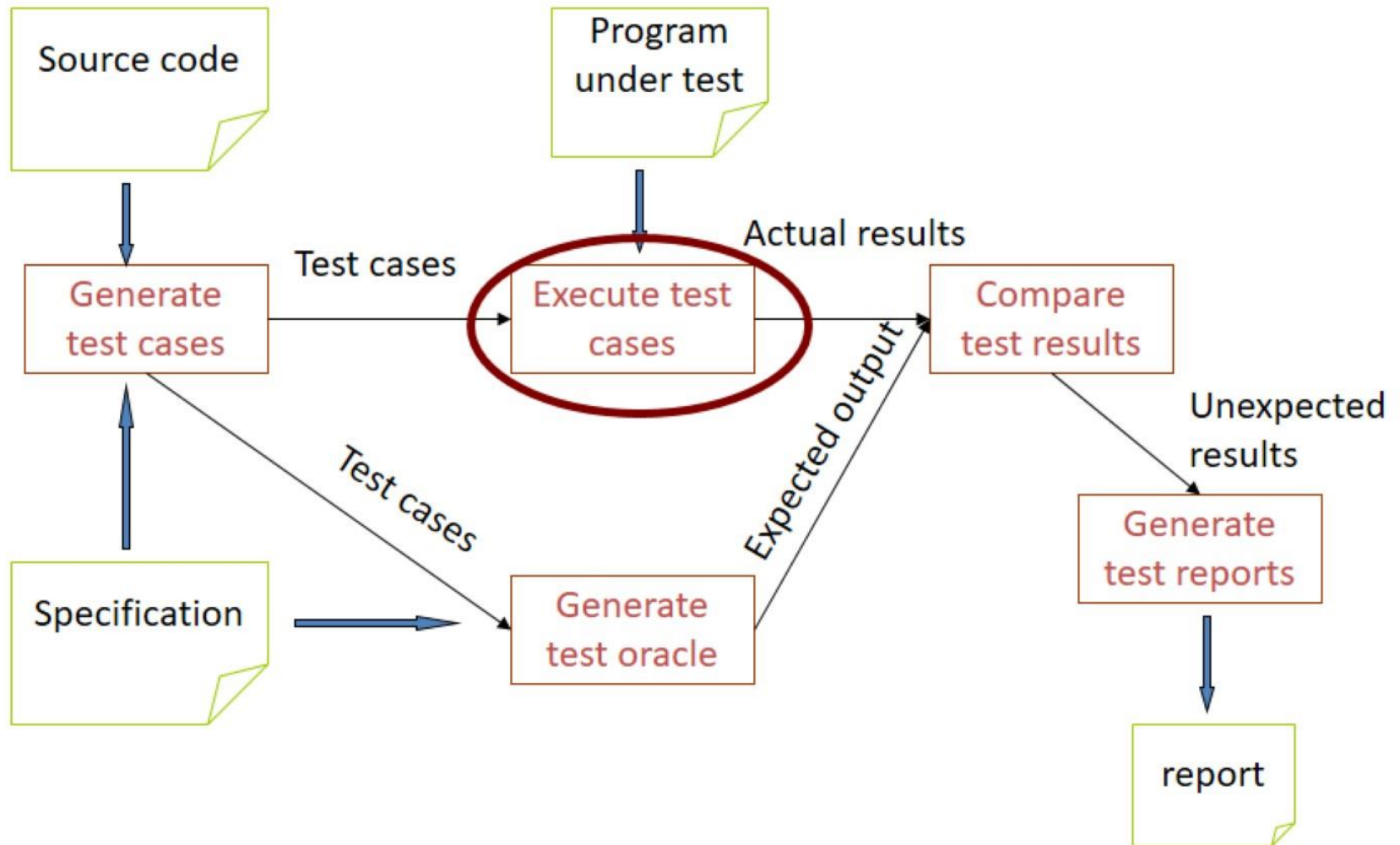
Test Case Management

- There are a huge number of test cases for a complex software system
- The test cases need to be saved so they can be used in regression testing
- Test cases can be retrieved (检索)
 - by name
 - by module
 - by project
- Test case execution can be retrieved as well

Test Case Management

- Each test case can contain the following information
 - Author
 - Module
 - Strategy
 - Execution result
 - Priority （优先级）
 - ...

