Testing Software Quality Characteristics – Part 2

Reliability Models

Ira A. Fulton Schools of Engineering
Arizona State University

Objective

Objective

Identify how software reliability models work

Modeling Software Reliability Growth

- Reliability growth model shows how reliability changes over time
- Models support answering "when to stop testing?" question
- Numerous models exist
- Effectiveness of any reliability measurement is directly related to the effectiveness of collecting the right data during testing such as:
  - Failure intensity: the number of failures per natural or time unit

Time to Failure

Cumulative Number of Failures

Number of Failures Per Unit of Time

Software Reliability Models

- **All models possess assumptions such as:**
  - No new errors are introduced by fixes
- **Models generally utilize a mathematical distribution to represent reliability growth**
  - Poisson
  - Exponential
- **Effective model predictions require testing with an operational profile**

Statistical Testing

- Testing software for reliability rather than fault detection
- An acceptable level of reliability should be specified and the software tested and amended
  until that level of reliability is reached

Reliability Testing Problems

Operational profile uncertainty

- Is the operational profile an accurate reflection of the real use of the system

High costs of test data generation

- Very expensive to generate and check the large number of test cases that are required

Statistical uncertainty for high-reliability systems

- It may be impossible to generate enough failures to draw statistically valid conclusions

Growth Model Selection

- Many different reliability growth models have been proposed
- No universally applicable growth model
- Reliability should be measured and observed data should be fitted to several models
- Best-fit model should be used for reliability prediction

Summary