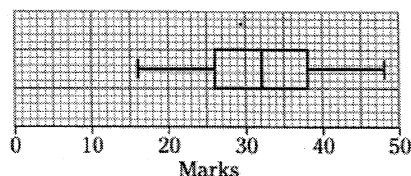Exercise 1.8 – Box and Whiskers Plot

1 Below is a box-and-whisker plot of pupils' marks in a test.

   (i) Write down the lower and upper quartiles.

   (ii) Write down the median.

   (iii) Work out the range.

   (iv) Work out the interquartile range.

   (v) Comment on the shape of the distribution.

2 In a survey on the number of words in a sentence in a particular novel, 100 sentences were chosen at random and the number of words in the sentence noted. The results are summarised in the table.

Lowest value	Lower quartile	Median	Upper quartile	Highest value
4	15	20	32	45

Draw a box-and-whisker plot on graph paper.

3 In each of the following, draw a box-and-whisker plot on graph paper to illustrate the following data and comment on the shape of the distribution.

   (i) 3, 5, 10, 11, 12, 16, 17, 17, 19, 20, 22

   (ii) 96, 105, 123, 151, 167, 178, 185, 200, 202, 220, 238, 246, 252, 269, 297

   (iii) $-7, -5, -4, -4, -3, -3, -2, -1, 0, 1, 4, 6, 8, 9$

4 The following stem-and-leaf diagram summarises the blood glucose level of a patient measured daily over a period of time.

Blood glucose level

| Key: 5 | 2 means 5.2 |

5	2 2 3 4 7 7 9 9	(8)
6	0 3 3 6 9	(5)
7	1 4 7 8 8	(5)
8	2 3 7	(3)
9	0 4	(2)

   (i) Find the median and quartiles of these data.

   (ii) On graph paper, draw a box-and-whisker plot to represent the data.

**5** These are the times of the postal delivery to my house over four successive weeks.

$$9:01 \quad 9:22 \quad 9:30 \quad 9:19 \quad 9:15 \quad 9:29$$
$$9:45 \quad 9:53 \quad 9:02 \quad 9:05 \quad 9:31 \quad 9:47$$
$$9:17 \quad 9:48 \quad 9:29 \quad 9:09 \quad 9:29 \quad 9:02$$
$$9:10 \quad 9:12 \quad 9:25 \quad 9:10 \quad 9:13 \quad 9:19$$

(i) Draw a stem-and-leaf diagram.

(ii) Find the median time.

(iii) Find the quartiles.

(iv) Draw a box-and-whisker plot.

6 Draw a box-and-whisker plot to represent the distribution given in the table.

x	0	1	2	3	4
f	4	6	8	6	1

7
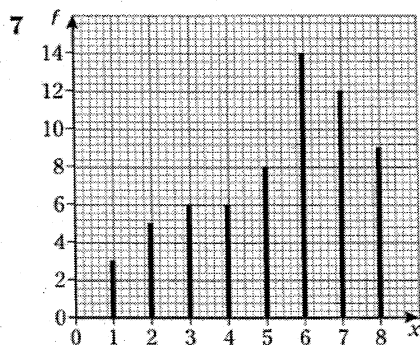
For the data represented in the vertical line graph above:

(i) State the minimum and maximum values of x.

(ii) Construct a cumulative frequency distribution table.

(iii) Find the median and the quartiles.

(iv) Draw a box-and-whisker plot.

8 In an experiment, 21 girls estimated the length of a line and gave their answers in millimetres. Their results were as shown.

$$51 \quad 45 \quad 31 \quad 43 \quad 97 \quad 16 \quad 18 \quad 23 \quad 34 \quad 35 \quad 35$$
$$85 \quad 62 \quad 20 \quad 22 \quad 51 \quad 57 \quad 49 \quad 22 \quad 18 \quad 27$$

(i) Find the median, quartiles and interquartile range (IQR).

(ii) Draw a box-and-whisker plot.

