

Test of Hypothesis – GCSE Statistics**1. No.6**

When some people eat a bacon sandwich, they have

- brown sauce on it
- red sauce on it
- no sauce on it.

Bob and Lisa decide to test the hypothesis

“The majority of people who have a bacon sandwich have red sauce on it.”

(a) Bob’s work canteen sells bacon sandwiches.

One morning, 300 people use the canteen for breakfast.

Bob decides to sample 30 of the 300 people to see which sauce, if any, they have on their bacon sandwich, if they buy one.

(a) (i) Describe how Bob could obtain a systematic sample of 30 people from the 300

[2 marks]

(a) (ii) Give **two** reasons why the sample Bob is obtaining is unlikely to be very useful in testing out the hypothesis.

[2 marks]

Reason 1 _____

Reason 2 _____

- (b) Lisa uses random sampling from those who eat bacon sandwiches at her local café to obtain the following data.

Type of sauce	Brown	Red	No sauce
Frequency	24	21	5

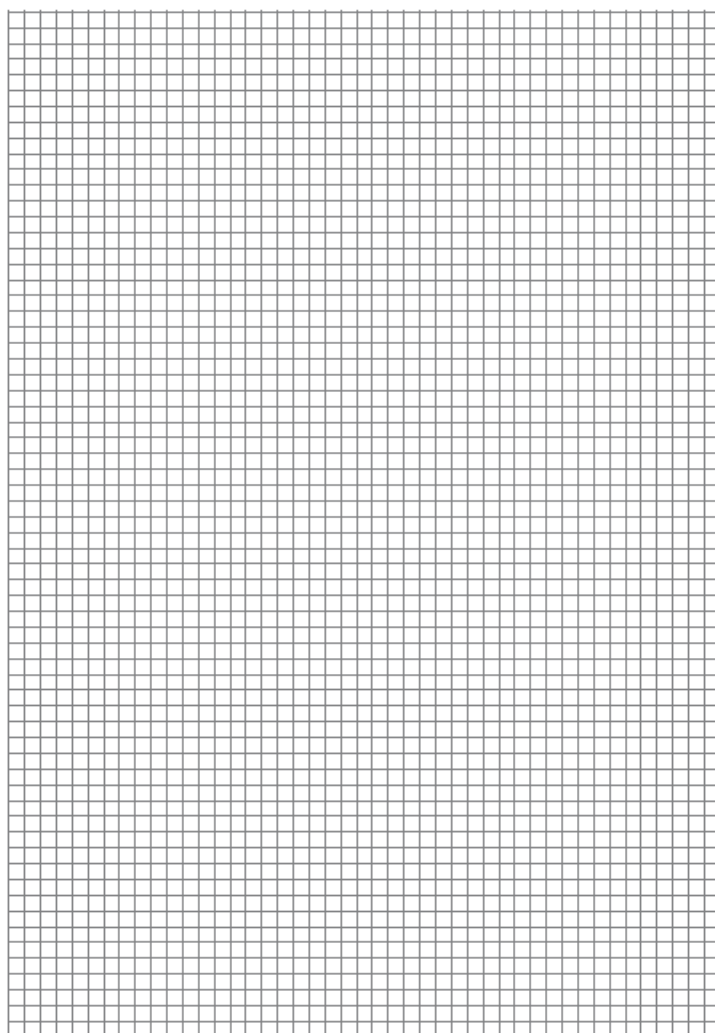
- (b) (i) There is only one type of average available for the data.
Name the average and write down its answer.

[2 marks]

Name of average _____ Answer _____

- (b) (ii) On the blank grid below, draw a suitable fully labelled graph for these data.

[4 marks]



- (c) Using these data, write an appropriate conclusion for the hypothesis in part (a).

[1 mark]

2. No.9

Poppy wants to buy a season ticket at her local football club.

This will give her entry to all 20 home games over the season.

The table shows the cost of season tickets for the areas she is interested in.

Area	Cost if bought in July	Cost if bought in August
South Stand	£200	£220
West Stand	£175	£195
East Stand	£240	£250

- (a) What is the cost of a West Stand season ticket bought on 15 August?

[1 mark]

Answer £ _____

- (b) There is a 10% chance that Poppy will miss a home game.

