

Measures of location and spread 2D

1 a CF = 4 8 10 17 37 61 71
71 slow worms were measured.

b $Q_1: \frac{71}{4} = 17.75$ th value, so Q_1 is in class 185–199

$$\frac{Q_1 - 184.5}{199.5 - 184.5} = \frac{17.75 - 17}{37 - 17}$$

$$Q_1 - 184.5 = 0.5625$$

$$Q_1 = 185.0625$$

$Q_3: 3 \times \frac{71}{4} = 53.25$ th value

so Q_3 is in class 200–214

$$\frac{Q_3 - 199.5}{214.5 - 199.5} = \frac{53.25 - 37}{61 - 37}$$

$$Q_3 - 199.5 = \frac{243.75}{24}$$

$$Q_3 = 209.656$$

$$\begin{aligned} \text{IQR} &= 209.656 - 185.0625 \\ &= 24.6 \text{ (3 s.f.)} \end{aligned}$$

c $\bar{x} = \frac{(132 \times 4) + (147 \times 4) + (162 \times 2) + (177 \times 7) + (192 \times 20) + (207 \times 24) + (222 \times 10)}{71}$
 $= \frac{13707}{71}$
 $= 193.1 \text{ mm (to 1 d.p.)}$

d $\bar{x} + \text{IQR} = 193.1 + 24.6$
 $= 217.7$

217.7 is in the class interval 215–229

1 d Using interpolation:

$$\frac{217.7 - 214.5}{229.5 - 214.5} = \frac{y - 61}{71 - 61}$$

$$y = 63.13\dots$$

$$71 - y = 7.87$$

8 slow worms have that length.

2 a 34th: $\frac{34}{100} \times 70 = 23.8$

$$\frac{P_{34} - 1000}{1100 - 1000} = \frac{23.8 - 3}{27 - 3}$$

$$P_{34} = 1086.7$$

66th: $\frac{66}{100} \times 70 = 46.2$

$$\frac{P_{66} - 1100}{1200 - 1100} = \frac{46.2 - 27}{55 - 27}$$

$$P_{66} = 1168.6$$

34% to 66% interpercentile range = $P_{66} - P_{34} = 1168.6 - 1086.7 = \text{£}81.90$

b $46.2 - 23.8 = 22.4$
So 22 data values

3 a 5th: $\frac{5}{100} \times 60 = 3$

$$\frac{P_5 - 14.5}{16.5 - 14.5} = \frac{3 - 0}{5 - 0}$$

$$P_5 = 15.7$$

95th: $\frac{95}{100} \times 60 = 57$

$$\frac{P_{95} - 20.5}{22.5 - 20.5} = \frac{57 - 50}{60 - 50}$$

$$P_{95} = 21.9$$

5% to 95% interpercentile range = $21.9 - 15.7 = 6.2$

3 b $57 - 3 = 54$
So 54 data values

4 a 9.4, 10.3, 10.3, 10.6, 10.9, 12.1, 12.4, 12.7, 13.2, 14.3

$$Q_2 = 5.5\text{th value} = \frac{10.9+12.1}{2} = 11.5$$

$$Q_1 = 3\text{rd value} = 10.3$$

$$Q_3 = 8\text{th value} = 12.7$$

$$\text{IQR} = 12.7 - 10.3 = 2.4$$

b On average, the temperature was higher in June than in May as the median is higher. However, the temperature was more variable in May than in June, as the IQR is higher.

c 10th: $\frac{10}{100} \times 31 = 3.1$

90th: $\frac{90}{100} \times 31 = 27.9$

$$27.9 - 3.1 = 24.8$$

So 24 days