h

Answers to Ch. 6 HH Text (2014)

EXERCISE 6A

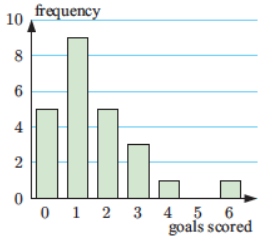
1 a quantitative discrete b categorical
c quantitative continuous d quantitative continuous
e categorical f quantitative discrete g categorical
h quantitative discrete i quantitative continuous
j quantitative continuous k quantitative continuous
l categorical m quantitative discrete

2 a 0, 1, 2, 3, ..., 8 b red, yellow, orange, green, ...
c 0 - 15 minutes d 0 - 25 m
e Ford, BMW, Renault, ... f 1, 2, 3, ..., 20
g Australia, Hawaii, Dubai, ... h 0.0 - 10.0
i 0 - 4 L j 0 - 80 hours k $-20°C$ - $35°C$
l cereal, toast, fruit, rice, eggs, ... m 0, 1, 2, ..., 10

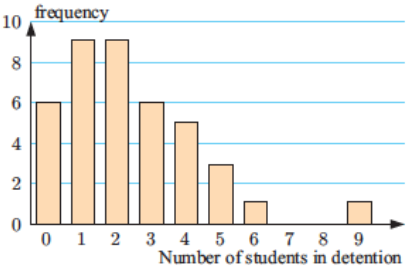
EXERCISE 6B

1 a the number of goals scored in a game
b variable is counted, not measured
c

Goals scored	*Tally*	*Frequency*	*Rel. Frequency*
0	𝍸	5	0.208
1	𝍸 ||||	9	0.375
2	𝍸	5	0.208
3	|||	3	0.125
4	|	1	0.042
5		0	0
6	|	1	0.042
	Total	24	

d 

e 1 goal
f positively skewed, one outlier, (6 goal
g ≈ 20.8%

2 a 

b 1 and 2 c positively skewed, one outlier, (9 dete
d $12\frac{1}{2}\%$

4 a 45 b 1 time c 8 d 20%
e positively skewed, no outliers

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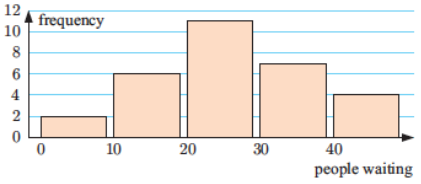
EXERCISE 6C

1 **a**

People waiting	Tally	Frequency	Rel. Freq.
0 - 9	||	2	0.067
10 - 19	𝍸 |	6	0.200
20 - 29	𝍸 𝍸 |	11	0.367
30 - 39	𝍸 ||	7	0.233
40 - 49	||||	4	0.133
	Total	30	

b 2 days **c** $\approx 36.7\%$ **e** 20 - 29 people

d



2 **a** 37 **b** 40 - 49 employees **c** negatively skewed

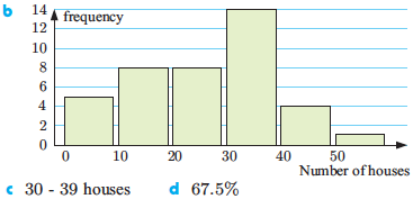
d $\approx 37.8\%$

e No, only that it was in the interval 50 - 59 employees.

3 **a**

Number of houses	Tally	Frequency
0 - 9	𝍸	5
10 - 19	𝍸 |||	8
20 - 29	𝍸 |||	8
30 - 39	𝍸 𝍸 ||||	14
40 - 49	||||	4
50 - 59	|	1
	Total	40

b

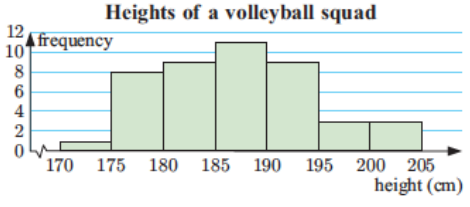


c 30 - 39 houses **d** 67.5%

EXERCISE 6D

1 **a** Height is measured on a continuous scale.

