Test Oracles

- Discussion
  - Automation of oracle necessary
  - Expected behavior given
  - Necessary parts of an oracle
  - Name spaces

Webster Dictionary - Oracle
- a person giving wise or authoritative decisions or opinions
- an authoritative or wise expression or answer

Purpose of Test Oracle

- Sequential Systems
  - Check functionality
- Reactive (event-driven) Systems
  - Check functionality
  - Timing
  - Safety

Test Oracle

- A test oracle determines whether a system behaves correctly for test execution

- Webster Dictionary - Oracle
  - a person giving wise or authoritative decisions or opinions
  - an authoritative or wise expression or answer

Reactive Systems

- Complete specification requires use of multiple computational paradigms
- Oracles must judge all behavioral aspects in comparison with all system specifications and requirements
- Hence oracles may be developed directly from formal specifications
**Parts of an Oracle**

- **Oracle information**
  - Specifies what constitutes correct behavior
    - Examples: input/output pairs, embedded assertions
- **Oracle procedure**
  - Verifies the test execution results with respect to the oracle information
    - Examples: equality
- **Test monitor**
  - Captures the execution information from the run-time environment
    - Examples:
      - Simple systems: directly from output
      - Reactive systems: events, timing information, stimuli, and responses

**Approach**

- **Test class**
  - Set of test data described by a condition that constrains input data and the initial system state
- Every test class will have an explicitly represented test oracle
- Results are monitored and verified against the oracle corresponding to all test classes satisfied for the test data

**Phases of the Approach**

- **Oracle derivation**
  - From specifications for each test class
- Monitoring test execution
- Mapping and applying the oracle procedure to the execution results