

- 2 Lakeview and Riverside are two schools. The pupils at both schools took part in a competition to see how far they could throw a ball. The distances thrown, to the nearest metre, by 11 pupils from each school are shown in the following table.

Lakeview	10	14	19	22	26	27	28	30	32	33	41
Riverside	23	36	21	18	37	25	18	20	24	30	25

- (a) Draw a back-to-back stem-and-leaf diagram to represent this information, with Lakeview on the left-hand side. [4]



Key: 0|1|8 means 10m for Lakeview and 18m for Riverside

- (b) Find the interquartile range of the distances thrown by the 11 pupils at Lakeview school. [2]

$$Q_1: \frac{11+1}{4} = 3^{\text{rd}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$\begin{aligned} \text{IQR} &= 32 - 19 \\ &= \underline{13} \end{aligned}$$

- DO NOT WRITE IN THIS MARGIN**

DO NOT WRITE IN THIS MARGIN

- DO NOT WRITE IN THIS MARGIN



- $$Q_1: \frac{15+1}{4} = 4^{\text{th}} \quad Q_2: \frac{15+1}{2} = 8^{\text{th}} \quad Q_3: \frac{3(15+1)}{4} = 12^{\text{th}}$$

$$Q_3 = 59$$

$$\text{IQR} = 59 - 44$$

= 15 minutes

- 3 The Lions and the Tigers are two basketball clubs. The heights, in cm, of the 11 players in each of their first team squads are given in the table.

Lions	178	186	181	187	179	190	189	190	180	169	196
Tigers	194	179	187	190	183	201	184	180	195	191	197

- (a) Draw a back-to-back stem-and-leaf diagram to represent this information, with the Lions on the left. [4]



Key: 8|17|9 means 178cm for Lions
and 179cm for Tigers

- (b) Find the median and the interquartile range of the heights of the Lions first team squad. [3]

$$Q_1: \frac{11+1}{2} = 3^{\text{rd}} \quad Q_2: \frac{11+1}{2} = 6^{\text{th}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$Q_1 = 179 \quad Q_2 = 186 \quad Q_3 = 190$$

$$\text{Median} = 186 \text{ cm} \quad \text{IQR} = 190 - 179 = 11 \text{ cm}$$

It is given that for the Tigers, the lower quartile is 183 cm, the median is 190 cm and the upper quartile is 195 cm.

- (c) Make two comparisons between the heights of the players in the Lions first team squad and the heights of the players in the Tigers first team squad. [2]

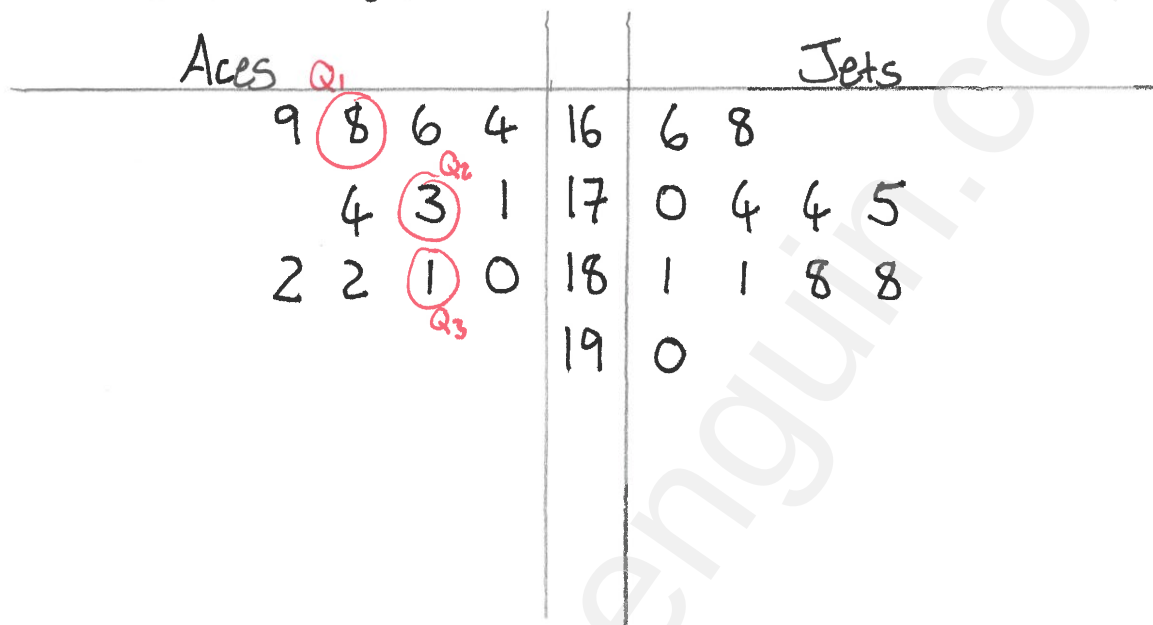
On average, the Tigers are taller than the Lions.

$$\text{IQR for Tigers} = 195 - 183 = 12 \text{ cm}$$

The heights of the Lions are more consistent than the heights of the Tigers.