b



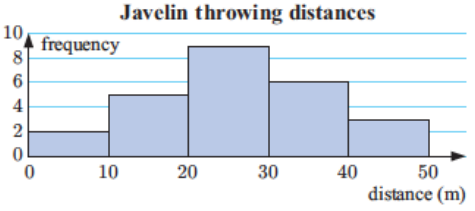
c $185 \leqslant H < 190$ cm. This is the class of values that most often.

d slightly positively skewed

4 **a, b**

Distance (m)	Tally	Frequency
$0 \leqslant d < 10$	||	2
$10 \leqslant d < 20$	𝍸	5
$20 \leqslant d < 30$	𝍸 ||||	9
$30 \leqslant d < 40$	𝍸 |	6
$40 \leqslant d < 50$	|||	3
	Total	25

c



d $20 \leqslant d < 30$ m **e** 36%

h

EXERCISE 6E.1

1 a 1 cup b 2 cups c 1.8 cups 2 9

3 a i 5.61 ii 6 iii 6 b i 16.3 ii 17 iii 18

c i 24.8 ii 24.9 iii 23.5

4 a data set A: 6.46, data set B: 6.85

b data set A: 7, data set B: 7

c The data are the same except for the last value, which pushes the mean of set B up.

d 7 is the middle value in both data sets. It is not affected by extreme values.

5 Ruth (164)

6 a i Pies: 67.1, Pasties: 53.6

ii Pies: 69, Pasties: 52

b Pies, higher mean (more sold), higher median (higher data values)

7 a Bus: mean = 39.7, median = 40.5,
Tram: mean ≈ 49.1, median = 49

b Tram has higher mean and median, but there are more bus trips per day and more people travel by bus in a day, so bus is more popular.

8 a 44 points b 44 points c 40.2 points

d increase, 40.3 points

9 $185 604 10 3144 km 11 17.25 goals 12 $x = 15$

13 $a = 5$ 14 37 15 14.8 16 6, 12 17 7, 9

EXERCISE 6E.2

1 a Mean: $163 770, median: $147 200
Mean has been affected by the extreme values (the two values greater than $200k).

b i the mean ii the median

2 a mean: $29 300, median: $23 500, mode: $23 000

b It is the lowest value in the data set.

c No, it is too close to the lower end of the distribution.

3 a mean: 3.19 mm, median: 0 mm, mode: 0 mm

b The median is not in the centre as the data is positively skewed.

c The mode is the lowest value.

d Yes, 42 and 21. e No

EXERCISE 6E.3

1 a 1 head b 1 head c 1.43 heads

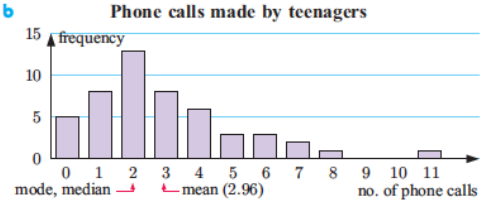
2 a i 2.61 children ii 2 children iii 2 children

b This school has more children per family than average.

c positive d mean is higher than the median, mode

3 a i 2.96 calls ii 2 calls iii 2 calls

b



c positively skewed d Because of the skewness.

e mean

4 a i 49 matches ii 49 matches iii 49.0 matche

b No c Need a larger sample.

5 a i 5.63 peas ii 6 peas iii 6 peas

b i 6.81 peas ii 7 peas iii 7 peas

c all of them d It has improved it.

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EXERCISE 6E.4

1 31.7 2 a 70 b $\approx 411\,000$ L c ≈ 5870 L

3 a 11.5 points b i 11.3 points ii 11.4 points

c ii is closer to the actual mean than i. Smaller class intervals give better estimates.

