Online practice assessment task for AS91037 (1.12)

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Demonstrate understanding of chance and data

Chapter 8

Externally assessed
4 credits

Practice assessment task

1. Tami is a Year 10 student, and her sister is in Year 13. Tami wondered how reaction times for Year 10 students compared with reaction times for students in Year 13.

Tami selected a class of Year 10 students and a class of Year 13 students and got them to complete an online reaction test, which timed reactions in seconds to two decimal places.

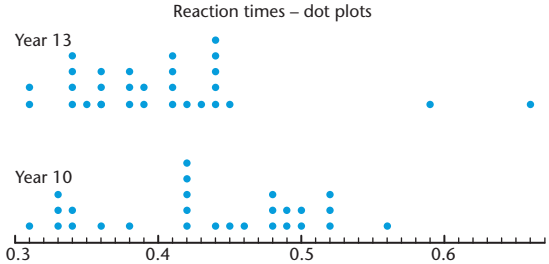
Tami cleaned the data (removing a 0 score and any scores over 1 second) then drew graphs and calculated statistics as shown below.

Reaction times (cleaned data)	
Year 10	Year 13
0.33	0.44
0.50	0.35
0.48	0.31
0.33	0.38
0.49	0.34
0.42	0.44
0.52	0.34
0.34	0.41
0.38	0.36
0.44	0.42
0.52	0.31
0.50	0.43
0.48	0.41
0.42	0.36
0.52	0.34
0.42	0.34
0.56	0.39
0.36	0.38
0.34	0.41
0.33	0.45

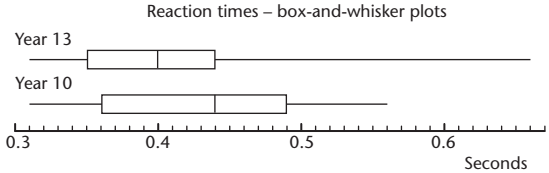
Reaction times (cleaned data)	
Year 10	Year 13
0.48	0.44
0.31	0.44
0.49	0.41
0.45	0.66
0.42	0.38
0.46	0.36
0.42	0.39
	0.59
	0.44

Reaction times (cleaned)		
	Year 10	Year 13
mean	0.43	0.40
median	0.44	0.40
mode	0.42	0.44
min	0.31	0.31
LQ	0.36	0.35
UQ	0.49	0.44
max	0.56	0.66
IQR	0.13	0.09
range	0.25	0.35
std dev	0.07	0.07

Reaction times – dot plots



Reaction times – box-and-whisker plots



Tami then reported her findings as follows:

Year 10 students' reaction times are faster than those of Year 13 students because the most common time of 0.42 seconds for Year 10 students was 0.02 seconds faster than the most common time for Year 13 students of 0.44 seconds. Also, the maximum score for Year 13 was 0.66 seconds, which was a lot slower than the maximum score of 0.56 seconds for Year 10 students.

Comment on the report that Tami produced for her investigation. Make at least four statements that evaluate what Tami did and the conclusions she reached.

2. A video store is running a promotion. Each DVD that is hired comes with a mystery envelope containing a code. The code is a letter followed by a number.

- The letter is A, B, C, D or E
- The number is 0, 1 or 2

For example a code might be B1 or C0.

There are equal numbers of the letters A–E in circulation.

The numbers 0, 1 and 2 appear in codes in the ratio 3:2:1.

a. What is the probability that an envelope contains a code with:

i. B in it?

ii. 2 in it?

iii. the code B2 in it?

The letters A, B, C, D and E correspond to different categories of DVD, eg A is a recent release, B is comedy, and so on. If the number is:

- 0 – no free DVDs hire is won
- 1 – then 1 free DVD hire is won (of the type defined by the letter)
- 2 – then 2 free DVD hires are won (of the type defined by the letter)

The store claims that there is a $\frac{2}{3}$ chance of winning a prize.

b. Do you agree or disagree with the store's claim? Explain why you would agree or disagree.