Aces	180	174	169	182	181	166	173	182	168	171	164
Jets	175	174	188	168	166	174	181	181	170	188	190

- (a) Draw a back-to-back stem-and-leaf diagram to represent this information with the Aces on the left-hand side of the diagram. [4]



Key: 4|16|6 means 164 cm for the Aces
and 166 cm for the Jets

- (b)** Find the median and the interquartile range of the heights of the players in the Aces. [3]

$$Q_1: \frac{11+1}{4} = 3^{\text{rd}} \quad Q_2: \frac{11+1}{2} = 6^{\text{th}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$Q_1 = 168 \quad Q_2 = 173 \quad Q_3 = 181$$

Median = 173cm IQR = 181 - 168
= 13cm

- (c) Give one comment comparing the spread of the heights of the Aces with the spread of the heights of the Jets. [1]

Range for Aces = 18 cm Range for Jets = 24 cm

So the Jets' heights are more spread than the Aces.

- 3 The back-to-back stem-and-leaf diagram shows the diameters, in cm, of 19 cylindrical pipes produced by each of two companies, A and B.

Company A						Company B				
				4	33	1	2	8		
9	Q_1 8	3	2	0	34	1	6	8	9	9
8	7	Q_2 5	4	1	1	35	1	2	2	3
		9	Q_3 6	5	2	36	5	6		
			4	3	1	37	0	3	4	
					38	2	8			

Key: 1 | 35 | 3 means the pipe diameter from company A is 0.351 cm and from company B is 0.353 cm.

- (a) Find the median and interquartile range of the pipes produced by company A. [3]

$$Q_1: \frac{19+1}{4} = 5^{\text{th}} \quad Q_2: \frac{19+1}{2} = 10^{\text{th}} \quad Q_3: \frac{3(19+1)}{4} = 15^{\text{th}}$$

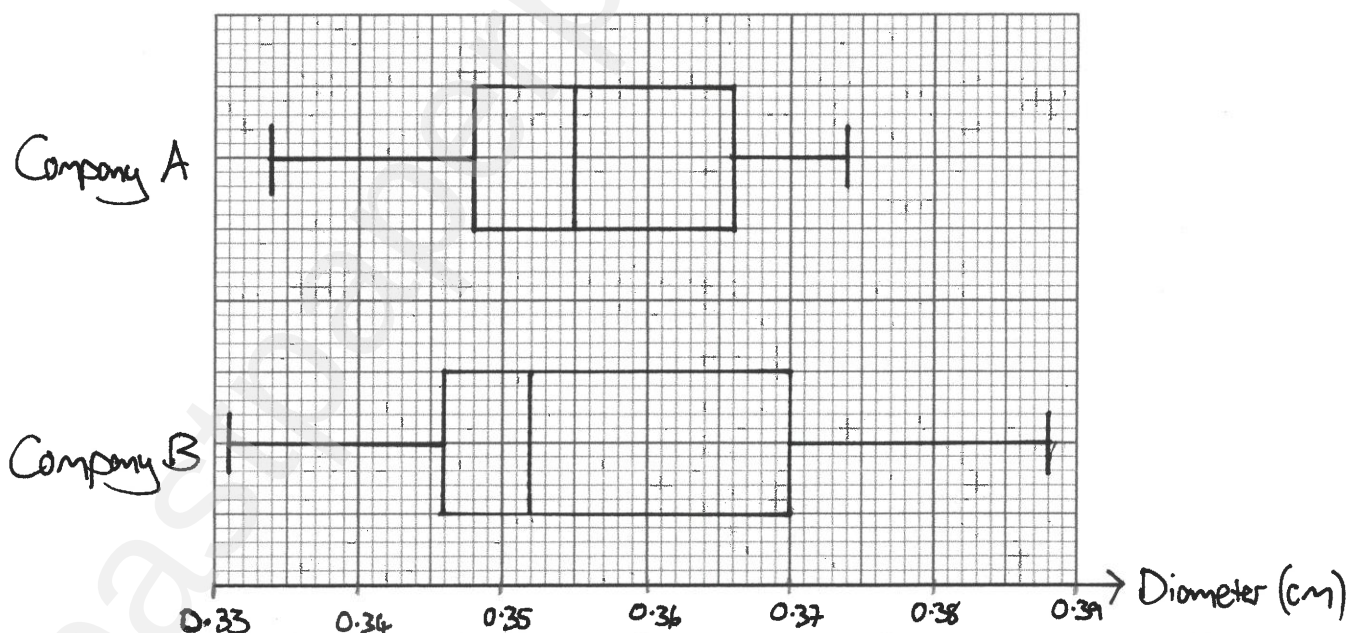
$$Q_1 = 0.348 \quad Q_2 = 0.355 \quad Q_3 = 0.366$$

$$\text{Median} = \underline{0.355 \text{ cm}} \quad \text{IQR} = 0.366 - 0.348$$

$$= \underline{0.018}$$

It is given that for the pipes produced by company B the lower quartile, median and upper quartile are 0.346 cm, 0.352 cm and 0.370 cm respectively.

- (b) Draw box-and-whisker plots for companies A and B on the grid below. [3]



- (c) Make one comparison between the diameters of the pipes produced by companies A and B. [1]

On average, the pipes produced by company A have a larger diameter than those from company B.

- 3 The following back-to-back stem-and-leaf diagram represents the monthly salaries, in dollars, of 27 employees at each of two companies, A and B.

