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## 2.2 Other Measures of location

1. 324 313 315 372 377 312 369

a) Put data in ascending order:

312, 313, 315, 324, 369, 372, 377

$$312 + 313 + 315 + 324 + 369 + 372 + 377 = 2382$$

$$LQ = \frac{2382}{4}$$

4

$$= 595.5 \text{th value}$$

$312 + 313 = 625$  ← where 595.5th value lies

so  $LQ = 313 \text{g}$

b)  $UQ = \frac{3}{4} \times 2382$

$$= 1786.5 \text{th value}$$

$312 + 313 + 315 + 324 + 369 + 372 = 2005$  ← where 1786.5th value lies

so  $UQ = 372 \text{g}$

2.

Number of siblings	1	2	3	4	5
frequency	7	12	15	11	6

a) Median

$$7 + 12 + 15 + 11 + 6 = 51$$

$$\frac{51 + 1}{2} \text{th value} = 26 \text{th value}$$

2

$7 + 12 + 15 = 34$  ← where 26th value lies

so median = 3

$$b) UQ = \frac{3}{4} \times 51$$

$$= 38.25 \text{th value}$$

$7+12+15+11=45 \leftarrow$  where 38.25th value lies  
so  $UQ = 4$

$$c) LQ = \frac{51}{4}$$

$$= 12.75 \text{th value}$$

$7+12=19 \leftarrow$  where 12.75th value lies  
so  $LQ = 2$

3.

Distance, $x$ (km)	$1 \leq x < 3$	$3 \leq x < 5$	$5 \leq x < 7$	$7 \leq x < 9$
frequency	6	8	5	3
Cumulative f	6	14	19	22

$$a) \text{ median: } \frac{22}{2} = 11 \text{th value}$$

Using linear interpolation: \_\_\_\_\_

$$\frac{3 \quad Q_2 \quad 5}{6 \quad 11 \quad 14}$$

$$\frac{Q_2 - 3}{5 - 3} = \frac{11 - 6}{14 - 6}$$

$$\frac{Q_2 - 3}{2} = \frac{5}{8}$$

$$Q_2 = \left( \left( \frac{5}{8} \right) \times 2 \right) + 3$$

$$= 4.25 \text{ km}$$

$$b) \frac{3}{4} \times 22 = 16.5 \text{th}$$

$$\frac{5}{14} \quad \frac{UQ}{16.5} \quad \frac{7}{19}$$

$$\frac{UQ - 5}{7 - 5} = \frac{16.5 - 14}{19 - 14}$$

$$\frac{UQ - 5}{2} = \frac{2.5}{5}$$

$$UQ = \left( \left( \frac{2.5}{5} \right) \times 2 \right) + 5$$

$$= 6 \text{ km}$$

$$4. \quad \begin{array}{cccccc} 13 & 14 & 12 & 18 & 20 & 14 & 17 \\ 15 & 15 & 21 & 20 & 15 & 17 & 20 \end{array}$$

a) Put data in ascending order:

~~12~~, ~~13~~, ~~14~~, ~~14~~, ~~15~~, ~~15~~, ~~15~~, ~~17~~, ~~17~~, ~~18~~, ~~20~~, ~~20~~, ~~20~~, ~~21~~

$$Q_2 = \frac{15 + 17}{2} = 16$$

$$b) LQ = \frac{1}{4} \times 14$$

$$= 3.5 \text{th}$$

$$= 4 \text{th}$$

$$LQ = 14$$

5.

Mass, $m$ (kg)	$40 \leq m < 45$	$45 \leq m < 50$	$50 \leq m < 55$	$55 \leq m < 60$
frequency	7	10	14	5
cumulative $f$	7	17	31	36

a) median:  $\frac{36}{2} = 18^{\text{th}}$  value

Using linear interpolation:

$$\begin{array}{ccc} 50 & Q_2 & 55 \\ \hline 17 & 18^{\text{th}} & 31 \end{array}$$

$$\frac{Q_2 - 50}{55 - 50} = \frac{18 - 17}{31 - 17}$$

$$\frac{Q_2 - 50}{5} = \frac{1}{14}$$

$$Q_2 - 50 = \left(\frac{1}{14}\right) \times 5$$

$$Q_2 = \frac{5}{14} + 50$$

$$Q_2 = 50.4 \text{ kg (3sf)}$$

b) It is assumed that the frequency in each class is evenly distributed throughout the interval

6.	Length, $x$ (cm)	$25 \leq x < 30$	$30 \leq x < 35$	$35 \leq x < 40$	$40 \leq x$
	frequency	25	28	17	12
	cumulative $f$	25	53	70	82

a)

i) median :  $\frac{82}{2} = 41^{\text{st}}$  value

30	$Q_2$	35
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25	41	53

$$\frac{Q_2 - 30}{35 - 30} = \frac{41 - 25}{53 - 25}$$

$$\frac{Q_2 - 30}{5} = \frac{16}{28}$$

$$Q_2 = \left( \left( \frac{16}{28} \right) \times 5 \right) + 30$$

$$Q_2 = 32.9 \text{ cm (3sf)}$$

ii) 70th Percentile :  $82 \times 0.70 = 57.4^{\text{th}}$

35	$P_{70}$	40
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53	57.4	70

$$\frac{P_{70} - 35}{40 - 35} = \frac{57.4 - 53}{70 - 53}$$

$$\frac{P_{70} - 35}{5} = \frac{4.4}{17}$$

$$P_{70} = \left( \left( \frac{4.4}{17} \right) \times 5 \right) + 35 = 36.3 \text{ cm (3sf)}$$

b) The 90th percentile is in the last class which has no upper class boundary

7.

Time, $t$ (mins)	$1 \leq t < 3$	$3 \leq t < 5$	$5 \leq t < 10$	$10 \leq t < 20$
frequency	6	13	18	4
Cumulative $f$	6	19	37	41

a) 60th percentile :  $41 \times 0.60 = 24.6^{\text{th}}$

$$\frac{5}{19} \quad P_{60} \quad \frac{10}{37}$$

$$\frac{P_{60} - 5}{10 - 5} = \frac{24.6 - 19}{37 - 19}$$

$$\frac{P_{60} - 5}{5} = \frac{5.6}{18}$$

$$P_{60} = \left( \left( \frac{5.6}{18} \right) \times 5 \right) + 5$$

$$P_{60} = 6.56 \text{ mins (3 sf)}$$

b) The data is assumed to be evenly distributed within each class

c) 80th percentile:  $41 \times 0.80 = 32.8^{\text{th}}$

$$\frac{5}{19} \quad P_{80} \quad \frac{10}{37}$$

$$\frac{P_{80} - 5}{10 - 5} = \frac{32.8 - 19}{37 - 19}$$

$$\frac{P_{80} - 5}{5} = \frac{13.8}{18}$$

$$P_{80} = \left( \left( \frac{13.8}{18} \right) \times 5 \right) + 5$$

$$= 8.83 \text{ mins (3sf)}$$

The advertisement is incorrect. 20% of trains are delayed by more than 8.83 mins.



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