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Grade 7/8 Math Circles
February 24, 2021
Confidence Intervals - Problem Set

1. Identify the point estimator and point estimate.

   (a) The mean height for the sample of classmates you took from your grade is 140cm.

   (b) Quality control inspectors note that 6 out of the 100 batteries they tested did not meet production standards.

   (c) Polling shows that 62% of surveyed voters from around the city voted for the new candidate.

   (d) Apples are packed into crates of 50 apples each. To estimate the mean weight of individual apples, one crate is weighed and found to be 35kg.

2. What is the point estimate and margin of error for each interval?

   (a) $[60, 70]$ *(this notation means the interval from 60–70.)*

   (b) $[3, 6]$

   (c) $[0.2, 1.6]$

   (d) $[\frac{1}{6}, \frac{5}{6}]$

   (e) $[31, 243]$

   (f) $[\frac{1}{8}, \frac{9}{4}]$

3. For a given sample, would a confidence interval have to get bigger or smaller:

   (a) when C increases? Why?

   (b) when C decreases? Why?

4. If researchers are aiming to have approximately 48 out of their 50 repetitions of an experiment to produce confidence intervals that capture the true parameter value, what confidence level should they be using to calculate their intervals?

5. If researchers were able to take 200 samples and calculated 85% confidence intervals based off the sample statistic for each of them, how many of the intervals would *not* capture the true parameter value?

6. Octagon News reports that based on their analysis of the game, the Prisms will score 3 ± 2 more goals in the last quarter, 4 times out of 5. The team needs to score 6 goals to win the game. Based on this estimation, is it plausible for the Prisms to win?

7. According to a survey done with a sample of students at your school, a 95% confidence interval for the percentage of students who would support later lunchtimes is $69\%\pm8$. Is it plausible that at least three-quarters of students at the school want later lunchtimes?

8. Interpret the confidence interval and the confidence level.

   (a) A study suggests that many adolescents lie about their age online to access certain websites. In a survey conducted, 83% of the participants answered "Yes" to the question, "Have you ever provided false information about your age to access an online website?" The researchers gave a 95% confidence interval of $[76\%, 90\%]$ for the true proportion of adolescents who lie about their age.

   (b) A study on car usage by Canadians suggests that the average driver adds around 20 000 km to their car mileage each year. According to the researchers, the resulting 99% confidence interval from the study is $20\ 000\pm8200$km.

   (c) Octagon News reports that up to 7 out of every 8 people don't wash their hands after using the washroom. A 90% confidence interval of $80\%\pm7.5$ is cited in an annotation for the article.

9. True or False? Why?

   (a) If you take samples from the same population over and over again and construct C% confidence intervals from each sample for the unknown population parameter, about C% of those intervals will contain the sample statistic.

   (b) If you take samples from the same population over and over again and construct C% confidence intervals from each sample for the unknown population parameter, about C% of those intervals will contain the parameter value.

   (c) Decreasing the margin of error also makes the confidence interval more precise.

   (d) The more precise an interval is, the more accurate it is.

   (e) Since samples are all taken from the same population, any random sample you take will have the same statistic values.

(f) Having a 95% confidence interval of 100±30 for the population mean means that there is a 95% chance that the population mean is between 70 and 130.

(g) Plausible values are all possible values that the unknown parameter could be.

(h) Usually, if a value is inside of the confidence interval, then it is plausible.

(i) A wider 95% confidence interval has a better chance of capturing the parameter value than a narrower 95% confidence interval.

(j) For any given sample, if a confidence interval is made wider, then C increases.

10. How big would a 100% confidence interval have to be to? Why?

11. Try to find a real-life example of a confidence interval! It might be helpful to look in the news.