

Normal and Exponential Distribution Group Work – Friday 2/8

1. Suppose that the useful lifetime of a certain model of hairdryer is normally distributed with a mean of 29 months with a standard deviation of 7.3 months. The manufacturer will replace the hairdryer for free if it fails before the guarantee period has expired.

If the guarantee period is 18 months, what is the probability that a hair dryer will fail and be replaced for free under this guarantee? Draw shade and label your graph. Show your work. Round to 3 decimal places.

$$X \sim N(29, 7.3)$$

$$P(X < 18) = \text{normalcdf}(-10, 99, 18, 29, 7.3)$$

$$P(X < 18) = .066 \quad \text{6.6\% replaced for free}$$



If the manufacturer only wants to replace 1% of hairdryers under this guarantee, how long should the guarantee period be? Draw shade and label a graph. Show your work.

$$P(X < k) = .01$$

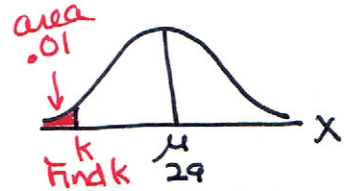
Find k

So k is "1st" percentile

$$k = \text{invnorm}(.01, 29, 7.3)$$

$$k = 12.018$$

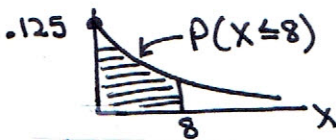
$$\boxed{12 \text{ months}}$$



2. Suppose a certain item has a useful lifetime until failure that is exponentially distributed with a mean lifetime of 8 years. Find the probability that the item lasts at most 8 years? (Round to 3 decimal places)

Draw shade and label your graph. Show your work.

$$X \sim \text{Exp}(1/8) \quad \text{or} \quad X \sim \text{Exp}(.125) \quad \text{because} \quad m = \frac{1}{\mu} \quad (\text{and } \mu = 8 \text{ given})$$



$$P(X \leq 8) = 1 - e^{-.125 \times 8} = .632$$

$$1 - e^{\lambda(-.125 \times 8)}$$

63.2 % of these items fail in 8 years or less.

Approximately what percentile is a failure time of 8 years? 63rd percentile

Based on the information above, for the exponential distribution which is true? (Circle one)

A. Mean < Median

B. Mean = Median

C. Mean > Median

Write a brief explanation of your conclusion above using the probability (or percentile) calculated above to justify your conclusion. (1 or 2 complete sentences)

The mean is 8 and it is the 63rd percentile (you just calculated that above).

The median is always the 50th percentile (that's the definition of the median, from Chapter 2)

Since the mean for the exponential distribution has a higher percentile than the median, we can conclude that the mean is greater than the median, for exponential.

(Or you could answer that its because the exponential distribution is skewed to the right.)

How this was graded: Out of 5 points.

2 points for doing groupwork and handing in any written work (participation points).

1 point for each correct graph with correct probability calculation to total up to 3 points.

Credit deducted for questions not answered, missing or incorrect graphs or calculations.

Extra Credit: If you answered the explanation about why mean > median for exponential correctly, you earned 1 extra credit point. (because the explanation either was harder for students than I thought it would be or perhaps my question was not clear, so no deductions for wrong answers or no answer, but extra credit for correct answer.)