Company A							Company B					
5	4	1	1	0		25	4	4	5	6	6	7
9	9	8	7	2	Q_1	26	0	1	3	5	5	7
8	6	4	2	1	Q_2	27	1	3	4	6	6	8
6	5	4	2	0	Q_3	28	0	1	2	2	2	
		9	8	5		29						
				1		30						9

Key: 1 | 27 | 6 means \$2710 for company A and \$2760 for company B

- (a) Find the median and the interquartile range of the monthly salaries of employees in company A.

$$Q_1: \frac{27+1}{4} = 7^{th}$$

$$Q_2: \frac{27+1}{2} = 14^{th}$$

$$Q_3: \frac{3(27+1)}{4} = 21^{st}$$

$$Q_1 = 2610$$

$$Q_2 = 2710$$

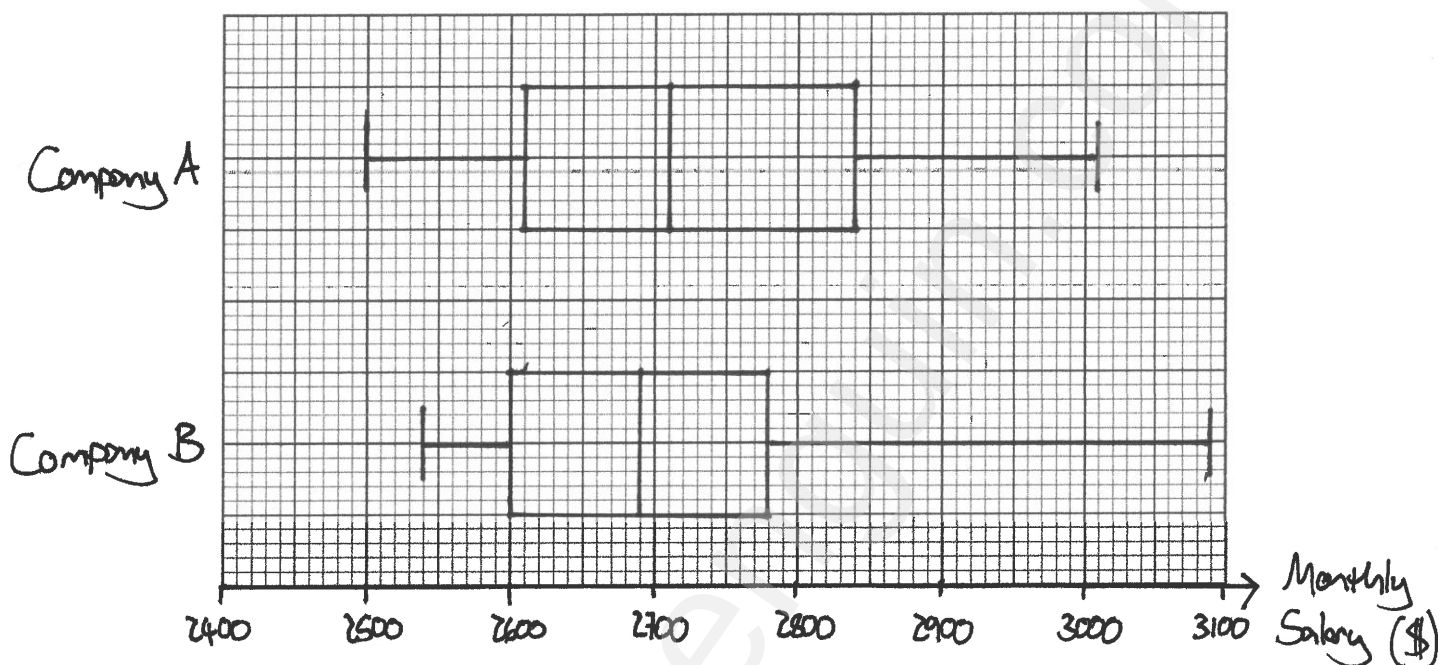
$$Q_3 = 2840$$

$$\text{Median} = \$2710$$

$$\begin{aligned} \text{IQR} &= 2840 - 2610 \\ &= \$230 \end{aligned}$$

The lower quartile, median and upper quartile for company B are \$2600, \$2690 and \$2780 respectively.

- (b) Draw two box-and-whisker plots in a single diagram to represent the information for the salaries of employees at companies A and B. [3]



- (c) Comment on whether the mean would be a more appropriate measure than the median for comparing the given information for the two companies. [1]

No, the median would be more appropriate because the mean is affected by extreme values like \$3090 for company B.

- 3 Two machines, *A* and *B*, produce metal rods of a certain type. The lengths, in metres, of 19 rods produced by machine *A* and 19 rods produced by machine *B* are shown in the following back-to-back stem-and-leaf diagram.

<i>A</i>						<i>B</i>				
					21	1	2	4		
	7	6	3	0	22	2	4	5	5	6
Q_1 8	7	4	3	1	23	0	2	6	8	9
	5	5	3	2	24	3	3	4	6	
Q_3 5	4	3	1	0	25	6				

Key: 7 | 22 | 4 means 0.227 m for machine *A* and 0.224 m for machine *B*.

- (a) Find the median and the interquartile range for machine *A*.

