

Getting ready for A Level Maths

Week 8 – Statistics

Week 8 - Statistics

- * Welcome to week 8 – the final week.
- * The key statistical techniques from GCSE are the start of your studies in Statistics for A level. The A level ‘Class Wizz’ calculator can help speed up any calculations that are needed. If you don’t have one already wait until you start in September to find out the model and any deals available.
- * This PowerPoint contains some A level questions on the following:
 - * Calculating averages
 - * Cumulative frequency and boxplots
 - * Histograms
 - * Venn diagrams
- * No examples this time, look back over your GCSE notes if you need to.

Sunita and Shelley talk to one another once a week on the telephone. Over many weeks they recorded, to the nearest minute, the number of minutes spent in conversation on each occasion. The following table summarises their results.

Time (to the nearest minute)	Number of Conversations
5–9	2
10–14	9
15–19	20
20–24	13
25–29	8
30–34	3

Calculating averages

Two of the conversations were chosen at random.

(a) Find the probability that both of them were longer than 24.5 minutes.

The mid-point of each class was represented by x and its corresponding frequency by f , giving $\Sigma fx = 1060$.

(b) Calculate an estimate of the mean time spent on their conversations.

During the following 25 weeks they monitored their weekly conversations and found that at the end of the 80 weeks their overall mean length of conversation was 21 minutes.

(c) Find the mean time spent in conversation during these 25 weeks.

(d) Comment on these two mean values.

Calculating averages - answers

(a) $P(\text{both longer than 24.5}) = \frac{11}{55} \times \frac{10}{54} = \frac{1}{27}$ or $0.\dot{0}\dot{3}\dot{7}$ or 0.037

(b) Estimate of mean time spent on their conversation is

$$\bar{x} = \frac{1060}{55} = 19\frac{3}{11} \text{ or } 19.\dot{2}\dot{7} \text{ or } 19.3$$

1060 / total, awrt 19.3 or 19 mins 16s

(c) $\frac{1060 + \sum fy}{80} = 21$

$$21 \times 80 = 1680$$

$$\sum fy = 620$$

Subtracting 'their 1060'

$$\therefore \bar{y} = \frac{620}{25} = 24.8$$

Dividing their 620 by 25

(d) Increase in mean value

Length of conversation increased considerably

During 25 weeks relative to 55 weeks

*Context-ft only from **comment** above*

Boxplots

The number of bags of potato crisps sold per day in a bar was recorded over a two-week period. The results are shown below.

20, 15, 10, 30, 33, 40, 5, 11, 13, 20, 25, 42, 31, 17

- (a) Calculate the mean of these data. (2)
- (b) Draw a stem and leaf diagram to represent these data. (3)
- (c) Find the median and the quartiles of these data. (3)

An outlier is an observation that falls either $1.5 \times$ (interquartile range) above the upper quartile or $1.5 \times$ (interquartile range) below the lower quartile.

- (d) Determine whether or not any items of data are outliers. (3)
- (e) On graph paper draw a box plot to represent these data. Show your scale clearly. (3)
- (f) Comment on the skewness of the distribution of bags of crisps sold per day. Justify your answer. (2)

(Total 16 marks)

Boxplots - answers

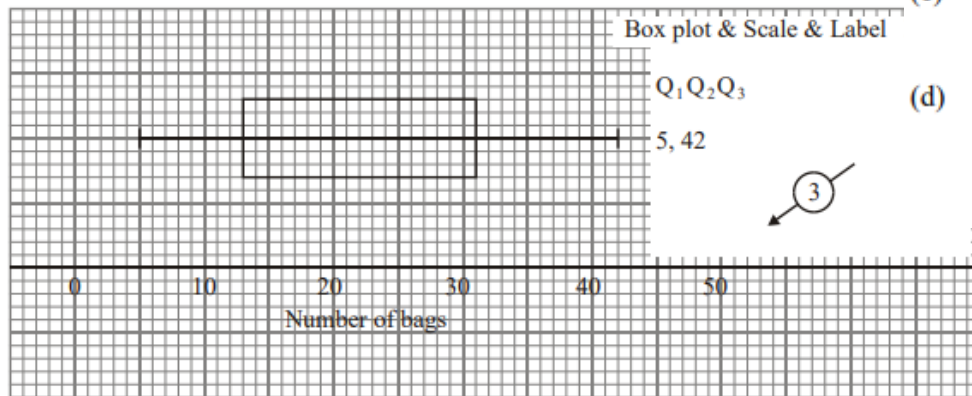
(a) $\bar{x} = \frac{20+15+\dots+17}{14} = \frac{312}{14} = 22.2857\dots$ (awrt 22.3)

(b)

Bags of crisps	1/0 means 10	Total
0	5	(1)
1	0 1 3 5 7	(5)
2	0 0 5	(3)
3	0 1 3	(3)
4	0 2	(2)

*Label & key
2 correct rows
All correct*

(e)



