Higher Check In - 12.03 Analysing data

1. Given that the mean is 2.16, find the value of x in the following data set.

    3.45   1.2   2.2   3.4   1.1   1.15   2.02   3.01 x

2. Given that the median is $\dfrac{5}{18}$, find the range of values of x in the following data set.

    $$\frac{1}{6}, \frac{2}{3}, \frac{1}{18}, \frac{5}{18}, \frac{1}{3}, \frac{2}{9}, x$$

3. Given that the mode is 9 and the range is 7, find the values of x and y in the following data set.

    x, x, x, y, y, y, y

Questions 4-9 refer to an investigation into hospital waiting times at weekends.

A medical receptionist recorded the waiting times, to the nearest minute, for a random sample of patients at an Accident and Emergency department over a weekend.

Waiting time (mins)	0-19	20-39	40-59	60-79	80-99	100-119	120-139	140-159
Frequency	9	18	32	20	13	5	2	1

4. Calculate an estimated mean waiting time for the randomly sampled data above.

5. In which class is the median waiting time located for the randomly sampled data above?

The following weekend the receptionist records another random sample of waiting times.

56	84	11	15	60	93	46	6	59	98	42	18	54	58	65	25	37	39	94	109
103	56	39	41	23	68	15	75	5	128	38	20	77	63	45	52	53	73	8	108
353	9	10	69	76	78	43	25	34	81	92	20	39	47	51	81	59	90	39	54
38	51	48	90	60	19	8	26	101	47	12	102	35	48	57	88	34	53	83	42
20	5	120	63	69	78	36	58	65	77	26	45	49	83	73	40	49	19	23	86

6. Explain why 353 may be considered an outlier result from the new set of data above.

7. In the data table above, the mode of the raw data is 39 and the modal class, when grouped using the same groups as before, is 40-59. Explain which of these two measures would be better to summarise the data.

8. The box plots below show the data for waiting times from two different Accident and Emergency departments on the same day. Make two comparisons between the waiting times for each department.

Department A

Department B
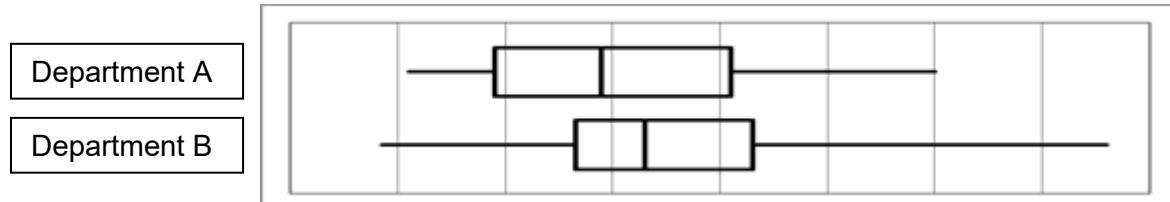
9. The mean of all 100 results in the results table above is 56.35 minutes. What is the mean when the outlier result 353 minutes is ignored?

10. Bob and Darren each keep records of the number, and size, of fish they catch. The data are shown in these tables.

Bob

Mass (m) in kg	Frequency
$0 < m < 2$	9
$2 \leq m < 4$	4
$4 \leq m < 6$	5
$6 \leq m < 8$	3
$8 \leq m < 10$	2

Darren

Mass (m) in kg	Frequency
$0 < m < 2$	15
$2 \leq m < 4$	6
$4 \leq m < 6$	3
$6 \leq m < 8$	4
$8 \leq m < 10$	1

Who can claim to be the better fisherman?

Extension (following on from Questions 4-9)

Dr Abelson argues that the hospital should use the median to represent the average waiting time. Dr Brown argues that the mean would be a better measure. Dr Chaudra believes the hospital should use the modal class. For each of the three doctors, give one reason to support their case.

Answers

1. 1.91

2. $x \geq \dfrac{5}{18}$

3. $x = 2$, $y = 9$ [allow $x = 16$]

4. 57.1 minutes

5. 40-59 minutes

6. 353 minutes is over 200 minutes greater than any other waiting time oe

7. The modal class. The fact that there happens to be more of one single value (39) than any other single value is not significant. Grouping the data gives a better idea of the shape of the distribution.

8. Average waiting time in Department A is less (lower median) than in Department B oe.
   Waiting times in Department A are more variable (larger interquartile range) than in Department B oe.
   Waiting times less extreme (smaller range) in Department A than in Department B oe.

9. 53.35(353535…) minutes

10. Any suitable answer as long as it is correctly justified. Examples include:

    - Darren caught 29 fish, whilst Bob only caught 23 fish. As Darren caught more fish than Bob, Darren is a better fisherman.
    - The mean number of fish that Darren caught is 2.9, whilst the mean number of fish that Bob caught is 3.7. As Bob caught, on average, more fish than Darren, Bob is a better fisherman.
    - The modal class of fish that Darren caught was $0 < m < 2$, whilst the modal class of fish that Bob caught was also $0 < m < 2$. As the most common fish size was the same, neither was better than the other.
    - The class containing the median number of fish caught by Darren was $0 < m < 2$, whilst the class containing the median number of fish caught by Bob was $2 < m < 4$. On average, Bob caught larger fish than Darren, so Bob is a better fisherman than Darren.

Extension

Dr Abelson: the median is better as it takes less account of outliers, e.g. 353, which are not typical of how patients are treated.

Dr Brown: the mean takes account of all the data, including those patients who have to wait an unusually long time to get seen (and are the most likely to complain!).

Dr Chaudra: the modal class represents the typical waiting time most patients should expect, as they are the most common times.

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AO1	1	Use formula for the mean			
AO1	2	Use rules for the median			
AO1	3	Use mode and range definitions			
AO1	4	Estimate the mean of a grouped frequency distribution			
AO1	5	Estimate the median from a grouped frequency distribution			
AO2	6	Understand why a value may be considered an outlier			
AO2	7	Understand the significance of the mode and modal class			
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