

Achievement Standard 91264 (Mathematics and Statistics 2.9)

Use statistical methods to make an inference

Practice assessment

Solution

Answers will vary – an outline example is given.

Problem: Is there a difference in the median heights of Year 9 boys and Year 9 girls for students in the New Zealand 2011 Census at School database?

Plan: Use the random sampling tool in the New Zealand 2011 Census at School database to select the heights of 36 Year 9 boys and 36 Year 9 girls. A sample of 36 should be sufficiently large to make an inference about the heights of all Year 9 students in the New Zealand 2011 Census at School database.

Data: A random sample of 36 Year 9 boys and 36 Year 9 girls was taken from the Census at School database and put in a table, as shown.

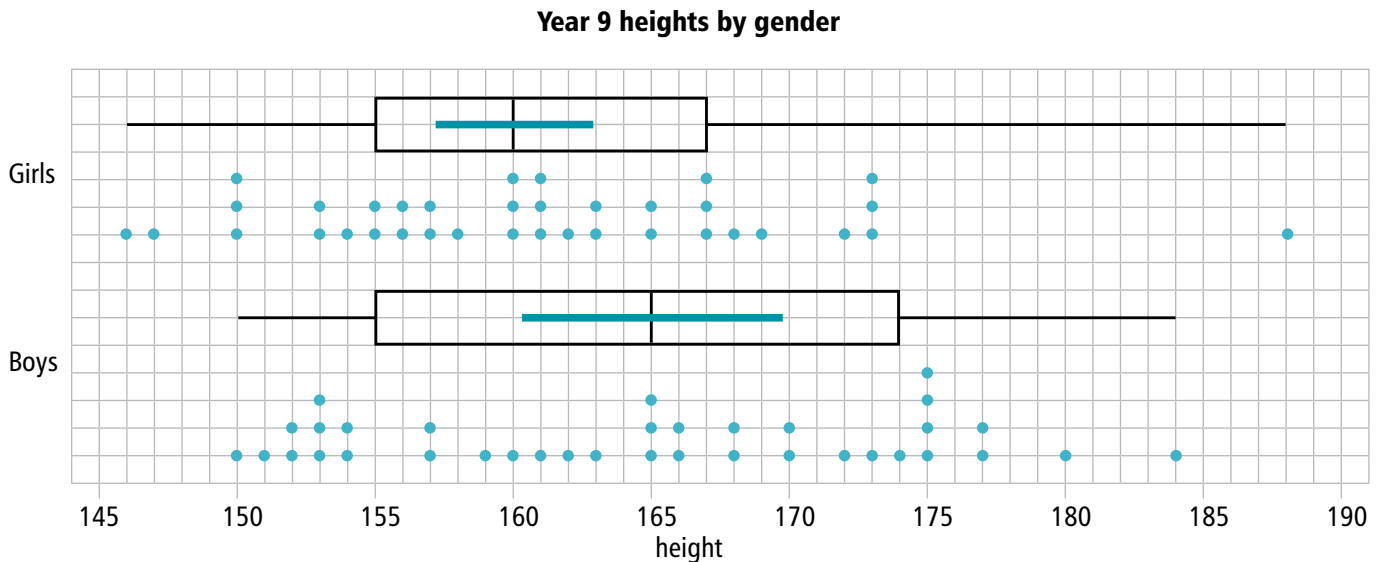
Y9 student heights (cm)			
Boys	Girls		
168	147	175	172
174	187	177	167
161	163	168	156
162	161	175	159
172	153	175	155
184	162	151	150
175	160	157	153
163	157	166	173
160	150	165	160
159	163	153	173
157	154	177	165
170	173	152	150
154	146	165	157
180	155	170	161
153	156	166	167
173	167	153	168
154	165	150	157
152	161	165	160

Analysis

Summary statistics are calculated for the data.

	Min	LQ	Median	UQ	Max	IQR	n	$1.5 \times \frac{IQR}{\sqrt{n}}$
boys	150	154.75	165	173.75	184	19	36	4.75
girls	146	155	160	166.5	187	11.5	36	2.875

Dot plots and box-and-whisker plots are drawn for the data.



Sample observations:

In the sample, the median girls' height is 5 cm below the median boys' height.

In the samples, the range of Y9 girls' heights is 41 cm which is 7 cm greater than the range of Y9 boys' heights (34 cm). The large range of Y9 girls' heights is due to an unusually large Y9 girl's height of 187 cm.

By comparison, the interquartile range of Y9 girls' heights is 11.5 cm which is 7.5 cm less than the interquartile range of Y9 boys' heights (19 cm) showing that the middle 50% of girls' heights are more consistent than the middle 50% of boys' heights.

The distribution of girls' heights is skewed to the right (mainly because of the unusual height of 187 cm). The distribution of boys' heights is also a little skewed to the right.

The boxes of the distributions have a considerable overlap, with the box for the girls' heights lying completely inside the box for the boys' heights.

Informal confidence intervals for the population median:

Informal confidence intervals for the population Year 9 median heights are also drawn on the box-and-whiskers plots (boys: 165 ± 4.75 ; girls: 160 ± 2.875)

The informal confidence intervals are:

$160.25 \text{ cm} < \text{population median Year 9 boys' height} < 169.75 \text{ cm}$ and

$157.125 \text{ cm} < \text{population median Year 9 girls' height} < 162.875 \text{ cm}$

So it is a fairly safe bet that the population median Year 9 boys' height lies between 160.2 cm and 169.8 cm, and the population median Year 9 girls' height lies between 157.1 cm and 162.9 cm.

These two confidence intervals overlap (as can be seen on the graphs), so it is possible that the population median heights for Year 9 boys and girls in the New Zealand 2011 Census at School database are the same.

Conclusion

The informal confidence interval for the population median height for Year 9 boys in the New Zealand 2011 Census at School database overlaps with the informal confidence interval for the population median height for Year 9 girls in the New Zealand 2011 Census at School database. So there is insufficient evidence to make the claim that the population median height for

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Year 9 boys in the New Zealand 2011 Census at School database is different from the population median height for Year 9 girls in the New Zealand 2011 Census at School database. It is possible that the median heights for these two groups are the same.

Samples vary each time a new one is taken, but since the overlap in the confidence intervals is quite large for this sample, I think that if the investigation were repeated with a new random sample, a similar conclusion would be reached.