Student 2: High Merit
NZQA Intended for teacher use only

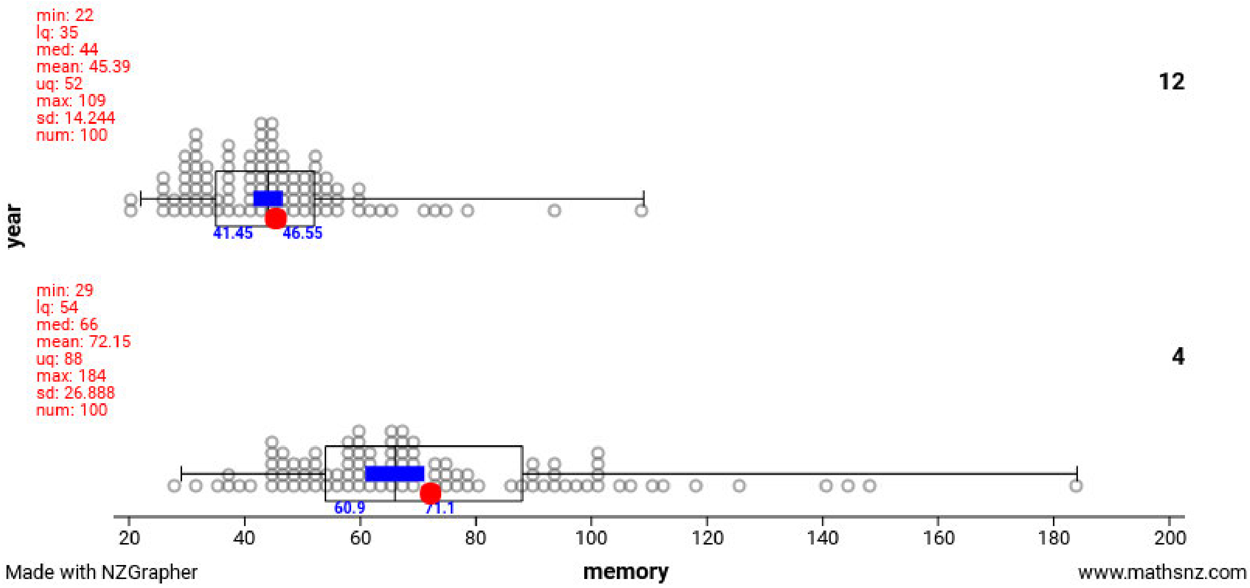
Investigative question

Many studies have shown that as we grow older, our brains grow with us and the brain of a teenager will be more developed than the brain of a person at primary school. As our neurons and brain transmitter grow our memories and brain activity increases. I will investigate whether the median time taken to complete a memory game for the year 4s in the New Zealand 2011 Census at School is longer than the median time taken to complete a memory game of the year 12s in the 2011 Census at School. My hypothesis is that the time it takes for year 4s to match all the pairs in the memory game is longer than the time it takes for the year 12's to complete the memory game and find all the pairs. This is because year 12's have a more developed brain than year 4's so should have a better memory. 1

To get my sample I went to CensusAtSchool data set 2011 to get a random sample of 100 year 12s and 100 year 4s. CensusAtSchool data set 2011 uses a simple random sampling method, this means my sample has no bias because every element has an equal chance of being selected. I chose a sample of 200 - 100 year 12s and 100 year 4s - because I wanted to get a sample big enough so it will be a good representation of all year 4s and 12s that did the census in New Zealand and that the median times in my samples will be close to the median times for all year 4s and 12s in New Zealand 2011 census.

Analysis

Median time in seconds for year 12s and year 4s to complete the memory game



In my sample I can see that there is a large shift of the times for the year 12's middle 50% to the left. This shows that the year 12's tend to complete the memory test faster. The large shift can be seen by the upper quartile of the year 12's (52 sec) being less than the lower quartile of the year 4's (54 sec) so more than 75% of the year 12 times for the game are less than 25% of the year 4 times. This makes sense to me because as we grow our memory functions develop so older students should do the memory game faster. 2 1

The year 4's data is visually more spread than the year 12's data. This is true in the middle 50% of the data. The year 4's IQR is exactly double (34 sec) the year 12's IQR (17 sec), which also means a much wider ICI. But to see the overall spread of the data I will use standard deviation. The sd for the year 12's is 14.4s and the sd for the year 4's is 26.8s, almost double. So you can see based on both the standard deviation and IQR, the year 4's data is much more spread.

Most of the year 12s times for the game are tightly packed up but the year 4s times are spread out and there are some large values above 140 sec making it slightly skewed to the right.

The shape of both graphs look unimodal. The year 4's data does look like it could be bimodal because of that spike at around 100 sec and the gap just after 80 sec but the gap is most likely noise and if I was to get a larger sample, that gap and spike would probably flatten out.

Conclusion

I can use my sample to estimate the population medians. Based on the confidence intervals, I can be pretty sure that the median time to find all the pairs in the memory game for year 12's in the 2011 CensusAtSchool is between 41.5 sec and 46.6 sec and the median time for year 4's in 2011 CensusAtSchool is between 60.9 sec and 71.1 sec. The confidence intervals do not overlap so therefore I can confidently infer that the median time to complete the memory game for year 4's in the 2011 CensusAtSchool is longer than the median time to complete the game for year 12's in the 2011 CensusAtSchool. This backs up what my analysis shows. There was a large shift between the two medians, 44 seconds for the year 12's median time and 66 seconds for the year 4's median. This is reasonably big difference.

If I had a smaller sample size, I wouldn't be able to make as good estimates for the population's median and my ICI's would be wider, but I would still be reasonably sure that the population median would be within the ICI's. At some point the sample size would get to small and the ICI's would overlap meaning I would no longer be able to make an inference for the population. However, If I were to take another sample I would most certainly get different statistics (median, upper lower quarters etc, but I would still expect to get the same result most of the time.