NCEA Level 2 · AS 91264: Making an Inference from Samples

Name: _____ Date: _____

This standard is all about taking samples from populations and using them to make a fair claim (an inference) about the wider group. Work through the sheet building box plots, calculating informal confidence intervals, and writing clear justified conclusions, that's what earns the marks.

Revision summary

- The statistical enquiry cycle (PPDAC): Problem, Plan, Data, Analysis, Conclusion. Your investigative question should compare a variable between two populations, e.g. 'I wonder if Year 12 boys at our school are taller than Year 12 girls, on average?'
- We take a SAMPLE to make an inference about the whole POPULATION (we don't have all the data). Use the median as the measure of centre for comparisons.
- Five-number summary: minimum, lower quartile (Q1), median (Q2), upper quartile (Q3), maximum. IQR = Q3 – Q1. Box plot: box from Q1 to Q3, line at median, whiskers to min and max.
- Informal confidence interval for a median: median ± 1.5 × (IQR ÷ √n). This estimates where the true population median likely sits.
- To make a call: if the two informal confidence intervals do NOT overlap, you can make the call back to the population that one median is likely bigger. If they overlap, you cannot make a call.
- Always describe features in context: centre (median), spread (IQR/range), shape (symmetry, skew), and any unusual/outlying values.
- A good conclusion answers the question, refers to the sample evidence, makes a call back to the population (or says you can't), and mentions sampling variability.
- Bigger sample sizes give narrower confidence intervals, so a more reliable inference.

Key skills

1. The reaction times (in seconds) of 9 students on a computer test are: 0.28, 0.31, 0.33, 0.35, 0.36, 0.39, 0.41, 0.44, 0.52. Find the five-number summary.

2. For a sample the lower quartile is 152 cm and the upper quartile is 168 cm. Calculate the interquartile range (IQR).

3. A sample of 25 kiwifruit has a median weight of 92 g and an IQR of 20 g. Calculate the informal confidence interval for the population median.

4. Explain the difference between a sample and a population, using the example of investigating the weekly screen time of Year 11 students at your school.

Achieved

5. A student investigates whether Year 13 students at Avondale College sleep more on weekends than on weeknights. Write a suitable investigative comparison question and identify the variable and the two groups being compared.

6. A sample of 16 avocados from a Kaitaia orchard has weights (g): 180, 190, 195, 200, 205, 210, 210, 215, 220, 225, 230, 235, 240, 250, 260, 280. Find the median, Q1 and Q3, then describe how you would draw the box plot.

7. A survey of 36 café flat whites finds a median price of $5.20 and an IQR of $0.90. Calculate the informal confidence interval for the median price and interpret it in context.

8. Two box plots show the heights of sampled netball players (median 172 cm) and basketball players (median 179 cm). The netball confidence interval is 168–176 cm and the basketball interval is 175–183 cm. State whether you can make a call about the populations and why.

Merit

9. A student compares reaction times (seconds) of a sample of 30 Year 12 students who play video games regularly (median 0.34, IQR 0.09) with 30 who do not (median 0.41, IQR 0.12). Calculate both informal confidence intervals, compare them, and make a call.

10. A sample of 50 commute times (minutes) to an Auckland CBD workplace has median 34, Q1 = 26, Q3 = 46, minimum 15, maximum 78. Describe the distribution referring to centre, spread and shape, and explain what the shape suggests about commute times.

11. Two students take separate samples of the same population of Year 9 running times. Sample A has n = 20 (median 62 s, IQR 10 s); Sample B has n = 80 (median 62 s, IQR 10 s). Calculate both confidence intervals and explain how sample size affects the reliability of the inference.

Excellence

12. A student concludes: 'Because the median height of my sample of boys (170 cm) is bigger than my sample of girls (163 cm), all boys at the school are taller than all girls.' Critique this conclusion and explain what a statistically valid conclusion should include.

13. Explain why the informal confidence interval uses median $\pm$ 1.5 $\times$ (IQR $\div$ $\sqrt{n}$), and why we compare intervals rather than simply comparing the two sample medians directly. Reason in terms of what would happen if the samples were taken again.

14. Two samples of tomato weights give overlapping confidence intervals, so a call cannot be made. A student says 'This proves the two populations have equal median weights.' Explain why this is incorrect, and describe two changes to the investigation that could allow a valid call to be made if a real difference exists.