4 90.1 km h^{-1} 5 768 m^2

6 a 125 people b 119 marks c $\frac{3}{25}$ d 137

EXERCISE 6F

1 a i 6 ii $Q_1 = 4$, $Q_3 = 7$ iii 7 iv 3

b i 17.5 ii $Q_1 = 15$, $Q_3 = 19$ iii 14 iv 4

c i 24.9 ii $Q_1 = 23.5$, $Q_3 = 26.1$ iii 7.7 iv 2.6

2 a median = 2.45 min, $Q_1 = 1.45$ min, $Q_3 = 3.8$ min

b range = 5.2 minutes, IQR = 2.35 minutes

c i 2.45 min ii 3.8 min iii 0, 5.2, 5.2

3 a 6 b 28 c 15 d 12 e 21 f 22 g 9

4 a i 124 cm ii $Q_1 = 116$ cm, $Q_3 = 130$ cm

b i 124 cm ii 130 cm c i 29 cm ii 14 cm

d 14 cm

5 a i 7 peas ii 6 peas iii 5 peas iv 7 peas v 2 peas

b i 10 peas ii 7 peas iii 6 peas iv 8 peas

v 2 peas

c The fertiliser does improve the yield of peas.

EXERCISE 6G.1

1 a i 35 points ii 78 points iii 13 points

iv 53 points v 26 points

b i 65 points ii 27 points

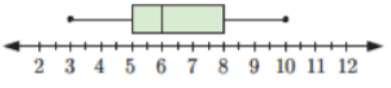
2 a i 98, 25 marks ii 70 marks iii 85 marks

iv 55, 85 marks

b 73 marks c 30 marks d 67 marks

3 a i min = 3; $Q_1 = 5$; med = 6; $Q_3 = 8$; max = 10

ii

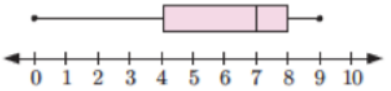


iii 7

iv 3

b i min = 0, $Q_1 = 4$; med = 7; $Q_3 = 8$, max = 9

ii

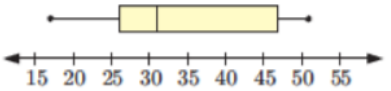


iii 9

iv 4

c i min = 17, $Q_1 = 26$; med = 31; $Q_3 = 47$, max = 51

ii



iii 34

iv 21

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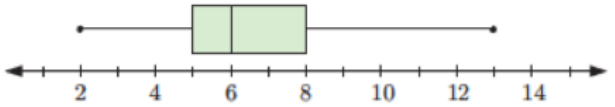
4 **a** median $= 6$, $Q_1 = 5$, $Q_3 = 8$ **b** 3

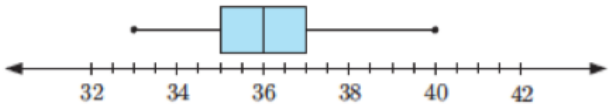
c



5 **a** min $= 33$, $Q_1 = 35$, med $= 36$, $Q_3 = 37$, max $= 40$

b **i** 7 **ii** 2

c



d No

EXERCISE 6G.2

1 **a**

Statistic	*Year 9*	*Year 12*
minimum	1	6
Q_1	5	10
median	7.5	14
Q_3	10	16
maximum	12	17.5

b **i** Year 9: 11, Year 12: 11.5

ii Year 9: 5, Year 12: 6

c **i** cannot tell **ii** true since Year 9 Q_1 < Year 12 min.

2 **a** Friday: min $= \$20$, $Q_1 = \$50$, med $= \$70$, $Q_3 = \$100$, max $= \$180$

Saturday: min $= \$40$, $Q_1 = \$80$, med $= \$100$, $Q_3 = \$140$, max $= \$200$

b **i** Friday: \$160, Saturday: \$160

ii Friday: \$50, Saturday: \$60

3 **a** **i** Class 1 (96%) **ii** Class 1 (37%) **iii** Class 1

b 18 **c** 55 **d** **i** 25% **ii** 50%

e **i** slightly positively skewed **ii** negatively skewed

f .... class 2, ... class 1

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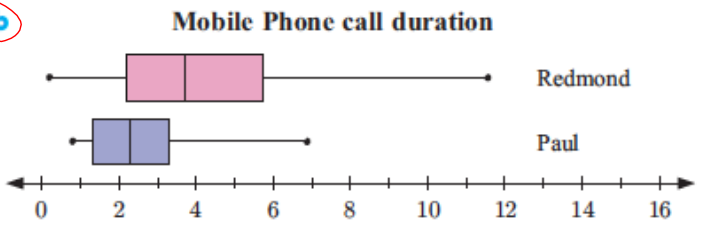
4 a Paul: min = 0.8; $Q_1 = 1.3$; med = 2.3; $Q_3 = 3.3$; max = 6.9