3. Two fair 6-sided dice have their faces painted.

- The first die has only red or green faces.
- The second die has faces coloured red, green, blue or yellow.

The dice are rolled together 150 times and the resulting combinations of colours are counted. The table shows the outcomes.

1st die \ 2nd die	red	green	blue	yellow
red	39	19	42	22
green	7	5	10	6

a. Estimate the probability that on the next roll the result will be:

i. a red and a yellow face

ii. a red and a green face

iii. both faces the same colour

iv. two different colours

v. red on neither face

b. The two dice show the same colour. Estimate the probability that the colour is green.

c. Estimate the probability that if there are no red faces showing, then there is a yellow face showing.

d. Work out how many red faces are on the 2-colour die. Explain your answer fully.

A second 2-colour die is also painted red and green. The two 2-colour dice are rolled together 60 times and the results shown in the table.

Both red	One of each	Both green
17	36	7

e. Estimate the probability of getting two colours the same.

f. What is the most likely number of red faces on the second 2-colour die? Explain.

Answers

1. *Answers will vary, an example is given.*

The mode and maximum times were selected for Tami's conclusions, possibly because they were faster times for the Year 10s than the Year 13s. However, these are not robust measures to use for comparisons as their values can rapidly change with new data (when cleaning the data Tami had previously removed larger scores over 1 second, which were the original maximum values). It would be better to use the mean and median times as a basis for comparison, both of which are faster for the Year 13 students.

Both the IQR and the standard deviation suggest that the Year 13s are also more consistent than the Year 10s although the range would suggest that the Year 10s are more consistent overall. However, the Y13 range was affected by the inclusion of one score of 0.66 seconds (if this score were removed, then the range for Y13 would be the same as the range for Y10).

The sample was from two classes, but it was unknown if these classes were randomly selected, or that Tami's school offered a typical cross-section of Y10 and Y13 students. It is therefore difficult to know how generally Tami's results can be applied to the population of all Y10 and Y13 students. The experiment may not have been correctly explained or supervised since a few unusual results had to be cleaned from the data (times over 1 second, and a time of 0 seconds).

2. a. i. $\frac{1}{5}$ **ii.** $\frac{1}{6}$ **iii.** $\frac{1}{30}$

b. The table shows the number of prizes for the possible combinations (the numbers appear in the correct ratio). The chance of winning no prize is $\frac{1}{2}$ (see table).

	A	B	C	D	E
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
1	1	1	1	1	1
1	1	1	1	1	1
2	2	2	2	2	2

However, 20 free hires are won out of every 30 possibilities, so it could be argued that the probability of a win is 20 out of 30 or $\frac{2}{3}$.

3. a. i. $\frac{22}{150}$ or $\frac{11}{75}$

ii. $\frac{26}{150}$ or $\frac{13}{75}$

iii. $\frac{44}{150}$ or $\frac{22}{75}$

iv. $\frac{106}{150}$ or $\frac{53}{75}$

v. $\frac{21}{150}$ or $\frac{7}{50}$

b. $\frac{5}{44}$

c. $\frac{6}{21}$ or $\frac{2}{7}$

d. *Answers will vary, an example is given.*
The ratio of red faces to green is 122:28 (adding rows) which is approximately 125:25 or 5:1, so estimate 5 red faces and 1 green face.

e. $\frac{2}{5}$

f. *Answers will vary, an example is given.*
Assume the first die has 5 red faces. Let p be the proportion of red on the second 2-colour die. $\frac{5}{6}$ of the faces on the first 2-colour die are red, so the probability of two reds in a row is $\frac{5}{6}p$.

$\frac{5}{6}p$ is approximately $\frac{17}{60}$. Solving gives $p = 0.34$. The most likely number of red faces on the second 2-colour die is 2. (0.34 of 6 is 2.04 which rounds to 2.)