

**Matlab Problem:**

1. Write a Matlab program to simulate the failure probability of a system composed of two components in parallel and compare the reliability function obtained this way to the one obtained analytically. Use the 2,000 random numbers you generated in HW #4 (Matlab Problem #1 from Chapter 4) so that the failure rate is equal to 2 for each component. In order to simulate two in parallel you have to generate 2,000 more numbers for the second component, then for each pair you select the larger value to represent the time to failure of the parallel connection.

Here are the results expected of you:

- a. The Matlab program
- b. The reliability functions of a component (fraction of systems surviving after time  $t$ ) and of the system as a whole and compare to the analytical result.
- c. A histogram of the time to failure of the system and compare to theoretical one.
- d. The sample average of the time to failure of each component and of the entire system

**Regular Problems:**

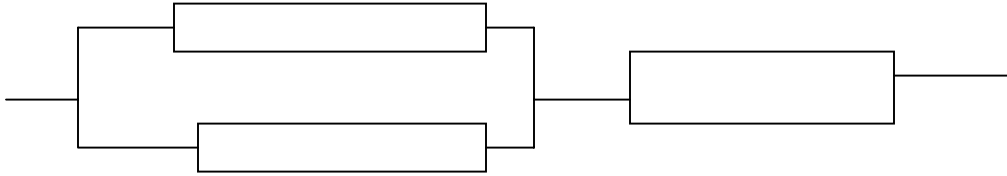
1. Consider the data samples (shown at the end of the problem set) from a random variable  $X$  containing 20 data points:
  - a. Find the sample mean and sample variance of the sample.
  - b. Assuming the standard deviation of the distribution is known and is given as to you as 0.5. Estimate the mean of the distribution of  $X$  and provide a margin of error  $m$  for confidence level of 0.85.
  - c. How large should be the number of samples if we were to wish for the same margin of error you obtained in b. but we want a confidence level of 0.95.
  - d. What is the confidence level in estimating the mean if we want a margin of error of 0.05 and  $n = 100$  (instead of 20).
2. A component has a probability density function for the time to failure  $X$  as:
$$f_X(t) = 2t/T^2, \quad \text{for } 0 < t < T, \text{ and is zero elsewhere}$$
  - a. Find its reliability function and its failure rate. Plot for  $T=1$ .
  - b. Find the mean time to failure.
3. For the system given below suppose that the components fail independently of each other and that the reliability function of each component is given by:

$$R_1(t) = \exp(-\lambda t)$$

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- Find the reliability function  $R(t)$ , the failure probability  $F(t)$ , the failure probability density function, and the failure rate for the system. Plot for  $\lambda=1$ .
- Find the mean time to failure for the system.



X

0.66  
1.02  
0.02  
0.54  
0.73  
1.66  
0.49  
1.59  
0.42  
0.66  
0.65  
1.43  
0.5  
0.71  
1.27  
1.08  
0.69  
1.57  
1.11  
1.9

Data for Problem #1