Level 1 Data Practice #1

Everett has data from asking students from a Year 11 class and a Year 12 class how many hours a week they spend watching TV on average. His statistics and graphs are shown below.
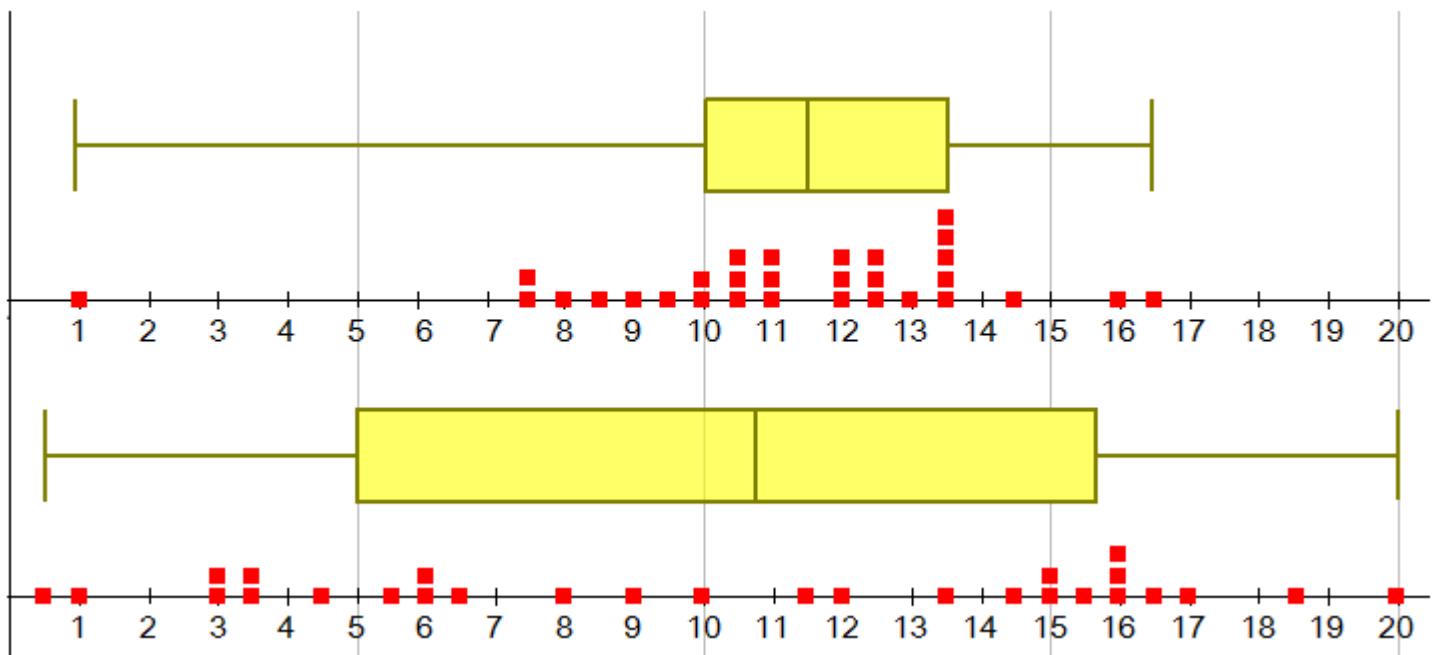
Statistics Calculated

	Year 11	Year 12
Lowest	1	0.5
Q1	10	5
Median	11.5	10.75
Q3	13.5	15.75
Highest	16.5	20
Mean	11.2	10.3

Everett compares the means and sees that the average for Year 11 is higher than for Year 12. His conclusion is that at his school Year 11 students watch more television than Year 12 students.

1. Can Everett's conclusion be justified using the means?

   Give statistical reasons for your answer.

2. Would you reach the same conclusion from the data and statistics?

   Give statistical reasons for your answer.

3. What problems do you see with Everett's calculated statistics and graphs?

4. How might Everett have improved the quality of the data gathered?

Original Data

	Year 11	Year 12
1	1	0.5
2	7.5	1
3	7.5	3
4	8	3
5	8.5	3.5
6	9	3.5
7	9.5	4.5
8	10	5.5
9	10	6
10	10.5	6
11	10.5	6.5
12	10.5	8
13	11	9
14	11	10
15	11	11.5
16	12	12
17	12	13.5
18	12	14.5
19	12.5	15
20	12.5	15
21	12.5	15.5
22	13	16
23	13.5	16
24	13.5	16
25	13.5	16.5
26	13.5	17
27	13.5	18.5
28	14.5	20
29	16	
30	16.5	

Answers: Level 1 Data Practice #1

These answers are a guide only, as a range of answers is possible.

1. No, Everett cannot make this call.

    Because the mean for Year 11 is higher does not mean we can say something like "they watch more television", only that a typical person might.

    Mean is not a good measure for typical when the data isn't "normal" (centred evenly around a middle peak). The data for the Year 12s definitely isn't normal – it is bimodal.

    The difference in means is not significant compared to the range of values seen.

2. No, I would reach the conclusion that we cannot tell which Year typically watches more.

    I would use medians rather than means, as they are less likely to be affected significantly by extreme values (such as the person watching 1 hour in Year 11).

    The median for Class 1 is 0.75 more than that for Class 2, but that is not a significant difference. The medians are inside the IQRs so we cannot make a call from these classes to the population (Year 11/12 at the school). We would need much larger sample sizes to make a call for the population for such a small difference in IQR compared to the OVS.

3. There is an outlier of 1 hour for the Year 11s which affects the mean time by dragging it quite a bit lower than the typical score (but does not affect the median, which is unaffected by extreme values). This is another reason to use medians not means.

    It would be useful to mark the extreme value for the Year 11s with a dot, and stop the whisker for the box plot at 7.5, to show that the whisker is that long only because of one extreme value.

    (The values at the ends of the Year 12 plots are definitely not outliers, as there are other values quite close.)

    Using measures of central values like medians and means is not very useful when the data is bimodal, as the Year 12 data is.

    Note: there is no problem with the samples being different sizes – the use of the correct statistical measures overcomes this.

4. The use of whole classes probably does not give representative samples, as those students in a particular class are likely to be similar to each other. Ideally a random sample across all Year 11 and Year 12 students should be taken.

    People are poor judges of what they do on average, and asking this sort of question is likely to introduce bias. Everett should have got the students to record exactly how much they watched for a week.

    A single week may not be representative of the year. Ideally a spread of weeks – some school weeks and some holidays should be taken.

    There is no need to round the time to the nearest half hour.

    Note: because it is too obvious to state that bigger sample sizes are better, the markers are unlikely to award students much for saying this.

It is important that students use the correct terms: range, IQR, outlier, bimodal, normal, bias, representative etc.