[3]

$$Q_1: \frac{19+1}{4} = 5^{\text{th}} \quad Q_2: \frac{19+1}{2} = 10^{\text{th}} \quad Q_3: \frac{3(19+1)}{4} = 15^{\text{th}}$$

$$Q_1 = 0.231 \quad Q_2 = 0.238 \quad Q_3 = 0.245$$

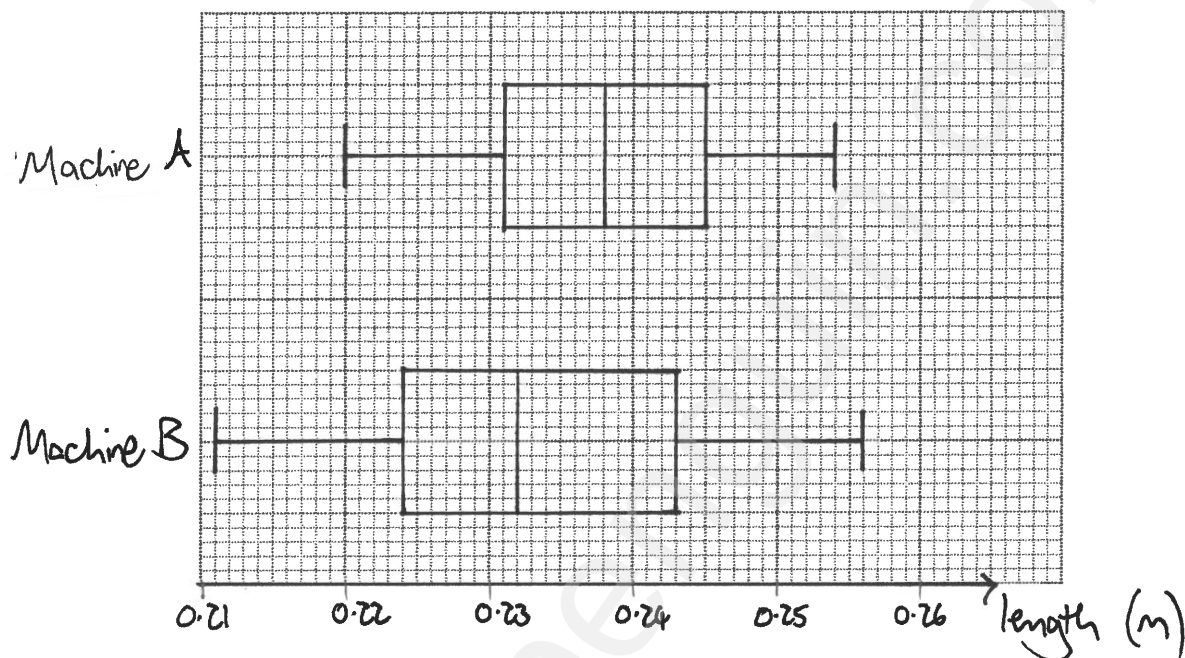
$$\text{Median} = \underline{0.238 \text{ m}} \quad \text{IQR} = 0.245 - 0.231$$

$$= \underline{0.014 \text{ m}}$$

It is given that for machine *B* the median is 0.232 m, the lower quartile is 0.224 m and the upper quartile is 0.243 m.

(b) Draw box-and-whisker plots for *A* and *B*.

[3]



(c) Hence make two comparisons between the lengths of the rods produced by machine *A* and those produced by machine *B*.

[2]

On average, Machine A produces longer rods than machine B.

Machine A produces rods of a more consistent length than Machine B.

- 4 The back-to-back stem-and-leaf diagram shows the annual salaries of 19 employees at each of two companies, Petral and Ravon.

Petral						Ravon				
			3	0 0	30	2	6			
9	9	8	2	2 1	31	1	5			
			5	5 4 0	32	0	0 2			
			7	5 3	33	0	4 8 9			
				1 0	34	1	1 3 4 6			
					35	3				
				8	36	7	9			

Key: 2 | 31 | 5 means \$31 200 for a Petral employee and \$31 500 for a Ravon employee.

- (a) Find the median and the interquartile range of the salaries of the Petral employees. [3]

$$Q_1: \frac{19+1}{4} = 5^{\text{th}} \quad Q_2: \frac{19+1}{2} = 10^{\text{th}}$$

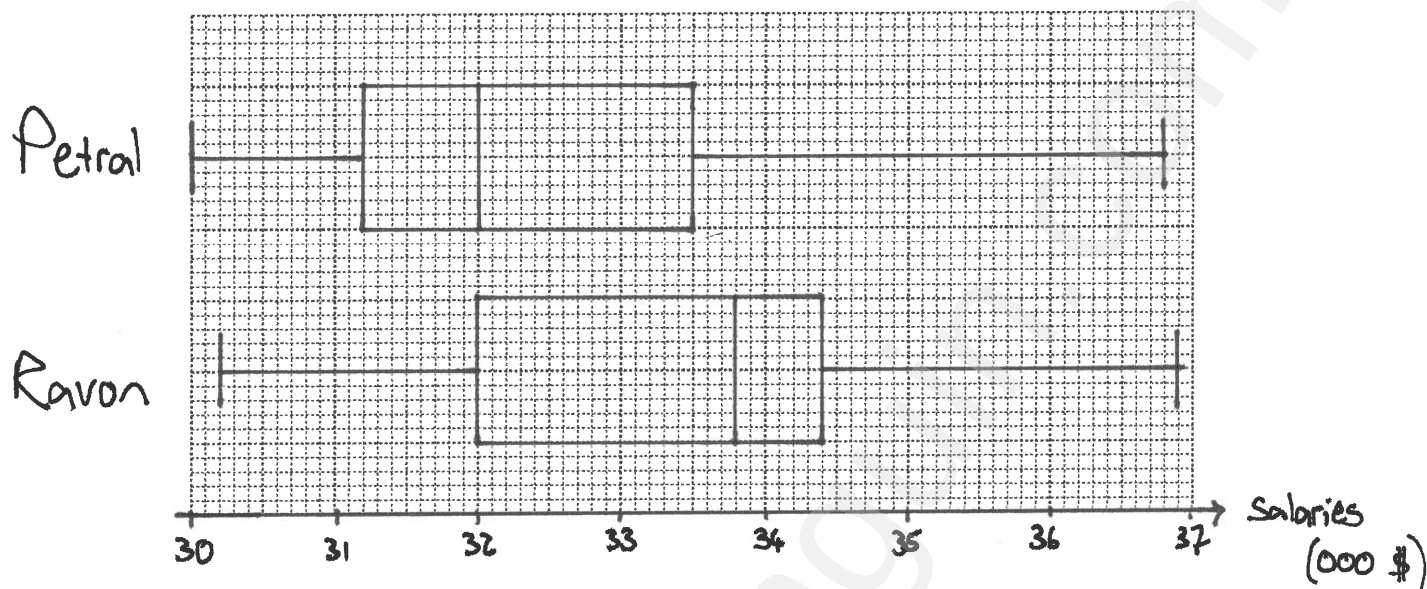
$$Q_3: \frac{3(19+1)}{4} = 15^{\text{th}}$$