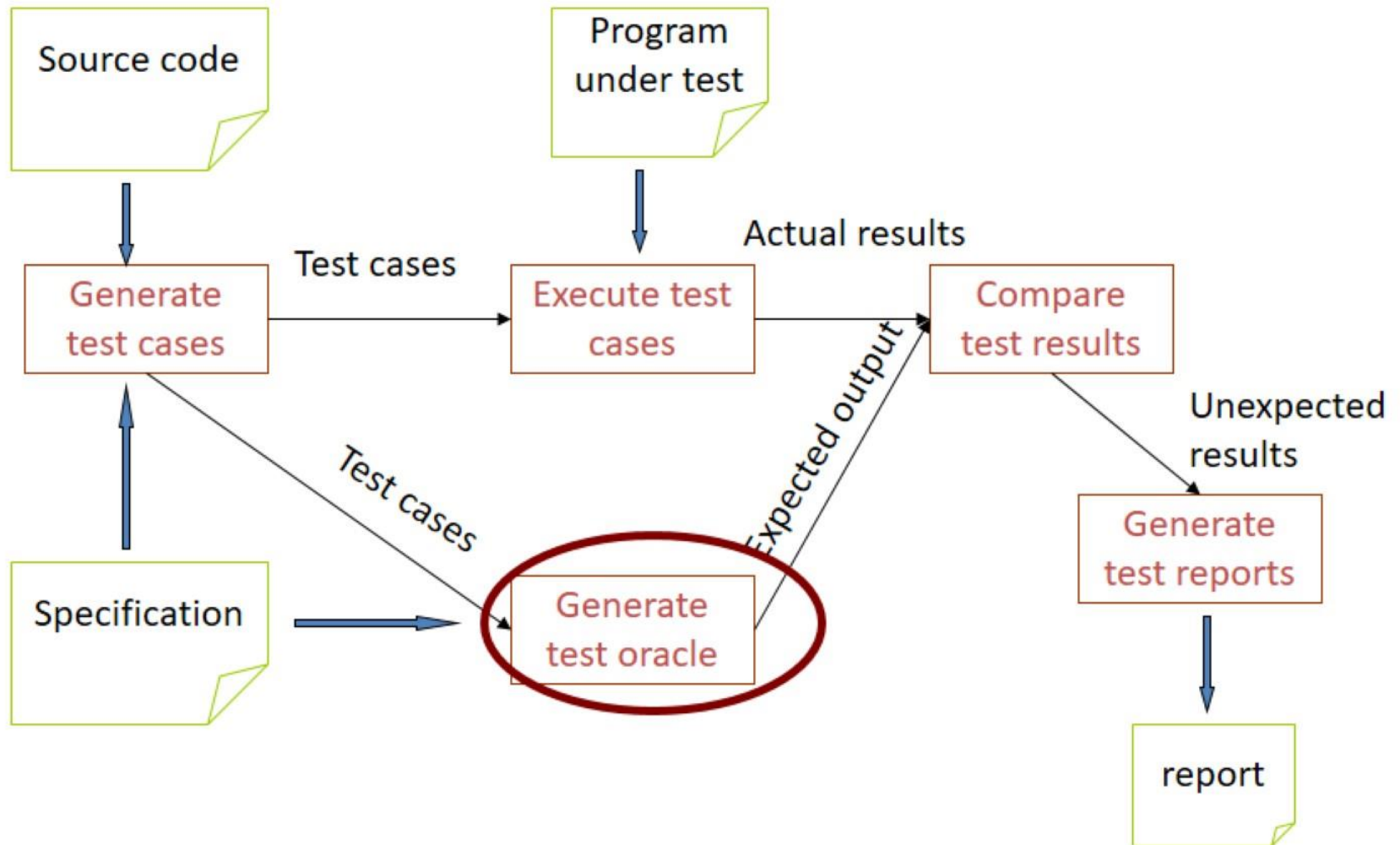
Test Automation



Test Execution

- This is relatively easy part in automating software testing
- A test driver （驱动程序）
 - reads test data (test scripts) from a file or a database
 - runs the program under test
 - writes output into a file for comparison purpose
- “Record – Playback” is the most popularly used technique for regression testing
 - A demo

