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Software Reliability Growth Modeling Services

Ann Marie Neufelder has been using reliability growth models for software since the 1980s. She has applied these models to hundreds of sets of real test data. Other consultants have applied the models to academic data from small one person software projects in which the data collection is perfect. In the real world there aren't many "one person" software programs and the data collection with regards to the time between failures is often less than perfect.

The software reliability prediction methods are employed early in development before the software is in testable state. Once the software is in a testable state the reliability can be estimated via forecasting models also called reliability growth models. The required inputs are problem reports generated during testing. The test hours between problem reports is computed and input to the models which are recommended by the IEEE 1633. For several decades it has been observed that the distribution of software faults typically *resembles* a bell shaped (or Rayleigh curve) as shown below.

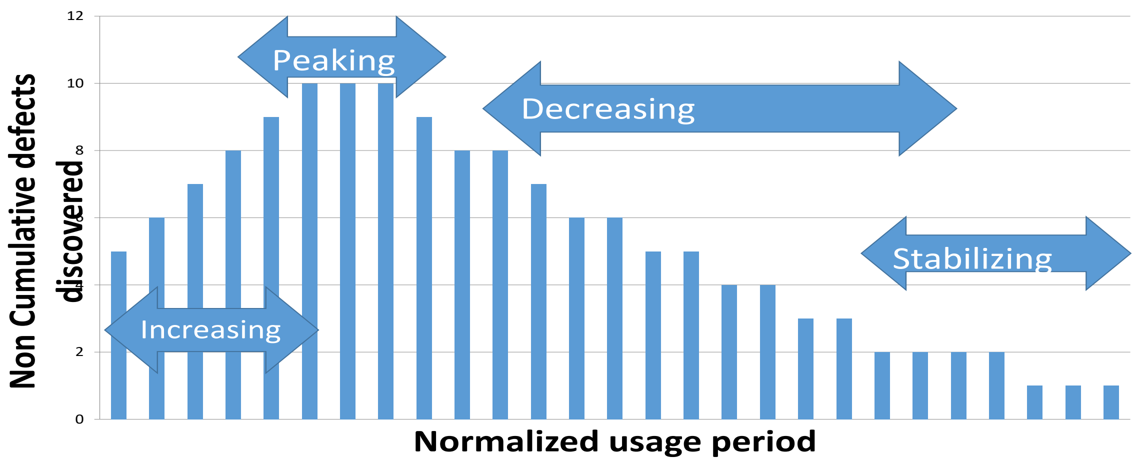

Figure 1 Expected defect discovery profile during testing

During the testing activity, the software may be in any of one or several of these 4 stages:

1. Faults are steadily increasing. This is very typical for the early part of testing.
2. Faults are peaking (statistically this happens when about 39% of total faults are observed [B29]). There could be one peak or several peaks if there is incremental development.
3. Faults are steadily decreasing. If there a no new features and the software is tested and defects that cause faults are removed, eventually the fault occurrences will decrease.
4. Faults are happening relatively infrequently until no new observations.

Statement of Work

Ann Marie Neufelder will plot the defect discovery from software problem reports from your organization and then apply the appropriate reliability estimation model as shown below.

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Phase	Models employed
Increasing defect discovery	The best case scenario is that 39% of the defects have been discovered so far. The software is not ready for deployment with this trend.
Peaking defect discovery	Approximately 39% of the defects have been found so far based on the Rayleigh model. The software is not ready for deployment with this trend.
Linearly decreasing defect discovery or stabilizing defect discovery	The exponential model is used to determine the current failure rate and then forecast it forward to planned deployment date.
Non-linearly decreasing defect discovery	The logarithmic model is used to determine the current failure rate and then forecast it forward to planned deployment date.

Table 1 Models used for forecasting defects

If the defect discovery profile is decreasing it can be determined when/if the software is ready for release based on the overall system objectives of the organization. Historically these are the characteristics of successful, mediocre and failed releases:

	Successful	Mediocre	Distressed
Estimated remaining defects as percentage of total	75%	40%-74%	< 40%
Defect discovery profile	Stabilizing	Recently peaked	Increasing
Test coverage	Path coverage Fault injection Requirements coverage	Requirements coverage only	Insufficient requirements coverage

Table 2 Typical thresholds for releasing software

In addition to estimating the type of release Ann Marie Neufelder will also estimate the defect pileup by superimposing estimates from several sequential releases. If the estimated defects is increasing from release to release then there is defect pileup as illustrated below. Defect pileup is one of the leading contributors to late releases and distressed releases. It is entirely possible that a particular software release meets the requirements for reliability but may cause future releases to be late due to too many deployed defects accumulating.

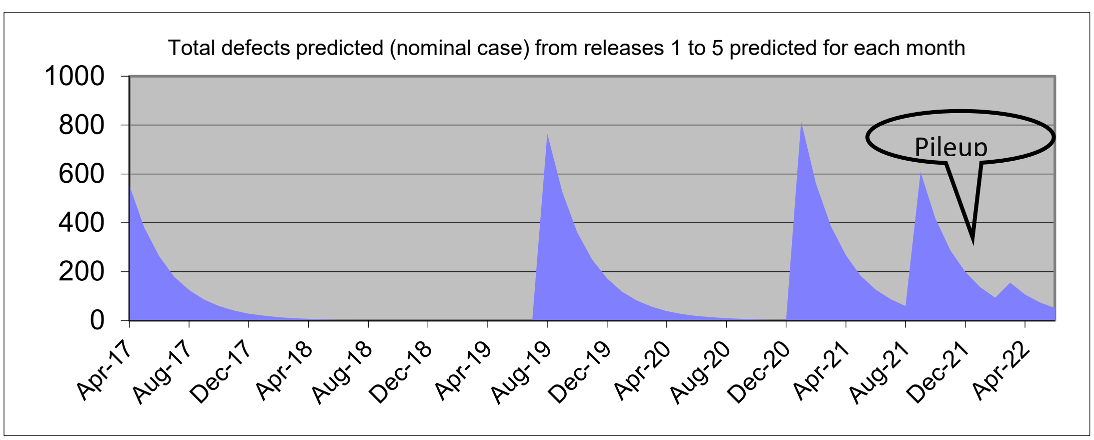

Figure 2 Example of defect pileup

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