$$\text{Median} = \underline{\underline{\$32000}}$$

$$\begin{aligned} \text{IQR} &= 33500 - 31200 \\ &= \underline{\underline{\$2300}} \end{aligned}$$

The median salary of the Ravon employees is \$33 800, the lower quartile is \$32 000 and the upper quartile is \$34 400.

- (b) Represent the data shown in the back-to-back stem-and-leaf diagram by a pair of box-and-whisker plots in a single diagram. [3]



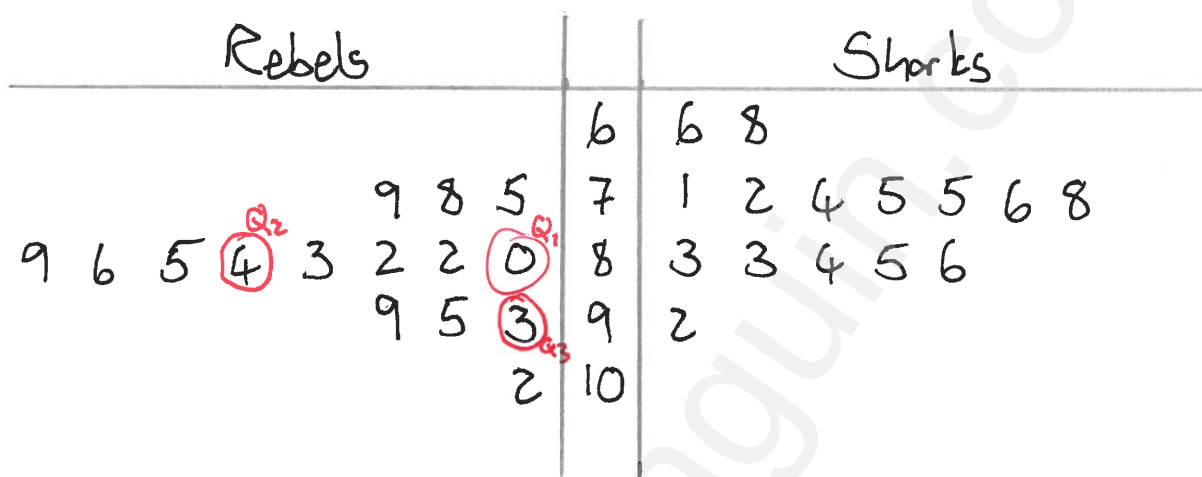
- (c) Comment on whether the mean or the median would be a better representation of the data for the employees at Petral. [1]

The median would be better because it isn't affected by the outlier (\$36 800).

- 6 The weights, in kg, of 15 rugby players in the Rebels club and 15 soccer players in the Sharks club are shown below.

Rebels	75	78	79	80	82	82	83	84	85	86	89	93	95	99	102
Sharks	66	68	71	72	74	75	75	76	78	83	83	84	85	86	92

- (a) Represent the data by drawing a back-to-back stem-and-leaf diagram with Rebels on the left-hand side of the diagram. [4]



Key: 5|7|1 means 75kg for Rebels
and 71kg for Sharks

- (b) Find the median and the interquartile range for the Rebels. [3]

$$Q_1: \frac{15+1}{4} = 4^{th} \quad Q_2: \frac{15+1}{2} = 8^{th} \quad Q_3: \frac{3(15+1)}{4} = 12^{th}$$

$$Q_1 = 80 \text{ kg}$$

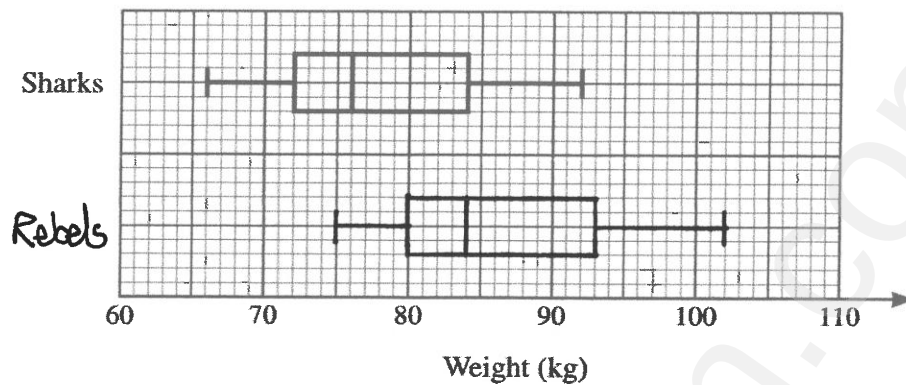
$$Q_2 = 84 \text{ kg}$$

$$Q_3 = 93 \text{ kg}$$

$$\text{Median} = \underline{84 \text{ kg}}$$

$$\text{IQR} = 93 - 80 \\ = \underline{13 \text{ kg}}$$

A box-and-whisker plot for the Sharks is shown below.



