Stat 509: Statistics for Engineers

Homework Assignment 6

1. You are in charge of monitoring errors in the production of a certain part. Let X represent the absolute difference in mm between the length of a part and its desired length. You have collected data on these differences in 50 randomly selected parts. You wish to use this data to construct a model for the error in these parts so you can make predictions and informed decisions. Read the *part* data into R in order to answer the following questions:

   (a) Fit the following models to the data: normal, exponential, gamma, and Weibull. You must include the maximum likelihood estimates of the model parameters for each model. Which model do you prefer? Do you believe the model fits the data well and thus can be used to model the population? You must include supporting evidence for your conclusions.

Weibull plot diagram is okay. Histogram is bad.

Normal plot diagram is worse. Histogram is worse.

Exponential plot diagram is very bad. Histogram is extremely bad.

Gamma plot diagram is best. Histogram is also very good.

The Gamma diagrams fit the data set the best since the lines line up with the data and the plot diagram is not in a direct pattern.

   (b) A part is defective if the error is at least 1 mm. Based on your model, what is the estimated probability that a randomly produced part is defective?

Based on the model, there is about a 25% chance of a part being defective.

   (c) A shipment consists of a batch of five parts. The shipment will be rejected if it contains a defective part. Assuming each part is independent of the other parts, what is the estimated probability that a shipment is rejected?

P(non-defective) = $(0.75)^5$

P(rejected) = 1 – P(non-defective)

P(rejected) = $1 – (0.75)^5 = 0.76 = 76\%$

   (d) Based on your answer in (c), do you believe the production quality of the parts is adequate?

I believe that the production quality of the parts is inadequate based on my answer for (c). The probability shows that a shipment will get rejected ¾ of the time, making it inadequate.