

Year 1

~ S T A T I S T I C S ~

Partitioning Data

Measures of Location & Spread

Representations of Data



STATISTICS

Partitioning Data Measures of Location & Spread Representations of Data

Lesson 1

A-level Statistics : Year 1 Partitioning Data

1.1 Quartiles, Deciles, Percentiles

Given a large amount of numerical data, it's often helpful to;

- Put it in order.
- Partition it into parts, each part containing (roughly) the same number of items of data.

The most simple action would be to partition some data into just two parts. The location of the partition is then given by the statistic called the **median**. Half the data is below the median and half above.

Other popular partitioning involves dividing the data into,

- Quartiles : 4 parts : Q_1, Q_2, Q_3
- Deciles : 10 parts : D_1, D_2, \dots, D_9
- Percentiles : 100 parts : P_1, P_2, \dots, P_{99}

The following “partitioning rule” will make more sense once a couple of examples have been worked through.

1.2 The Partitioning Rule

The partitions that divides the n items of data up into x parts are located at;

$$\frac{1}{x} \times n, \frac{2}{x} \times n, \dots, \frac{x-1}{x} \times n$$

Each term in the partition list is further rounded as follows;

- If integer, take the mean of this and the next piece of data.
- If NOT integer, take the item of data one place further on.

1.3 Example involving Quartiles

A class of 17 school children contains 8 boys and 9 girls.
They all sit a test, marked out of 24.

Here are their scores for the boys.

Boys	15	15	16	17	19	19	20	21
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(i) Work out Q_1 , Q_2 and Q_3 for the boys.

(ii) Determine the Inter Quartile Range (IQR) of the boys' data.

(iii) Show the partitioning of the boys' data below;

Boys	15	15	16	17	19	19	20	21
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Here are their scores for the girls.

Girls	8	17	18	21	22	22	23	24	24
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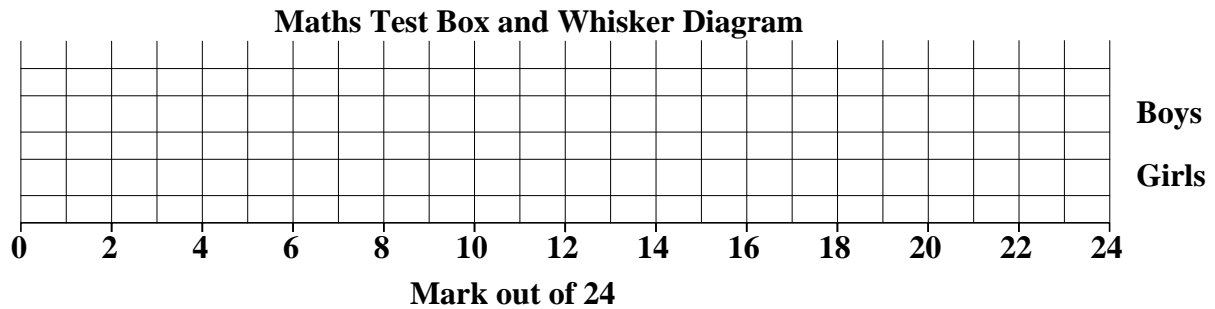
(iv) Work out Q_1 , Q_2 and Q_3 for the girls.

(v) Determine the Inter Quartile Range (IQR) for the girls' data.

(vi) Show the partitioning of the girls' data below;

Girls	8	17	18	21	22	22	23	24	24
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(vii) Plot a box and whisker diagram for the two sets of data.



(viii) Make two comments about the data based on the box and whisker diagram.

1.4 Example involving Percentiles

A shipment of 138 boxes of apples is examined.

The number of bad apples found in the boxes is given in the following table.

N° of bad apples	0	1	2	3	4	5	6	7	8	9	10
Frequency	55	14	21	12	9	15	3	5	0	3	1

(i) Calculate the 80th percentile.