- (c) On the same diagram, draw a box-and-whisker plot for the Rebels. [2]
- (d) Make one comparison between the weights of the players in the Rebels club and the weights of the players in the Sharks club. [1]

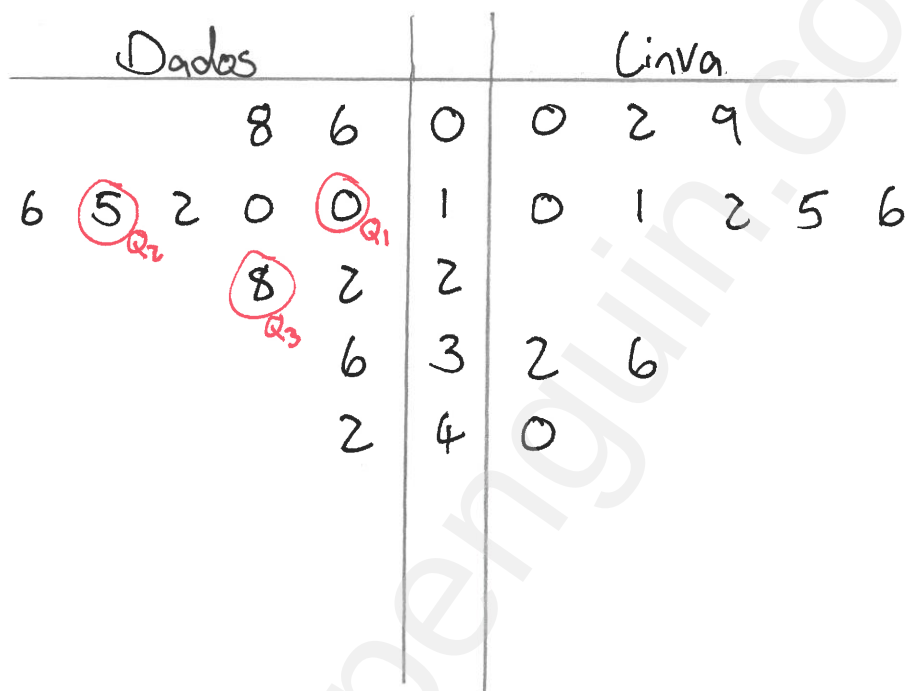
On average, Rebels players are heavier than Sharks players : Rebels median = 84kg
Sharks median = 76kg

- 5 The following table gives the weekly snowfall, in centimetres, for 11 weeks in 2018 at two ski resorts, Dados and Linva.

Dados	6	8	12	15	10	36	42	28	10	22	16
Linva	2	11	15	16	0	32	36	40	10	12	9

- (a) Represent the information in a back-to-back stem-and-leaf diagram.

[4]



Key: 6/3/2 means 36cm in Dados
and 32cm in Linva

- (b) Find the median and the interquartile range for the weekly snowfall in Dados. [3]

$$Q_1: \frac{11+1}{4} = 3^{\text{rd}} \quad Q_2: \frac{11+1}{2} = 6^{\text{th}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$Q_1 = 10 \quad Q_2 = 15 \quad Q_3 = 28$$

$$\text{Median} = \underline{15\text{cm}} \quad \text{IQR} = 28 - 10 \\ = \underline{18\text{cm}}$$

- (c) The median, lower quartile and upper quartile of the weekly snowfall for Linva are 12, 9 and 32 cm respectively. Use this information and your answers to part (b) to compare the central tendency and the spread of the weekly snowfall in Dados and Linva. [2]

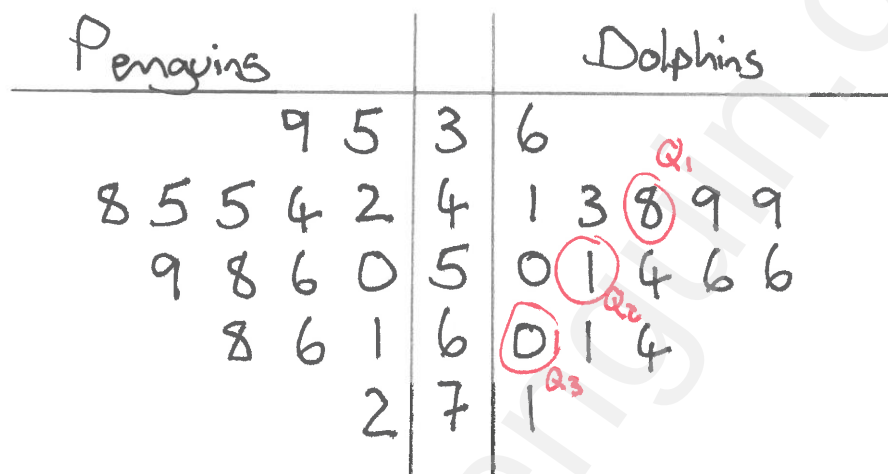
$$\underline{\text{Linva}}: \text{Median} = 12\text{cm} \\ \text{IQR} = 32 - 9 \\ = 23\text{cm}$$

Dados has higher snowfall on average than Linva.
The amount of snowfall is more consistent in Dados than in Linva.

