

**Homework 1**

Student ID: \_\_\_\_\_

These questions are for Are We Testing for True Reliability (by D. Hamlet)? article in the library. Please hand up to 3 pages of typewritten answers according to the format outlined in the syllabus.

1. [20pts] In Dick Hamlet's words what is reliability? Describe the two different kinds of reliability models (purpose and accuracy)?

*Reliability is the statistical study of failures, which occur because of some defect in the program. Reliability growth models are applied during debugging. Reliability models, in contrast, are applied after debugging, when the program has been tested and no failures have been observed for the purpose of predicting MTTF.*

2. [20pts] Compare structural testing versus white-box testing versus black-box testing?

*Structural testing and white-box testing are essentially the same thing/ They seek to exercise the code by looking at the structure of the (e.g., tests force the execution of each statement). In black-box testing, the specification supplies the organizing information for systematic testing. What is often called functional testing isolates a collection of actions (functions) a program should performance requires test data to exercise each function. Interestingly, functional testing directly tries what is expected of the software. You can plan tests as soon as you have the specification, which is a plus.*

3. [20pts] Define what is an operational profile?

*Hamlet uses the term operational profile with out actually defining it. Its important, as a professional, that you learn to find out what is meant by terms used in technical articles. This is a key concept that the author assumes that you know something about There was an entire issue devoted to the subject in IEEE Software. Check it out (especially see Page 14-32 of March 1993). Or ask one of your peers if you trust their answer. This will come up later on one or more exams so its to your benefit to look for the article.*

*A software-based product's reliability depends on just how a customer will use it An operational profile describes how users employ a system – a quantitative characterization of how a system will be used. It can help to increase productivity and reliability and speed development by allocating development resources (testing resources especially) to functions an the basis of use. Using such an approach will ensure that the most used operations will have received the most testing and the reliability level will be the maximum that is practically achievable for the given test time.*

4. [20pts] Why is it inappropriate to assume that the hazard rate is constant?

*I didn't really like the explanation that Hamlet gives here. That is, that for programs that are more likely to fail the longer they run, a model might use a time- or run-increasing hazard rate. He goes on to talk about state accumulation (i.e., he means that with a longer life time it is more likely that unexercised states will be encountered) the hazard rate will change. A more simplistic explanation is that during system testing, the defects are being removed and effectively cause the hazard rate to change (in a decreasing manner). During operations, supposedly if the software was to be only used as intended (i.e., as tested, see the question just above), the hazard rate should be very very very small. But, if we assume that there are undetected defects, then this would seem to indicate that the hazard rate would change, in correlation (or proportionately) with the number of untested states that were (in Hamlet's words) accumulated. In any case, the hazard rate does not remain constant. Note however that empirical experience shows that its not a bad assumption and it does away with complication in the formulas used in the SR model(s).*

5. [20pts] Why is it important to test software? What is random testing?

*Hamlet discusses that defect-free software is, in theory, plausible. However, there are several problems which he calls the intuitive problem, complex problem and slipshod maintenance) for those reasons it is important to test. It really boils down to customer satisfaction and quality of the product. But, its important to strike a balance between cost of testing and the level of reliability needed by the customer. Random testing requires many more orders of magnitude more test points than current practice. Its based on the premise that uniformly distributed state space based testing should be much better than partition testing at establishing confidence in apparently defect-free software. Hamlet argues for measurement of the state-space coverage (using program instrumentation techniques to record test penetration and statistically analyze the results). Such measurements can pin-point states that have been poorly tested and leave the difficult problem of how to reach them to the tester.*