(c) $Q_2 = 20; Q_1 = 13; Q_3 = 31$

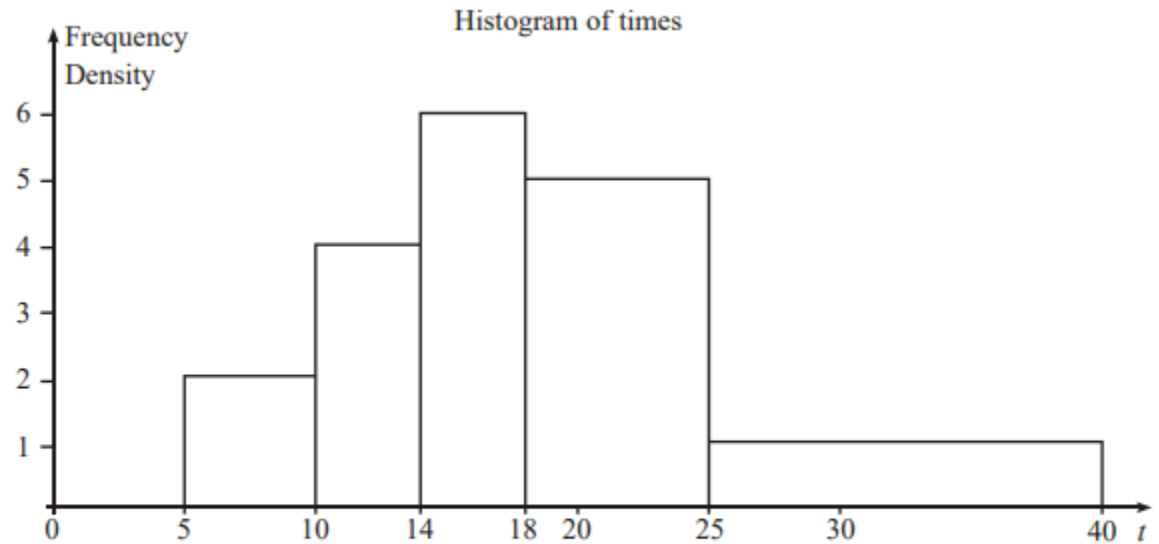
(d) $1.5 \times \text{IQR} = 1.5 \times (31 - 13) = 27$ (can be implied)
 $31 + 27 = 58; 13 - 27 = -14$ (both)
 No outliers

(f) $Q_2 - Q_1 = 7; Q_3 - Q_2 = 11; Q_3 - Q_2 > Q_2 - Q_1$
 Positive skew

M1
A1 2

[13]

Histograms



The diagram above shows a histogram for the variable t which represents the time taken, in minutes, by a group of people to swim 500m.

- (a) Complete the frequency table for t .

t	5-10	10-14	14-18	18-25	25-40
Frequency	10	16	24		

- (b) Estimate the number of people who took longer than 20 minutes to swim 500m.
- (c) Find an estimate of the mean time taken.

Histogram - answers

- (a) 18-25 group, area = $7 \times 5 = 35$
25-40 group, area = $15 \times 1 = 15$

- (b) $(25 - 20) \times 5 + (40 - 25) \times 1 = 40$
 5×5 is enough evidence of method for M1.
Condone 19.5, 20.5 instead of 20 etc.
Award 2 if 40 seen.

- (c) Mid points are 7.5, 12, 16, 21.5, 32.5

$$\Sigma f = 100$$

$$\frac{\sum \hat{f}r}{\sum f} = \frac{1891}{100} = 18.91$$

Look for working for this question in part (d) too.

Use of some mid-points, at least 3 correct for M1. These may be tabulated in (d).

Their $\frac{\sum \hat{f}r}{\sum f}$ for M1 and anything that rounds to 18.9 for A1.

Venn Diagrams

There are 180 students at a college following a general course in computing. Students on this course can choose to take up to three extra options.

112 take systems support,
70 take developing software,
81 take networking,
35 take developing software and systems support,
28 take networking and developing software,
40 take systems support and networking,
4 take all three extra options.

(a) Draw a Venn diagram to represent this information.

A student from the course is chosen at random.

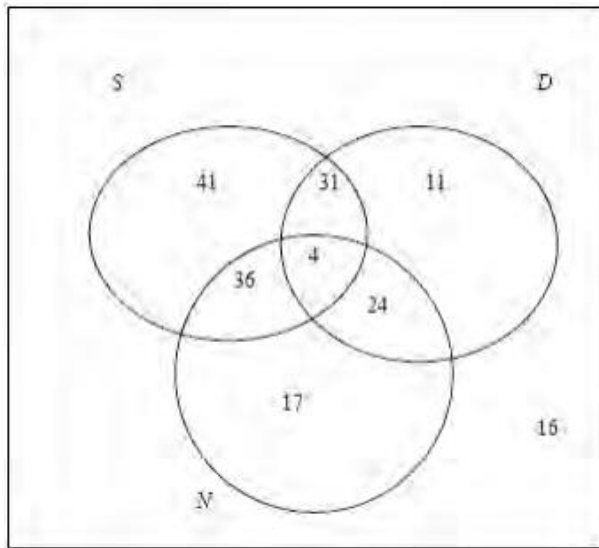
Find the probability that this student takes

(b) none of the three extra options,

(c) networking only.

Venn diagram answers

(a)



3 closed curves and 4 in centre

Evidence of subtraction

31,36,24

41,17,11

Labels on loops, 16 and box

M1

M1

A1

A1

B1

$$(b) \quad P(\text{None of the 3 options}) = \frac{16}{180} = \frac{4}{45}$$

$$(c) \quad P(\text{Networking only}) = \frac{17}{180}$$

$$(d) \quad P(\text{All 3 options/technician}) = \frac{4}{40} = \frac{1}{10}$$