1: Point estimation and confidence interval estimation

(a) Solve:

News coverage during a recent election projected that a certain candidate would receive 54.8% of all votes cast; the projection had a margin of error of $\pm 3\%$.

- Give a point estimate for the proportion of all votes the candidate will receive.

- Give an interval estimate for the proportion of all votes the candidate will receive.

- In your own words, state the difference between a point estimate and an interval estimate.

(b) Solve:

Researchers are interested in the effect of a certain nutrient on the growth rate of plant seedlings. Using a hydroponics grow procedure that utilized water containing the nutrient, they planted six tomato plants and recorded the heights of each plant 14 days after germination. Those heights, measured in millimeters, were as follows:

$$55.5 \quad 60.3 \quad 60.6 \quad 62.1 \quad 65.5 \quad 69.2$$

- Find a point estimate of the population mean height of this variety of seedling 14 days after germination.

- The method for confidence interval estimation provides a margin of error of 4.9 mm for a 95% confidence interval for the population mean height. Construct that interval.

- Use this example to explain why a point estimate alone is usually insufficient for statistical inference.

(c) Solve:

A national television network takes an exit poll of 1400 voters after each has cast a vote in a state gubernatorial election. Of them, 660 say they voted for the Democratic candidate and 740 say they voted for the Republican candidate.

- Treating the sample as a random sample from the population of all voters, would you predict the winner? Base your decision on a 95% confidence interval.

- Base your decision on a 99% confidence interval. Explain why you need stronger evidence to make a prediction when you want greater confidence.

(c) Solve:

In the previous exercise, suppose the same proportions resulted from $n = 140$ (instead of 1400), with counts 66 and 74.

- Now does a 95% confidence interval allow you to predict the winner? Explain.

- Explain why the same proportions but with smaller samples provide less information.

(d) Solve:

The 2008 General Social Survey asked, "What do you think is the ideal number of children for a family to have?" The 678 females who responded had a median of 2, mean of 3.22, and standard deviation of 1.99.

- What is the point estimate of the population mean?

- Find the standard error of the sample mean.

- The 95% confidence interval is (3.07, 3.37). Interpret.

- Is it plausible that the population mean $\mu = 2$? Explain.

(e) Solve:

Refer to the previous exercise. For the 604 males in the sample, the mean was 3.06 and the standard deviation was 1.92.

- Find the point estimate of the population mean, and show that its standard error is 0.078.

- The 95% confidence interval is 2.91 and 3.21. Explain what 95% confidence? means for this interval.

(f) Solve:

A standardized procedure is expected to produce washers with very small deviation in their thicknesses. Suppose that 10 such washers were chosen and measured. If the thicknesses of these washers were, in inches:

$$.123 \quad .124 \quad .126 \quad .120 \quad .130$$
$$.133 \quad .125 \quad .128 \quad .124 \quad .126$$

- What is a 90% confidence interval for the standard deviation of the thickness of a washer produced by this procedure?

- State and motivate the assumptions needed for the interval in previous point to be valid.