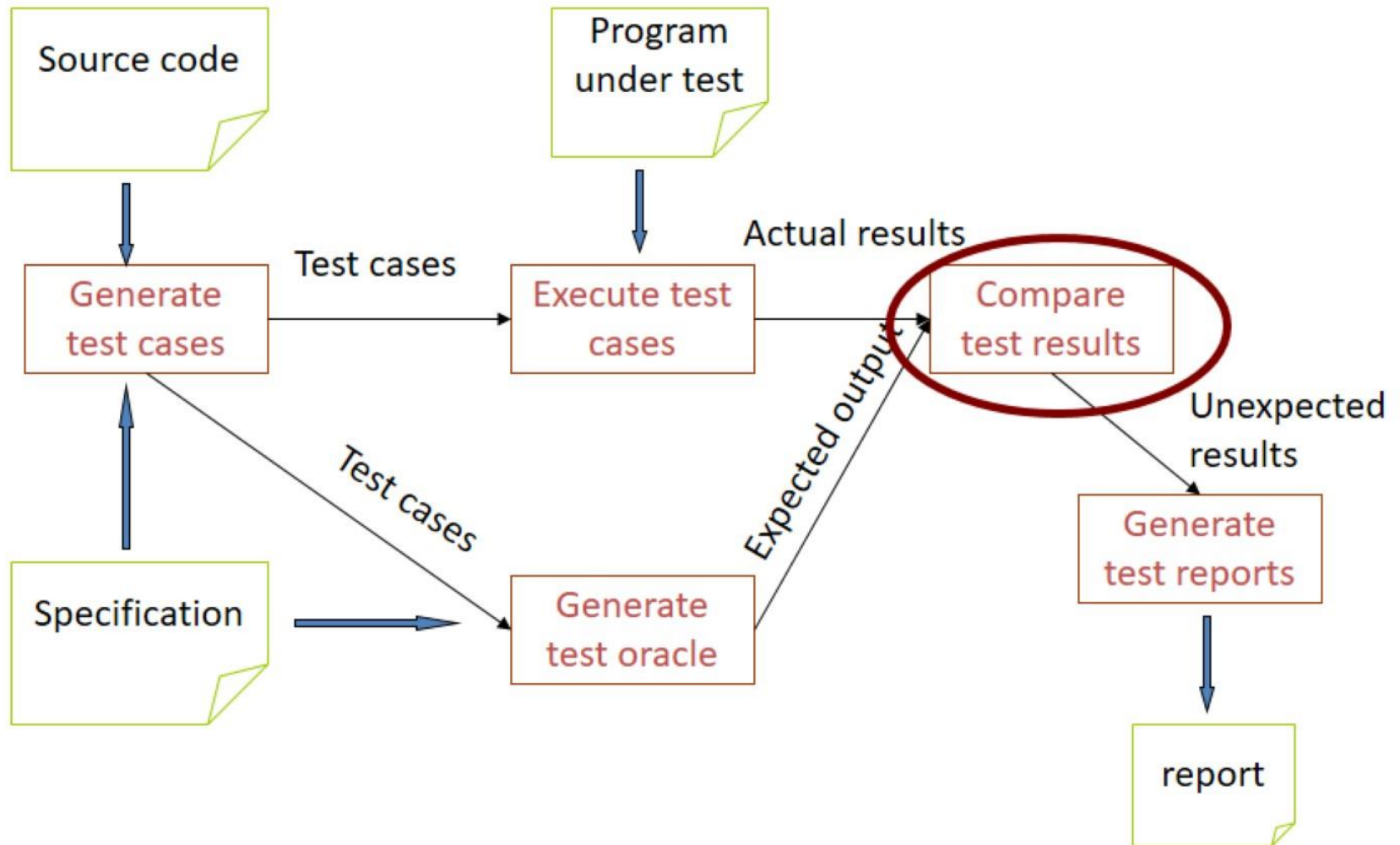
Test Automation



Generate Test Oracles

- Oracles can help determine if an output is expected or not
- Oracles are generated from software specifications
- Only the specification written in defined notation can be used to generate test oracles.