Redmond: min = 0.2; $Q_1 = 2.2$; med = 3.7; $Q_3 = 5.7$; max = 11.5

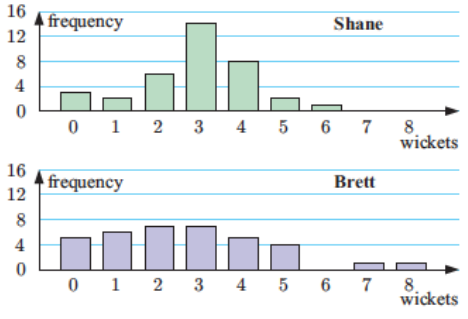
b



c Both are positively skewed (Redmond's more so than Paul's). Redmond's phone calls were more varied in duration.

5 a discrete

c

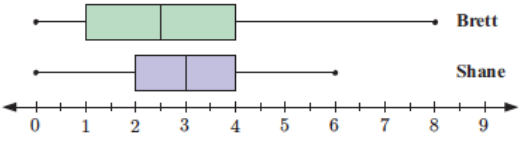


d Shane: approximately symmetrical Brett: positively skewed.

e Shane: mean ≈ 2.89, median = 3, mode = 3
Brett: mean ≈ 2.67, median = 2.5, mode = 2, 3
Shane's mean and median are slightly higher.
Shane has a clear mode of 3, whereas Brett has two modes (2 and 3)

f Shane: Range = 6, IQR = 2
Brett: Range = 8, IQR = 3
Shane's data set demonstrates less variability than Brett's.

g



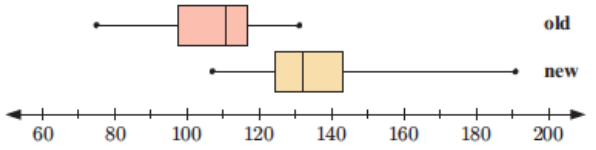
h Shane is more consistent with his bowling (in terms of wickets taken) than Brett.

h

6 a continuous (the data is measured)

c Old: mean = 107, median = 110.5, range = 56, IQR = 19, min = 75, max = 131
New: mean = 134, median = 132, range = 84, IQR = 18.5, min = 107, max = 191
The 'new' type of light globe has a higher mean and median than the 'old' type.
The IQR is relatively unchanged going from 'old' to 'new', however, the range of the 'new' type is greater, suggesting greater variability.

d



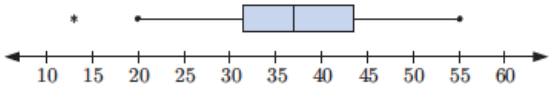
e Old type: negatively skewed, New type: positively skewed

f The 'new' type of light globes do last longer than the old type. Each number in the 5-number summary is at least 20% greater in the 'new' type. The manufacturer's claim appears to be valid.

