Test Oracles;
Planning Ahead for Test Automation

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Test Automation
is not just machines running tests!
Test Automation
includes interpreting results!
Test Oracles
Human Oracles

- Norm for manual testing
- Sometimes slower than computers
- Can’t observe system internals
- Loses concentration
- Easily “trained” to overlook errors
- Not Automated
Computer Oracles

- Facilitate manual verification
- Provide expected outcomes
- Machine generate in machine form
- Allow automated comparison of results
Prerequisites for Automation

- Test case organization
- Automated test execution
- Test results capture
- Machine readable expected outcomes
- Automated comparison of results
Modeling the SUT

• Inputs
• Processes
• Outputs
• Memory
• Side effects
I-P-O Testing Model
(Black Box)

Test Inputs → System Under Test → Test Results
Expanded Testing Model (Black Box)
Testing Model With Oracle
Automation Architecture

- SUT
- Monitoring tools
- ‘Interesting’ inputs, outputs, data, state, and environment characteristics
- Test running
- Results capture
- Results comparison, analysis, and reporting
Oracles Modeled in Testing

- Differ based on SUT
- May be more than one oracle for SUT
- Inputs may effect more than one oracle
- Oracle only produces some results
Oracle Characteristics

- Completeness of information from oracle
- Accuracy of information from oracle
- Independence of oracle from SUT
  - Algorithms
  - Sub-programs and libraries
  - System platform
  - Operating environment
Oracle Characteristics
(continued)

- Speed of predictions
- Time of execution of oracle
- Usability of results
- Correspondence (currency) of oracle through changes in the SUT
Running An Oracle

• Type of results
• Time of running
• Method of verification
  – Manual
  – Automated
    • With test case
    • With automated test environment
Oracle Limitations

• Oracle may become as complex as SUT
• More complex oracles make more errors
• Close correspondence reduces maintainability
• Close correspondence makes common mode faults likely
Conclusions

• Different types of oracles possible
• Some kind of oracle needed to automate tests
• Oracle is not constrained like SUT
• Solutions differ with SUT
• Oracles are critical part of automation