- (b) (i) How many of the 20 home games will Poppy expect to miss next season?

[2 marks]

Answer _____

- (b) (ii) Poppy wants to sit in the **East Stand**.

The price of a ticket for Poppy for each home game would be £16

However, on 30 July she decides to buy a season ticket.

How much will she expect to save by buying the season ticket?

[3 marks]

Answer £ _____

- (c) Poppy thinks the tickets at her club are more expensive than at other clubs in the same league.

She decides to investigate this.

Write down a possible hypothesis she could use.

[1 mark]

- (d) Identify the population for her investigation.

[1 mark]

- (e) Poppy decides to carry out a census.

What does that mean in this context?

[1 mark]

(f) Here are some options for how Poppy might obtain appropriate data.

A – write a questionnaire and send it to all the other clubs

B – phone each of the other clubs and interview someone from the club

C – log on to the website of each club to try to find out the data

D – ask a season ticket holder from each club what they paid

(f) (i) Circle the letter of the best option for obtaining appropriate data.

[1 mark]

A

B

C

D

(f) (ii) For **two** of the options you did not choose, give a reason, different each time, why you did not choose that option.

[2 marks]

Option _____

Reason _____

Option _____

Reason _____

(f) (iii) For the option you **did** choose, state one issue that might arise during the process of collecting the data.

[1 mark]

(f) (iv) Describe one strategy to overcome the issue you said might arise in **part (iii)**.

[1 mark]

3. No.8

A deadly disease currently has no treatment.

A researcher develops a drug which she believes will treat the disease.

She suggests a statistical experiment to test her drug.

Infect six people chosen at random with the disease.

Give the drug to all six people.

Record whether each person recovers or not.

- (a) Write down **two** problems with the researcher's experiment.

[2 marks]

Problem 1 _____

Problem 2 _____

- (b) The researcher carries out a more suitable experiment.

She writes an article for a magazine to highlight her results.

She gives the name of each patient in the experiment and records how they responded to the drug.

The magazine editor asks the researcher to rewrite her article.

Explain why.

[1 mark]

4. No.14

The tables show the **mean** number of portions of fruit and vegetables eaten per day by children and adults of different ages and gender in England.

Children

	Age (years)				
	5–7	8–10	11–13	14–15	All ages
Females	3.3	3.2	3.5	3.2	3.3
Males	3.3	3.5	3.1	2.9	3.2
All children	3.3	3.4	3.3	3.0	3.2

Adults

	Age (years)							
	16–24	25–34	35–44	45–54	55–64	65–74	75+	All ages
Females	3.2	3.8	3.7	3.7	3.8	3.9	3.4	3.7
Males	2.6	3.4	3.6	3.4	3.5	3.9	3.6	3.4
All adults	2.9	3.6	3.7	3.6	3.7	3.9	3.5	3.5

Source: Adapted from *Health Survey for England*, 2015

- (a) (i) Compare the amount of fruit and vegetables eaten by males **aged 14–15** with the amount eaten by females of the same age.

[1 mark]

- (a) (ii) Write **two** comparisons of the amount of fruit and vegetables eaten by different ages of **adults**.

[2 marks]

Comparison 1 _____

Comparison 2 _____

Natalie wants to investigate how many portions of fruit and vegetables students in her year group at school eat.

The table shows the number of students of each gender in her year group.

Gender	Number
Males	99
Females	121

Natalie decides to interview a sample of 40 students.

She decides to **stratify** by gender.

- (b) Explain why it is sensible for Natalie to stratify by gender.

[1 mark]

- (c) Show that Natalie should select 18 male students from her year group.

[2 marks]

- (d) Natalie's friend suggests she should interview students in her year group eating school dinners.

Explain why this could give biased results.