EXERCISE 6G.3

1 a 12 b lower: 13.5, upper: 61.5 c 13

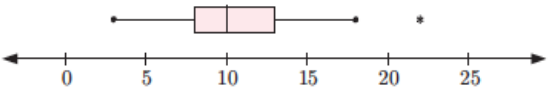
d



2 a median = 10, $Q_1 = 8$, $Q_3 = 13$ b 5

c lower = 0.5, upper = 20.5 d Yes, 22

e



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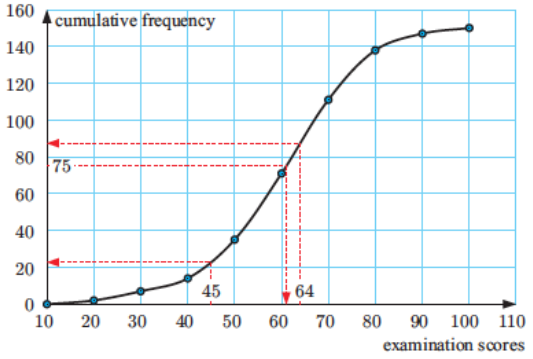
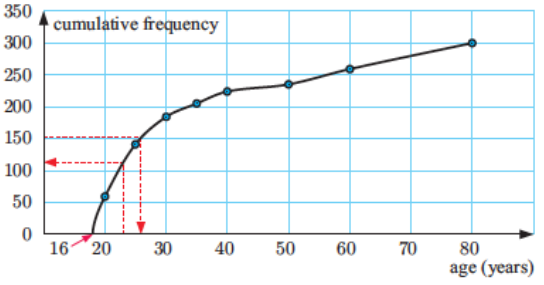
1



a ≈ 61 marks **b** ≈ 87 students **c** ≈ 76 students
d ≈ 23 students **e** 79 marks

2 **a** 9 **b** ≈ 28.3% **c** 7.1 cm **d** ≈ 2.4 cm
e 90% of the seedlings are shorter than 10 cm.

3

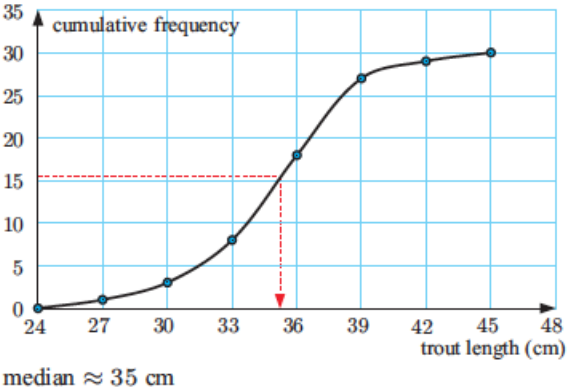


a 26 years **b** 36% **c** **i** 0.527 **ii** 0.0267

4 **a**

Length (cm)	*Frequency*	*Cumulative frequency*
$24 \leqslant x < 27$	1	1
$27 \leqslant x < 30$	2	3
$30 \leqslant x < 33$	5	8
$33 \leqslant x < 36$	10	18
$36 \leqslant x < 39$	9	27
$39 \leqslant x < 42$	2	29
$42 \leqslant x < 45$	1	30

b



c median ≈ 35 cm
d median = 34.5. Median from graph is a good approximation.

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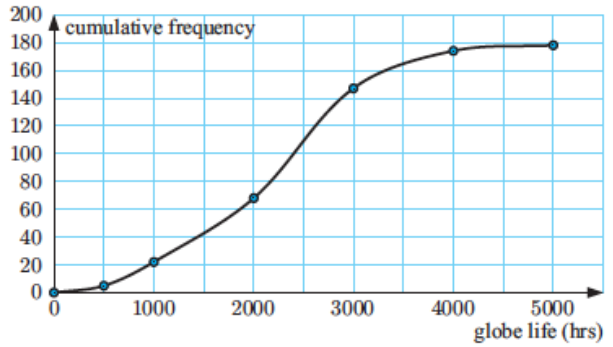
5 a 27 min b 29 min c 31.3 min
d 4.3 min e ≈ 28 min

