

Department of Electrical and Computer Engineering
University of Massachusetts Dartmouth

ECE544 Fault-Tolerant Computing
& Reliability Engineering

Fall 2022

Homework #4

Name: _____

Instructor: Prof. Liudong Xing

ECE544: Fault-Tolerant Computing & Reliability Engineering
(Fall 2022)
Homework #4

Assigned: October 5, Wednesday

Due: October 12, Wednesday, 3:30pm

Instructions:

1. Please type your answers or write your answers clearly (illegible writing will NOT be graded).
2. Please organize all pages of your answers into **one file**, name your file using “HW4-your last name.pdf or doc” (e.g., HW4-Xing.pdf), and submit it to lxing@umassd.edu electronically or submit a hard copy by the due date.
3. Relevant lecture notes: Lecture #7 & 8.

Problems:

1. Moon Systems, a manufacturer of scientific workstations, produces its Model 13 System at sites S1, S2, S3 (20% at S1, 35% at S2, and the remaining 45% at S3). The probability that a Model 13 System will be found defective upon receipt by a customer is 0.01 if it is shipped from site S1, 0.06 if from S2, and 0.03 if from S3.
 - a) What is the probability that a Model 13 System selected at random at a customer location will be found defective?
 - b) Suppose a Model 13 System selected at random is found to be defective at a customer location. What is the probability that it was manufactured at site S2?
2. A component with time-to-failure T has constant failure rate $\lambda=2.5*10^{-5}$ /hour
 - a) Determine the probability that the component survives a period of 2 months without failures (Assume each month has 30 days).
 - b) Find the MTTF of the component.
 - c) Find the probability that the component survives its MTTF.
 - d) Suppose the component has been functioning without failures during its first 3 months in operation. Find the probability that the component will survive another 2 months.
3. A component may fail due to two different causes, A and B . It has been shown that the time-to-failure T_A caused by A is exponentially distributed with probability density function (pdf) $f_A(t) = \lambda_A e^{-\lambda_A t}$ for $t \geq 0$, while the time-to-failure T_B caused by B is exponentially distributed with pdf $f_B(t) = \lambda_B e^{-\lambda_B t}$ for $t \geq 0$.
 - a) Describe the rationale behind using $f(t) = pf_A(t) + (1-p)f_B(t)$ as the pdf for the time-to-failure T of the component.
 - b) Explain the meaning of p in this model.