- 4 The times taken, in seconds, by 15 members of each of two swimming clubs, the Penguins and the Dolphins, to swim 50 metres are shown in the following table.

Penguins	35	39	42	44	45	45	48	50	56	58	59	61	66	68	72
Dolphins	36	41	43	48	49	49	50	51	54	56	56	60	61	64	71

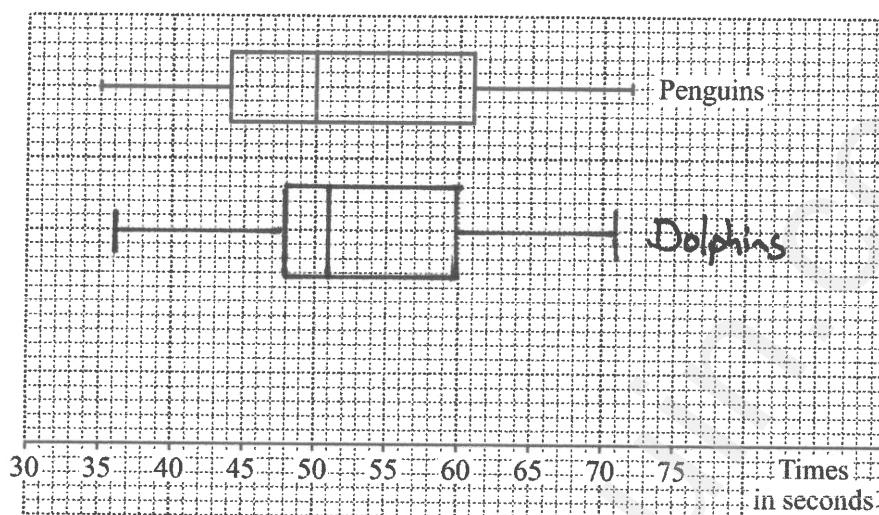
- (a) Draw a back-to-back stem-and-leaf diagram to represent this information, with Penguins on the left-hand side. [4]



Key: 5|3|6 means 35 seconds for Penguins
and 36 seconds for Dolphins

The diagram shows a box-and-whisker plot representing the times for the Penguins.

- (b) On the same diagram, draw a box-and-whisker plot to represent the times for the Dolphins. [3]



- (c) Hence state **one** difference between the distributions of the times for the Penguins and the Dolphins. [1]

The median time for Dolphins is higher than for the Penguins (51 vs. 50) so the penguins are faster on average.

Cheetahs						Panthers				
		9	8		7	4				
8	7	3	2	0	8	6	8			
		9	8	7	9	1	7	8	9	9
6	5	3	3	1	10	2	3	4	4	5
		9	8	2	11	1	2	8		
				4	12	0	6			

(a) Find the median and the interquartile range of the times of the Cheetahs. [3]

$$Q_1: \frac{19+1}{4} = 5^{\text{th}} \quad Q_2: \frac{19+1}{2} = 10^{\text{th}} \quad Q_3: \frac{3(19+1)}{4} = 15^{\text{th}}$$

Q. = 83

$$Q_2 = 99$$

$$Q_3 = 106$$

Median = 99 minutes

$$IQR = 106 - 83$$

$$= 23$$

(b) Make two comparisons between the times taken by the Cheetahs and the times taken by the Panthers.

On average, the Cheetahs are faster than the Panthers

The Panthers' times are more consistent than the Cheetahs.
(less spread out)

Another cyclist, Kenny, from the Cheetahs also took part in the race. The mean time taken by the 20 cyclists from the Cheetahs was 99 minutes.

(c) Find the time taken by Kenny to complete the race. [3]

Sum of times of 19 Cheetahs (without Kerry)

$$= 78 + 79 + 80 + 82 + \dots + 119 + 124 = 1862$$

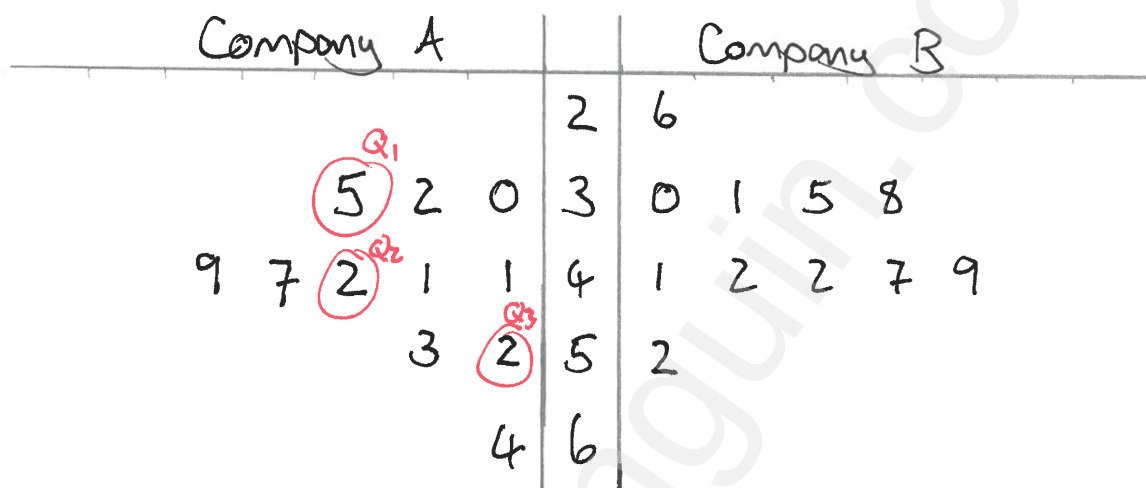
Sum of times of all 20 cheetahs (with Kerry) = 20×99
= 1980

Kenny's time = $1980 - 1862$
= 118 minutes

- 6 The annual salaries, in thousands of dollars, for 11 employees at each of two companies A and B are shown below.