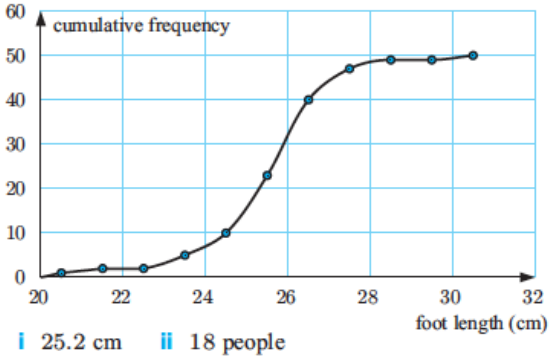
6 

a ≈ 2270 hours b ≈ 69% c ≈ 63

7 a $19.5 \leqslant l < 20.5$

b

Foot length (cm)	*Frequency*	*Cumulative frequency*
$19.5 \leqslant l < 20.5$	1	1
$20.5 \leqslant l < 21.5$	1	2
$21.5 \leqslant l < 22.5$	0	2
$22.5 \leqslant l < 23.5$	3	5
$23.5 \leqslant l < 24.5$	5	10
$24.5 \leqslant l < 25.5$	13	23
$25.5 \leqslant l < 26.5$	17	40
$26.5 \leqslant l < 27.5$	7	47
$27.5 \leqslant l < 28.5$	2	49
$28.5 \leqslant l < 29.5$	0	49
$29.5 \leqslant l < 30.5$	1	50

c 

d i 25.2 cm ii 18 people

h

EXERCISE 61.1

1 a 1.49 b 4.73

2 mean = 55 L, standard deviation ≈ 10.9 L

3 mean ≈ 1.69 kg, standard deviation ≈ 0.182 kg

4 a $\overline{x} = 169$, $s \approx 6.05$ b $\overline{x} = 174$, $s \approx 6.05$

c The distribution has simply shifted by 5 cm. The mean increases by 5 cm and the standard deviation remains the same.

5 a $\overline{x} = 1.01$ kg; $s = 0.17$ b $\overline{x} = 2.02$ kg; $s = 0.34$

c Doubling the values doubles the mean and standard deviation.

6 a 0.809 b 2.8, from volunteer F c 0.150

d the extreme value greatly increases the standard deviation

EXERCISE 61.2

1 $\overline{x} \approx 1.72$ children, $s_n \approx 1.67$ children

2 $\overline{x} \approx 14.5$ years, $s_n \approx 1.75$ years

3 $\overline{x} = 45$ clients, $s_n \approx 3.28$ clients

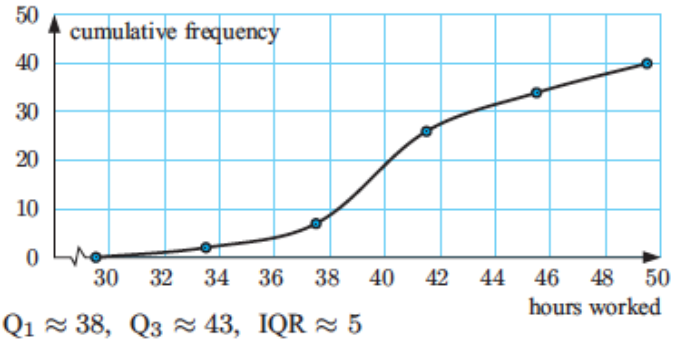
4 $\overline{x} \approx 48.3$ cm, $s_n \approx 2.66$ cm 5 $\overline{x} \approx \$390.30$, $s_n \approx \$15.87$

6 a $\overline{x} \approx 40.4$ hours $s_n \approx 4.23$ hours

b $\overline{x} = 40.6$ hours $s_n \approx 4.10$ hours

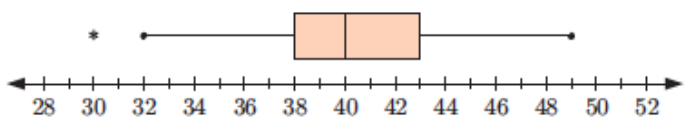
The mean increases slightly, the standard deviation decreases slightly. These are good approximations.

c



$Q_1 \approx 38$, $Q_3 \approx 43$, IQR ≈ 5

d



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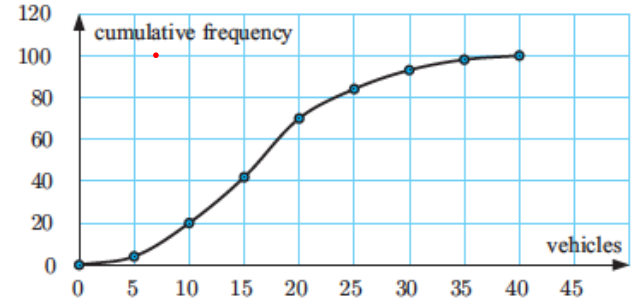
7 a $\overline{x} \approx 17.5$ cars, $s_n \approx 7.87$ cars

b



$Q_1 \approx 11$, $Q_3 \approx 22$, IQR ≈ 11

EXERCISE 61.3

1 a Sample A

b Sample A: mean $= 8$, Sample B: mean $= 8$

c Sample A: $s_n = 2$, Sample B: $s_n \approx 1.06$
Sample B's standard deviation is smaller than Sample A's.
The graph shows the data to be less 'spread out' in Sample B.

