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Safety and Reliability of Embedded Systems
(WS 11/12)

Problem Set 6

Due Thursday, January 19th, 2012

Problem 1: Weibull distribution

The so-called Weibull distribution is often used to describe the wear-out phase of components (caused by e.g. fatigue failures). Assume that the lifetime T of a component can be described by such a Weibull distribution with parameter $\beta = 2$.

In order to determine the parameter λ, you perform the following experiment:
The experiment is commenced with a large number of components all being initially intact. After 250 hours, the number of components that survived so far is recorded. After another 50 hours, it is observed that 25% of these components now have failed.

Please calculate the parameter λ of the corresponding Weibull distribution.

Problem 2: Musa's execution time model

Based on your experience you expect a total number of 200 failures for a software system. At present you run the system test. The initial failure rate was 0.05 / CPU-second. Your goal is to reduce the failure rate to 0.005 / CPU-second. Use Musa's execution time model to answer the following questions:

a) How much total execution time will be necessary? How much additional execution time will be necessary to observe a failure rate of 0.005 / CPU-second after you have reached a failure rate of 0.01 / CPU-second?

b) How many failures will have occurred when you reach the failure rate of 0.005 / CPU-second? How many additional failures will occur after you have reached a failure rate of 0.01 / CPU-second until you observe a failure rate of 0.005 / CPU-second?

c) What will be the failure rate after you have observed 100 failures?

d) What will be the failure rate after 5000 CPU-seconds and how many failures have occurred until then?