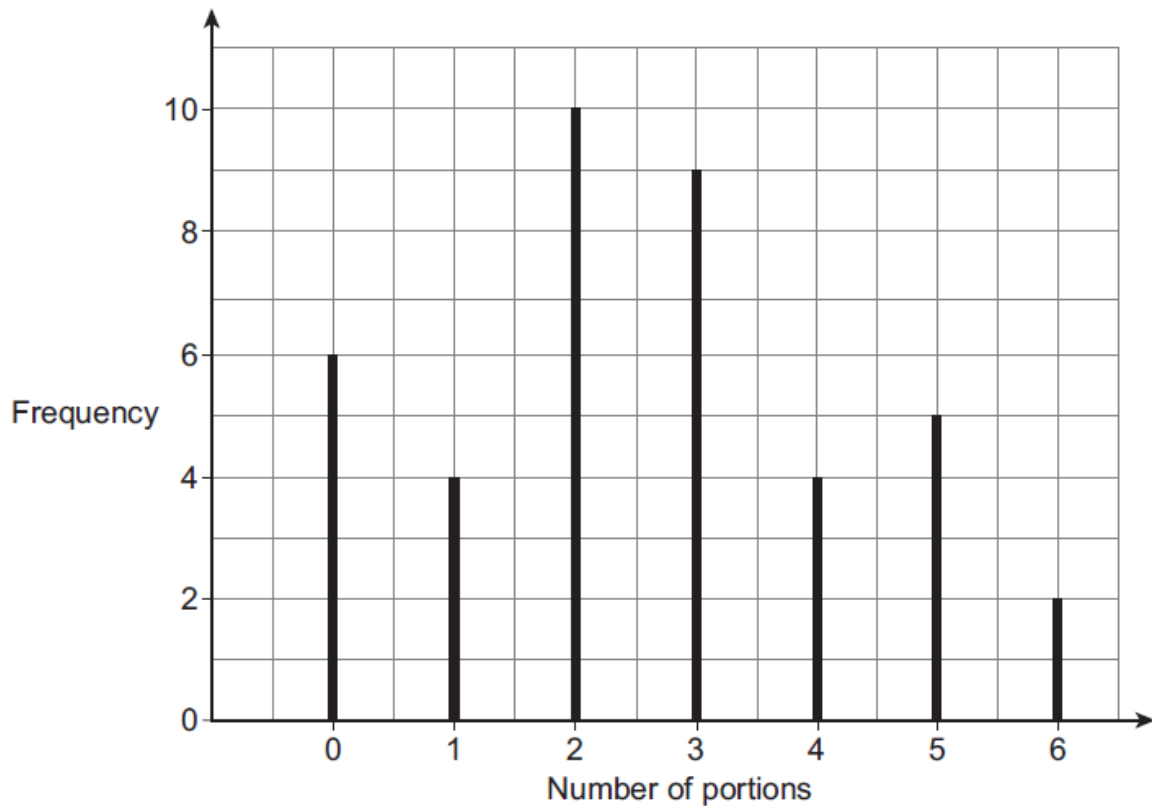
[1 mark]

Natalie decides to select 18 male students and 22 female students at random from her year group.

She asks each student,

“How many portions of fruit and vegetables did you eat yesterday?”

The bar line graph shows the number of portions of fruit and vegetables eaten by the 40 students in her sample.



It is recommended that everyone should eat at least 5 portions of fruit and vegetables every day.

- (e) Calculate an estimate of the percentage of students in Natalie's year group that ate at least 5 portions.

[2 marks]

Answer _____ %

Students in Natalie's year are aged **14–15 years**.

- (f) Compare the number of portions of fruit and vegetables eaten by students in Natalie's year with the corresponding figure for England.

You should,

- use the information from the bar line graph on page 24 and the information from the table on page 22
- calculate an appropriate average.

[5 marks]

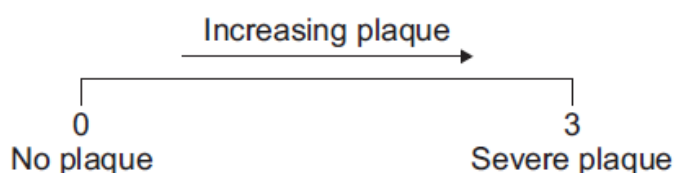
- (g) Suggest **two** things that Natalie could have done to make her comparison more reliable.

[2 marks]

Suggestion 1 _____

Suggestion 2 _____

At the end of the two months, he calculates a plaque score for each patient's teeth using a 0 to 3 continuous scale.