2 a Andrew: $\overline{x} = 25$, $s_n \approx 4.97$ b Andrew
Brad: $\overline{x} = 30.5$, $s_n \approx 12.6$

3 a Rockets: mean $= 5.7$, range $= 11$
Bullets: mean $= 5.7$, range $= 11$

b We suspect the Rockets, they have two zeros.

c Rockets: $s_n = 3.9$ ⟵ greater variability
Bullets: $s_n \approx 3.29$

d Standard deviation, as it takes into account all data values.

4 a No, because of random variation

b i the sample mean $\overline{x}$
ii the sample standard deviation s_n

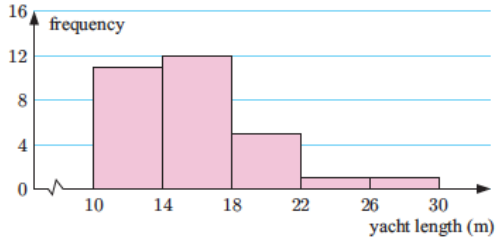
c Less variability in the volume of soft drink per can.

h

REVIEW SET 6A

1 a quantitative discrete b quantitative continuous
c categorical d categorical e categorical
f quantitative continuous g quantitative continuous
h quantitative discrete i quantitative discrete

2 a

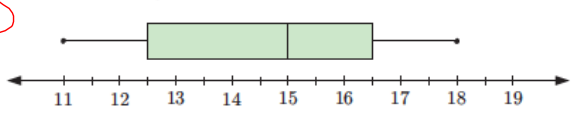


b i median = 14.5 m ii range = 17.3 m
c The data is positively skewed.

3 $a = 2$

4 a negatively skewed b 47.5% c 7.5%
d We do not know all the data values exactly, only the class intervals they fall into.

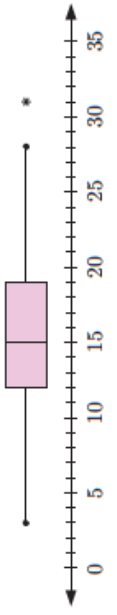
5



6 a 77 days b 12 days

7 a $\bar{x} \approx 122$, $s_n \approx 7.94$ b $\bar{x} \approx 7.01$, $s_n \approx 0.984$

8 a min = 3; $Q_1 = 12$; med = 15; $Q_3 = 19$; max = 31
b range = 28; IQR = 7
c



REVIEW SET 6B

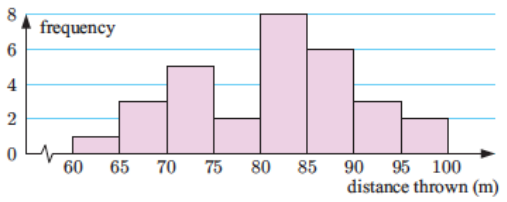
1 a quantitative continous b categorical c categorical
d quantitative continous e quantitative continous
f quantitative discrete g categorical