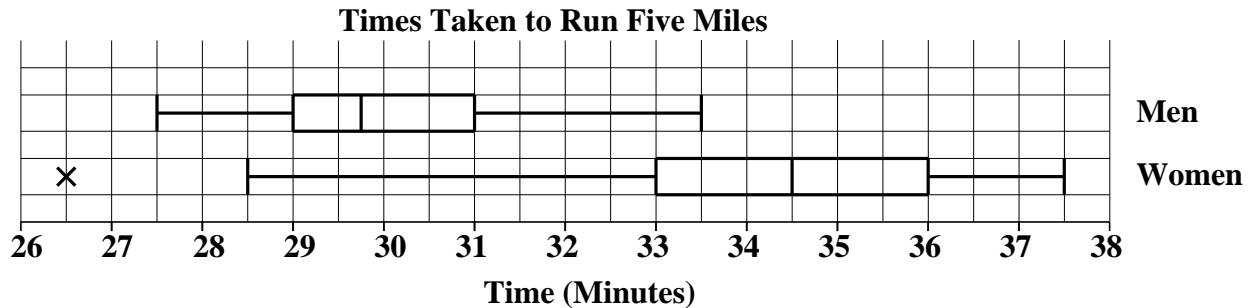
(ii) Calculate the 97th percentile.

(iii) What is the median of the data ?

1.5 Exercise

Question 1

The box and whisker diagram shows the times taken by the members of a sports club to run a five mile course.



- (i) For the men
- (a) what was the shortest time taken by the fastest runner ?
 - (b) what was the inter quartile range of the times taken ?
- (ii) For the women
- (a) what was the average (median) time taken ?
 - (b) what percentage of runners took longer than 33 minutes ?
- (iii) One runner is marked with a cross, ×
Explain what this tells you about this runner.
- (iv) Make two comments in which you compare and contrast the data for the men with that of the women.

Question 2

Here is some data;

4	18	24	31	34	37	38	38	38	39
41	41	43	44	44	44	44	45	45	46
47	47	47	48	48	49	49	50	50	50
51	53	54	55	55	56	56	57	59	59
59	60	60	61	62	64	64	65	66	69
70	72	72	73	74	76	78	78	81	84
84	87	90	95						

Let the number of items of data be, n .

- (i) State the value of n
- (ii) The fourth decile, D_4 is the piece of data in the location given by
- $$D_4 \text{ location} = \frac{4}{10} \times n$$
- (a) Determine the location of D_4
- (b) Hence state the value of D_4
- (iii) Determine the value of D_7
- (iv) What is the median of the data ?

Question 3

The shoe sizes in a class of 30 pupils are;

Shoe Size	2	2½	3	3½	4	4½	5	5½	6	6½	7
Frequency	3	2	7	5	9	2	1	0	0	0	1

(i) Determine Q_1 , Q_2 and Q_3 for this data.

(ii) State the IQR.

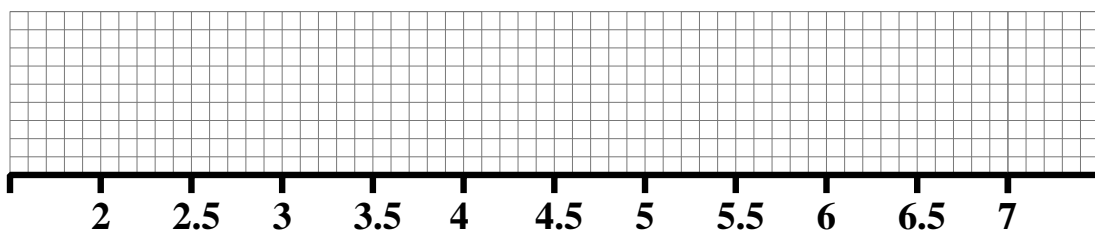
(iii) An outlier is any shoe size, s , for which

$$s > Q_3 + 1.5 \times \text{IQR}$$

Show that this definition classifies the shoe size of 7 as an outlier.

(iv) Plot a box and whisker diagram for the data.

Terminate the whisker that has an outlier at $Q_3 + 1.5 \times \text{IQR}$



Question 4

Partition the following data into four parts by finding the Quartiles, Q_1 , Q_2 and Q_3 .

7 10 9 7 2 2 8 8 3

Question 5

Find the partitions D_3 and D_9 for the data below.

(The 3rd and 9th deciles)

Number	0	1	2	3	4	5	6	7	8
Frequency	2	3	4	4	5	3	2	1	1

Question 6

Find the partitions P_{33} and P_{66} for the data below.

(The 33rd and 66th percentiles)

Number	10	11	12	13	14	15	16	17	18
Frequency	4	14	24	42	36	21	14	3	2

Question 7

For the data presented below find the Quartiles, Q_1 , Q_2 and Q_3

11	15	22	24	26	26	32	35	36	37
37	40	40	41	44	46	48	48	50	51
51	55	62	64	64	67	78	82	82	

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