

# Tutorial 4

## AID-521: Mathematics for Data Science

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### 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.**

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### Qn. 2.

A bottling machine can be regulated so that it discharges an average of  $\mu$  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  $\mu$  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  $\mu$  with probability .95?

**Ans/Sol.**

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**Qn. 3.**

The tensile strength for a type of wire is normally distributed with unknown mean  $\mu$  and unknown variance  $\sigma^2$ . 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  $\mu$  and variance  $\sigma^2$  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  $\mu$ .

**Ans/Sol.**

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**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.**