2 a minimum = 64.6 m, maximum = 97.5 m
b i mean ≈ 81.1 m ii median ≈ 83.1 m

c, d

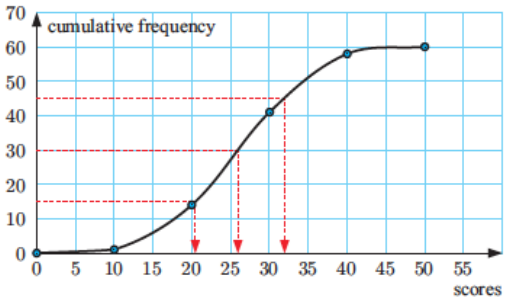
Distance (m)	*Tally*	*Frequency*
$60 \leqslant d < 65$	|	1
$65 \leqslant d < 70$	|||	3
$70 \leqslant d < 75$	𝍸	5
$75 \leqslant d < 80$	||	2
$80 \leqslant d < 85$	𝍸 |||	8
$85 \leqslant d < 90$	𝍸 |	6
$90 \leqslant d < 95$	|||	3
$95 \leqslant d < 100$	||	2
	Total	30

e



h

3 a

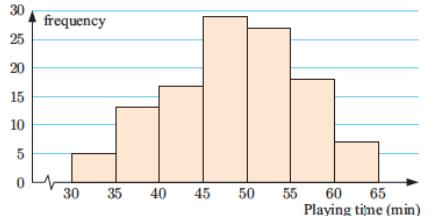


b i median ≈ 26.0 ii IQR ≈ 12
iii $\overline{x} \approx 26.0$ iv $s_n \approx 8.31$

4 a i £352.50 ii £336 iii £365.50
b £29.50 c $\overline{x} \approx$ £350, $s_n \approx$ £17.80

5 a 88 students b $m = 24$

6 a $\overline{x} \approx 48.6$ min, $s_n \approx 7.63$ min
b



c negatively skewed

7 range $= 19$; $Q_1 = 119$; $Q_3 = 130$; $s_n \approx 6.38$

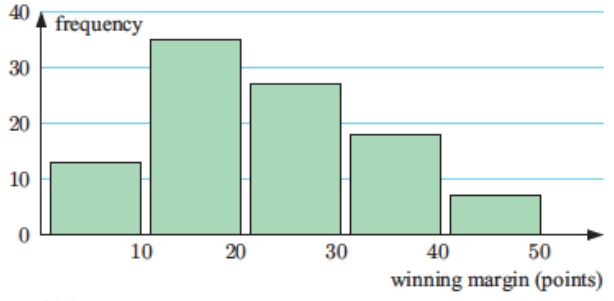
8 a $\overline{x} \approx 29.6$ allsorts, $s_n \approx 1.61$ allsorts
b More investigation is needed.

7 range $= 19$; $Q_1 = 119$; $Q_3 = 130$; $s_n \approx 6.38$
8 a $\overline{x} \approx 29.6$ allsorts, $s_n \approx 1.61$ allsorts
b More investigation is needed.

REVIEW SET 6C

1 $p = 7$, $q = 9$ (or $p = 9$, $q = 7$)

2



3 $\overline{x} \approx 414$ patrons

4 a A: min $= 11$ s; $Q_1 = 11.6$ s; med $= 12$ s;
$Q_3 = 12.6$ s; max $= 13$ s
B: min $= 11.2$ s; $Q_1 = 12$ s; med $= 12.6$ s;
$Q_3 = 13.2$ s; max $= 13.8$ s

b i A: range $= 2.0$ s ii A: IQR $= 1.0$ s
B: range $= 2.6$ s B: IQR $= 1.2$ s

c i A, the median time is lower.
ii B, the range and IQR are higher.

5 $\overline{x} \approx$ €104, $s_n \approx$ €19.40

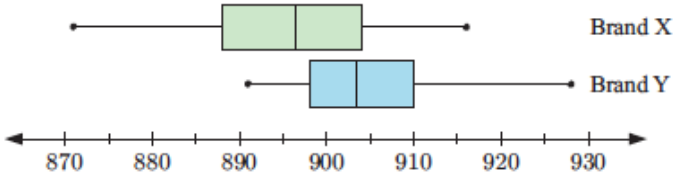
6 a 120 students b 65 marks c 54 and 75
d 21 marks e $\approx 73\%$ f 82 marks

h

7 **a**

	Brand X	*Brand Y*
min	871	891
Q_1	888	898
median	896.5	903.5
Q_3	904	910
max	916	928
IQR	16	12

b



c **i** Brand Y, as the median is higher.

ii Brand X, as the IQR is lower, so less variations.