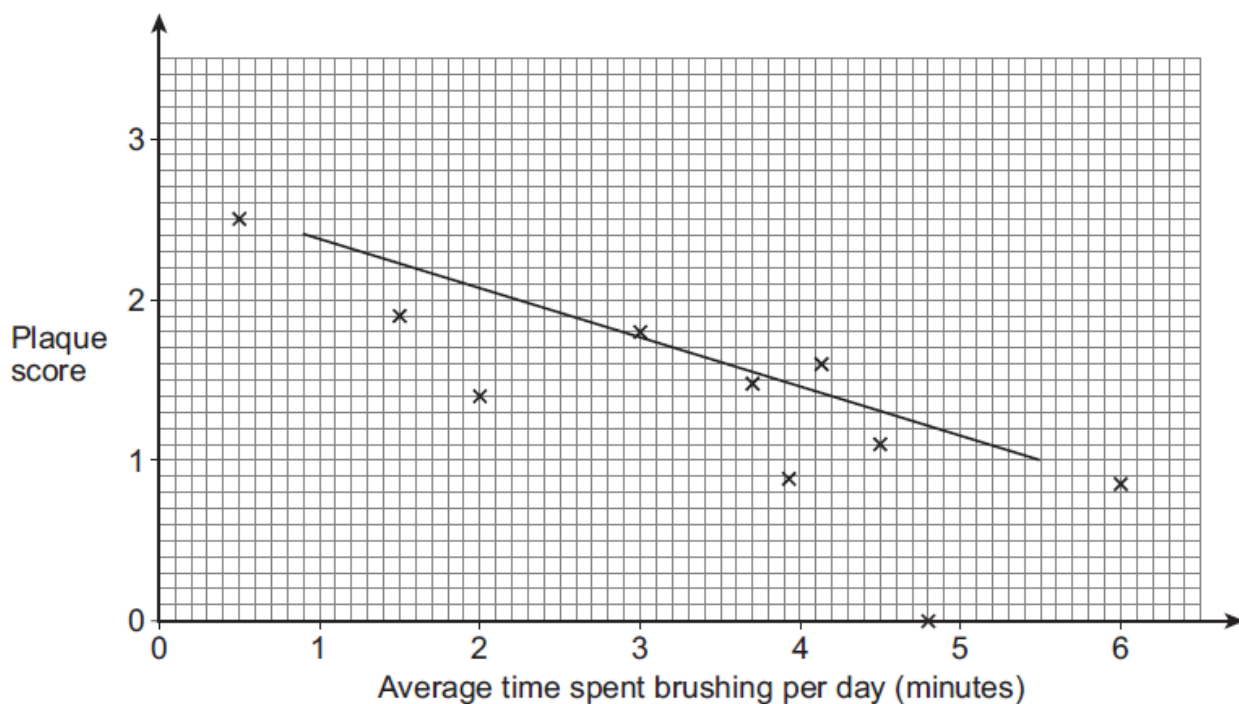


- [1 mark]

Answer _____

- [1 mark]

- (c) He draws this scatter diagram to show the data he collects and adds a line of best fit.



Write down **two** different problems with Tim's line of best fit.

[2 marks]

Problem 1 _____

Problem 2 _____

- (d) Ellie, another dentist, does the same experiment with some of her patients. She draws a line of best fit on her scatter diagram.

The equation of her line is $y = 2.7 - 0.43x$ where,

y is plaque score

x is average time spent brushing **per day** (minutes)

- (d) (i) Ellie suggests that her patients should brush their teeth **twice** a day for an average of 2 minutes each time.

Estimate the plaque score for a patient who follows Ellie's advice.

[2 marks]

Answer _____

- (d) (ii) Ellie collects her data from 12 patients.

She ranks her data and finds that $\sum d^2 = 520$

Calculate the value of Spearman's rank correlation coefficient.

Use $r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$

[2 marks]

Answer _____

- (e) Tim collects plaque data for some different patients.
He also asks them to record the average time they spend showering each day.
The Spearman's rank correlation coefficient for his data is -0.76
He concludes,

"People can reduce their plaque score by spending more time in the shower every day."

Is Tim's conclusion valid?

Tick (✓) a box.

Yes

☐

No

☐

Give a reason for your answer.

[1 mark]
