

Tutorial 4

AID-521: Mathematics for Data Science

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August 26, 2021

Qn. 1.

The following data give the time in months from hire to promotion to manager for a random sample of 25 software engineers from all software engineers employed by a large telecommunications firm.

5, 7, 229, 453, 12, 14, 18, 14, 14,
483, 22, 21, 25, 23, 24, 34, 37, 34,
49, 64, 47, 67, 69, 192, 125

- (a) Calculate the mean, median, mode, variance, and standard deviation for this sample.
- (b) Find lower and upper quartiles, median, and interquartile range (IQR).
- (c) Check for any outliers.

Ans/Sol.

Qn. 2.

A bottling machine can be regulated so that it discharges an average of μ ounces per bottle. It has been observed that the amount of fill dispensed by the machine is normally distributed with $\sigma = 1.0$ ounce. A sample of $n = 9$ filled bottles is randomly selected from the output of the machine on a given day (all bottled with the same machine setting), and the ounces of fill are measured for each.

- (a) Find the probability that the sample mean will be within .3 ounce of the true mean μ for the chosen machine setting.
- (b) How many observations should be included in the sample if we wish the sample average to be within .3 ounce of μ with probability .95?

Ans/Sol.

Qn. 3.

The tensile strength for a type of wire is normally distributed with unknown mean μ and unknown variance σ^2 . Six pieces of wire were randomly selected from a large roll. Y_i , the tensile strength for portion i , is measured for $i = 1, 2, \dots, 6$. The population mean μ and variance σ^2 can be estimated by \bar{Y} and S^2 , respectively. Because $\sigma_{\bar{Y}}^2 = \sigma^2/n$, it follows that $\sigma_{\bar{Y}}^2$ can be estimated by S^2/n .

- (a) Find the approximate probability that \bar{Y} will be within $2S/\sqrt{n}$ of the true population mean μ .

Ans/Sol.

Qn. 4.

Candidate A believes that she can win a city election if she can earn at least 55% of the votes in precinct 1. She also believes that about 50% of the city's voters favor her.

- (a) If $n = 100$ voters show up to vote at precinct 1, what is the probability that candidate A will receive at least 55% of their votes?

Ans/Sol.