

1 | Conceptual Exercises

1. A researcher is analysing individuals' relative fear of being a victim of burglary on a 1-100 scale. A random sample of 9 individuals found a mean score of 47 on the scale with a sample variance of 158.76 for fear of being burgled.

- a. What distribution would be used to calculate an 80% confidence interval around this mean?

A t-distribution as we don't know the population standard deviation and n is small.

- b. Construct that interval.

$$\bar{x} = 47$$

$$n = 9$$

$$t \text{ from tables} = 1.397$$

$$s = \sqrt{158.76}$$

$$s = 12.6$$

Confidence interval formula

$$\bar{x} \pm t \times \frac{s}{\sqrt{n}}$$

Lower bound

$$47 - 1.397 \times \frac{12.6}{\sqrt{9}} = 47 - 5.867 = 41.13$$

Upper bound

$$47 + 1.397 \times \frac{12.6}{\sqrt{9}} = 47 + 5.867 = 52.87$$

2. We are investigating the height of men in the UK. For this we have obtained a random sample of 100 UK men and found they had a mean height of 180cm with a standard deviation of 10cm.
- a. Construct a 95% confidence interval for the mean height of UK males.

$$\bar{x} = 180$$

$$s = 10$$

$$n = 100$$

As the population standard deviation is not known, the t distribution and t need to be used.

Find the t-score for a 95% confidence interval in the t-table with 99 df.

$$t = 1.984$$

Confidence interval:

$$\bar{x} \pm t \times \frac{s}{\sqrt{n}}$$

Lower bound:

$$180 - 1.984 \times \frac{10}{\sqrt{100}} = 180 - 1.984 = 178.02$$

Upper bound:

$$180 + 1.984 \times \frac{10}{\sqrt{100}} = 181.98$$

- b. Select all true statements concerning the constructed confidence interval and justify your choice for each statement.
- The probability of the population mean being within the upper and lower bounds is 95%.
FALSE - The population mean is fixed but unknown and therefore can either be inside the bounds or outside. The Probability is therefore 50%.
 - 95% of men's heights fall between the upper and lower bound.
FALSE - The distribution calculated is not the distribution of men's height, but the sampling distribution of the mean male height.
 - 95% of the cases in the sample fall between the upper and lower bound.
FALSE - The distribution calculated is not of men's height in this sample, but the sampling distribution of the mean male height.
 - On average 95% of confidence intervals constructed would contain the population mean.
TRUE

- v. On average 95% of the means of samples with 100 respondents will fall within the upper and lower bands.
FALSE - This confidence interval is not making statements about various sample means but rather about the population mean.
- vi. On average 95% of the sample means equal the population mean.
FALSE - The confidence interval is a range and does not make claims about where the population mean is exactly.

2 | Applied Exercises

See RScript in the [Online Companion](#)