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

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

\[ Q_1 = 184.5 \times 0.5625 \]

\[ Q_1 = 185.0625 \]

\[ Q_3 : 3 \times Q_1 = 53.25 \]th value

so \( Q_3 \) is in class 200 – 214

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

\[ Q_3 = 199.5 \times \frac{243.75}{24} \]

\[ Q_3 = 209.656 \]

IQR = 209.656 – 185.0625

= 24.6 (3 s.f.)

c  \( \bar{x} = \frac{(132 \times 4) + (147 \times 4) + (162 \times 2) + (177 \times 7) + (192 \times 20) + (207 \times 24) + (222 \times 10)}{71} \)

\[ \bar{x} = \frac{13707}{71} \]

= 193.1 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:

\[
\begin{align*}
\frac{217.7 - 214.5}{229.5 - 214.5} &= \frac{y - 61}{71 - 61} \\
y &= 63.13... \\
71 - y &= 7.87
\end{align*}
\]

7 slow worms have that length.

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

\[
\begin{align*}
P_{34} - 1000 &= \frac{23.8 - 3}{27 - 3} \\
P_{34} &= 1086.7
\end{align*}
\]

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

\[
\begin{align*}
P_{66} - 1100 &= \frac{46.2 - 27}{55 - 27} \\
P_{66} &= 1168.57
\end{align*}
\]

34% to 66% interpercentile range = \( P_{66} - P_{34} = 1168.57 - 1086.7 = £81.87 \)

b 46.2 - 23.8 = 22.4
So 22 data values

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

\[
\begin{align*}
P_{5} - 14.5 &= \frac{3 - 0}{5 - 0} \\
P_{5} &= 15.7
\end{align*}
\]

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

\[
\begin{align*}
P_{95} - 20.5 &= \frac{57 - 50}{60 - 50} \\
P_{95} &= 21.9
\end{align*}
\]

5% to 95% interpercentile range = 21.9 - 15.7 = 6.2
3 b 57 – 3 = 54
So 54 data values

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

\[ Q_2 = 5.5\text{th value} = \frac{10.9 + 12.1}{2} = 11.5 \]
\[ Q_1 = 3\text{rd value} = 10.3 \]
\[ Q_3 = 8\text{th value} = 12.7 \]

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