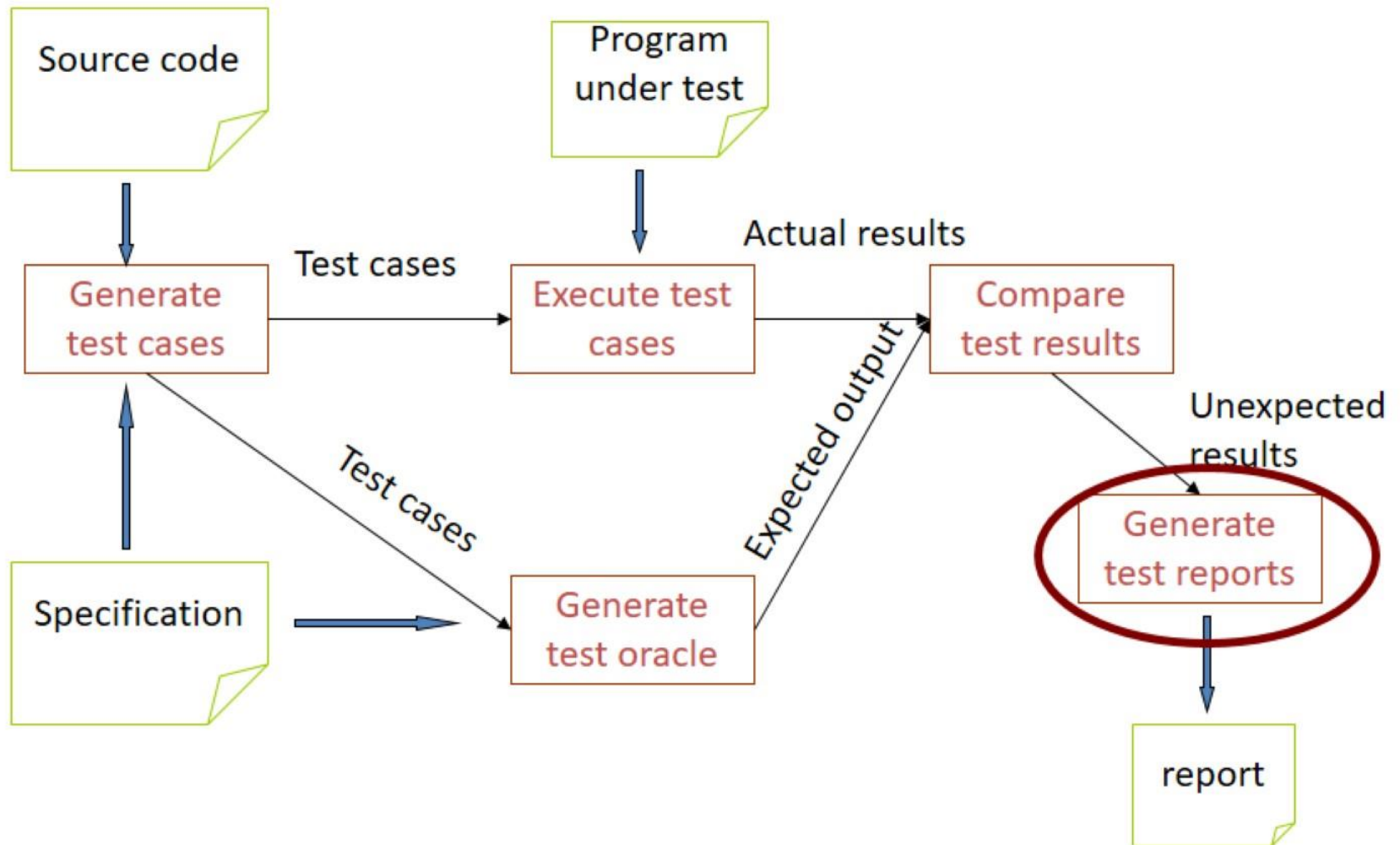
Test Automation



Compare Results

- Depending on if there is an oracle. If there is no oracle, it is hard to determine if the output is expected
- When there is no oracle, some auxiliary information can be used to check the result
 - But this is not 100% guaranteed

Test Automation



Generate Test Reports

- Create reports for the test cases that make the program to fail
- Reports are prepared in designated (指定的) formats
- If the defect tracking system (错误跟踪系统) is linked, the bugs should be automatically recorded in the system.

Test Automation

- Difficulties of test automation
 - Very difficult
 - Test case generation
 - Difficult
 - Test oracle generation
 - Compare result
 - Easy
 - Test execution
 - Test report
 - Tet case management

Testing Tools

- Functional Test Automation
 - TestComplete (Smartbear)

Demo: <https://support.smartbear.com/screencasts/testcomplete/testcomplete-demo/>

Trial version:

https://smartbear.com/product/testcomplete/free-trial/#_ga=2.148019063.1915355781.1555984719-1528855722.1491809882

- Rational Functional Tester (IBM)

Demo:

http://download.boulder.ibm.com/ibmdl/pub/demos/on_demand/Streamed/IBM_Demo_Rational_Functional_Tester8.1-Oct09/RFT8.1_Demo.html#IBM_Recorded_Demonstration

Testing Tools

- Mobile Testing
 - Maveryx (Maveryx) (For Java, Android)
 - UI Test Automation Framework (Ranorex)
- Performance & Load Testing
 - LoadRunner (HP)
 - AQ Time (Smartbear Software)

Testing Tools

- Static Analysis
 - Code Coverage (DMS, LLC)
 - Jtest (Parasoft)
 - C/C++ Test (Parasoft)
- Test Design
 - Rational Manual Tester (IBM)
 - Agile Designer (Grid-Tools)
- Test Management
 - DSTAR (Mosaic)
 - Business Process Testing (HP)

Testing Types

- From Wikipedia
 - Installation testing
 - Compatibility testing
 - Smoke and sanity testing
 - Regression testing
 - Acceptance testing
 - Alpha testing
 - Beta testing
 - Functional vs non-functional testing
 - Continuous testing
 - Destructive testing
 - Performance testing
 - Usability testing
 - Accessibility testing
 - Security testing
 - Internationalization and localization
 - Development testing
 - A/B testing
 - Concurrent testing
 - Conformance testing or type testing

Summary

- Test activities should follow certain process
- Test activities are performed in different levels
- Not all the test activities can be automated easily
- Testing tools can be used to support the testing activities