Homework # 8

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Problem 1

Statement

The length of time until the breakdown of an essential piece of equipment is important in the decision of the use of auxiliary equipment. Assume you are interested in the time to breakdown (in days) of a randomly chosen generator.

a. Define a random variable, Y that represents the quantity of interest.

b. What probability distribution(s) of those we have discussed, could you use to model the random variable of interest. Explain

c. Suppose that, historically the average time to breakdown of a randomly chosen generator is 10 days with a variance of 100 days. Specify a probability model for

Y.

d. Using your model in (c), what is the probability a generator will break down in the next 21 days?

e. A company owns 7 such generators. Assuming the breakdown of any one generator is independent of breakdowns of the other generators, what is the probability that at least 6 of the 7 generators will operate for the next 21 days without a breakdown? Be sure to first define a RV, X for the quantity of interest, describe what X is in words, provide notation to communicate the assumed distribution of X, and write a probability statement using proper notation. Compute the probability by hand or using software. If you use software provide the code you used

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Solution

Problem 2

Statement

4.130

Prove that the variance of a beta distributed random variable with parameters α, β is:

$$\sigma^2 = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$$

Solution

Problem 3

Statement

4.140

Identify the distributions of the random variables with the following moment generating functions:

a. $m(t) = (1 - 4t)^{-2}$

b. $m(t) = 1/(1 - 3.2t)$

c. $m(t) = e^{-5t+6t^2}$

Solution

Problem 4

Statement

Use the example code for plotting the Gamma pdf (posted on Brightspace) and do something similar for the Beta distribution. Make note of the parameterization R uses and describe how changing the values of α and β change the resulting Beta distributions

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Solution