Company A	30	32	35	41	41	42	47	49	52	53	64
Company B	26	47	30	52	41	38	35	42	49	31	42

- (a) Represent the data by drawing a back-to-back stem-and-leaf diagram with company A on the left-hand side of the diagram. [4]



Key: 1|4|2 means \$41 000 for company A
and \$42 000 for company B

- (b) Find the median and the interquartile range of the salaries of the employees in company A. [3]

$$Q_1: \frac{11+1}{4} = 3^{\text{rd}} \quad Q_2: \frac{11+1}{2} = 6^{\text{th}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$Q_1 = 35\,000 \quad Q_2 = 42\,000 \quad Q_3 = 52\,000$$

$$\text{Median} = \underline{\$42\,000} \quad \text{IQR} = 52\,000 - 35\,000 \\ = \underline{\$17\,000}$$

A new employee joins company B. The mean salary of the 12 employees is now \$38 500.

- (c) Find the salary of the new employee. [3]

$$\text{Sum of salaries of 11 employees} = 433\,000$$

add up data in diagram

$$\text{Sum of salaries of all 12 employees} = 12 \times 38\,500 \\ = 462\,000$$

$$462\,000 - 433\,000 = \underline{\underline{\$29\,000}}$$

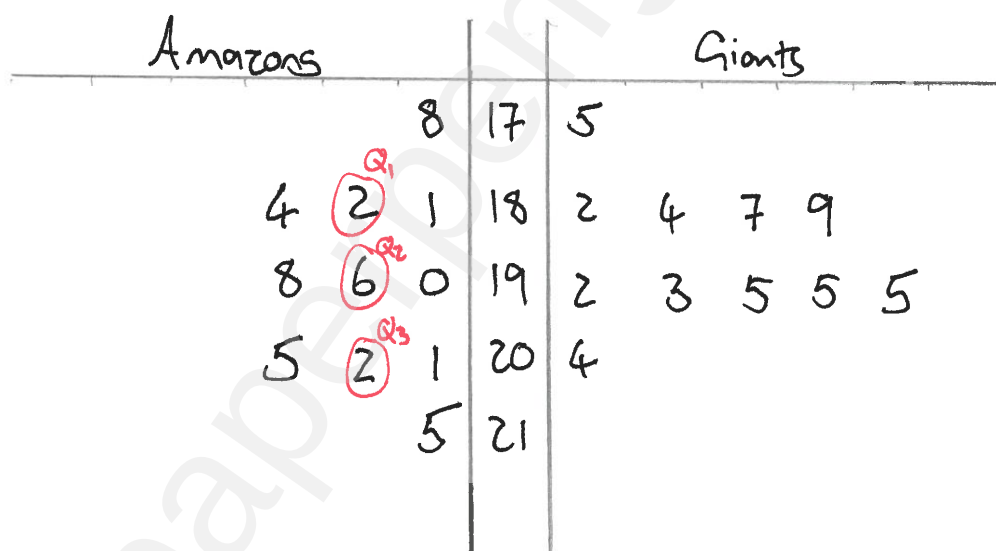
- 7 The heights, in cm, of the 11 basketball players in each of two clubs, the Amazons and the Giants, are shown below.

Amazons	205	198	181	182	190	215	201	178	202	196	184
Giants	175	182	184	187	189	192	193	195	195	195	204

- (a) State an advantage of using a stem-and-leaf diagram compared to a box-and-whisker plot to illustrate this information. [1]

A stem and leaf diagram shows the values of all of the data.

- (b) Represent the data by drawing a back-to-back stem-and-leaf diagram with Amazons on the left-hand side of the diagram. [4]



Key: 8|17|5 means 178cm for Amazons
and 175cm for Giants

- (c) Find the interquartile range of the heights of the players in the Amazons.

[2]

$$Q_1: \frac{11+1}{4} = 3^{\text{rd}} \quad Q_2: \frac{11+1}{2} = 6^{\text{th}} \quad Q_3: \frac{3(11+1)}{4} = 9^{\text{th}}$$

$$Q_1 = 182$$

$$Q_2 = 196$$

$$Q_3 = 202$$

$$\begin{aligned} \text{IQR} &= 202 - 182 \\ &= \underline{20\text{cm}} \end{aligned}$$

Four new players join the Amazons. The mean height of the 15 players in the Amazons is now 191.2 cm. The heights of three of the new players are 180 cm, 185 cm and 190 cm.

- (d) Find the height of the fourth new player.

[3]

$$\begin{aligned} \text{Total height of all 15 players} &= 191.2 \times 15 \\ &= 2868 \end{aligned}$$

$$\text{Sum of all other 14 players' heights} = 2687$$

order up
data

$$\begin{aligned} \text{Height of missing player} &= 2868 - 2687 \\ &= \underline{181\text{cm}} \end{aligned}$$