

Example Problems for Lecture on Quantitative Tools for Reliability Analysis (Continuous Case)

ECE 60872/CS 590 –Fault-Tolerant Computer System Design School of Electrical and Computer Engineering Purdue University Fall 2017

1. Failure rate and Reliability

Consider that the failure rate of a component is $h(t) = \lambda_0 t$ where $\lambda_0 > 0$ is a constant.

Which phase of the component's life does this failure rate characterize?

What is the reliability of the component? What is the expected life of the component (i.e., its MTTF)?

2. Weibull distribution

The lifetime of a component is modeled by a Weibull distribution with shape parameter $\alpha = 2$. Starting with a large number of components it is seen that 15% of the components that have lasted 90 hours fail before 100 hours. What is the scale parameter λ ?

3. Reliability of a parallel system

Consider a parallel system of n independent components. Let X denote the lifetime of the overall system. Assume that the lifetime of each component, X_i , is exponentially distributed with parameter λ (all components have the same parameter). What is the reliability and MTTF of the parallel system?

4. Reliability of a series system

Consider a system made out of n components in series. Component i has lifetime $X_i \sim \text{WEI}(\lambda_i, \alpha)$. What can you say about the reliability of the overall system?

5. Error distribution

Consider that the measurement error is given by the variable X . We are interested in the distribution of the square of the error, i.e., of the variable $Y = X^2$. Write down the cdf of Y , i.e., formulate $F_Y(y)$.

If $X \sim \text{EXP}(\lambda)$, what form does $F_Y(y)$ take?