9 This back-to-back stem-and-leaf diagram gives the daily hours of sunshine in December and July in a certain city.

> **Key:** 1 | 3 | 5 means 3.1 hours in December and 3.5 hours in July

Hours of sunshine

| December			July	
(12)	8 8 7 3 3 2 0 0 0 0 0 0	0	3 4	(2)
(6)	9 8 8 6 0 0	1	1 2	(2)
(6)	7 6 4 4 3 3	2	6	(1)
(1)	1	3	5 5	(2)
(2)	9 1	4	1 3	(2)
(1)	1	5	0 0 2 8 4	(5)
(3)	4 2 0	6	5 5 6 6 6	(5)
(0)		7	3 4	(2)
		8		(0)
		9	2 2 8 8	(4)
		10		(0)
		11	1 3 3 4	(4)
		12	0 1	(2)

(i) Find the median and quartiles for each month.

(ii) Draw two box-and-whisker plots on the same diagram.

(iii) Compare the distributions.

10 The table below gives the lengths, in minutes, of 50 telephone calls from a school office.

Length of call (x minutes)	$0 < x \leqslant 2$	$2 < x \leqslant 5$	$5 < x \leqslant 8$	$8 < x \leqslant 15$
Frequency	10	23	11	6

(i) Draw a cumulative frequency graph to illustrate the data.

(ii) Use your cumulative frequency graph to estimate the median and quartiles.

The shortest call was 1 minute and the longest call was 14 minutes.

(iii) Draw a box-and-whisker plot and comment on the distribution.

11 The time, in minutes, that patients waited to be seen by a doctor was recorded for two different surgeries. The box-and-whisker plots show the results.

Waiting times (minutes)
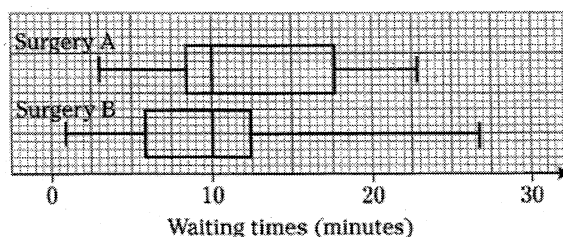
Compare the waiting times at the two surgeries.

12 The employees in a firm were asked to record the distance, in km, they travelled by car in a giv week. The distances, to the nearest km, are shown below.

```
67  76  85  42  93  48  93  46  52  72  77  53  41
48  86  78  56  80  70  70  66  62  54  85  60  58
43  58  74  44  52  74  52  82  78  47  66  50  67
87  78  86  94  63  72  63  44  47  57  68  81
```

(i) Construct a stem-and-leaf diagram to represent these data.

(ii) Find the median and the quartiles.

(iii) Draw a box-and-whisker plot to represent these data.

(iv) Give one advantage of using

    (a)   a stem-and-leaf diagram,

    (b)   a box-and-whisker plot.

to illustrate data such as those given above.

13 In a test on the protein quality of a new strain of corn, a farmer fed 20 newborn chicks with the new corn and observed how much weight they gained after three weeks. The results are given below.

Weight gain (grams): 360, 445, 403, 376, 434, 402, 397, 425, 407, 369,
                    462, 399, 427, 420, 410, 391, 430, 369, 410, 397

(i) Find the median and quartiles.

The farmer also fed a control group of 20 newborn chicks on the standard strain of corn he had previously used and recorded their weight gains after three weeks.

The lowest weight gain was 321 grams and the highest weight gain was 423 grams.

The median was 368.5 grams, the lower quartile was 353 grams and the upper quartile was 383 grams.

(ii) Draw two box-and-whisker plots on the same diagram showing the weight gains of the chicks fed the new strain of corn and the weight gains of the control group fed the standard strain of corn.

(iii) Use the box-and-whisker plots to compare the two distributions.

14 The back-to-back stem-and-leaf diagram below shows the time, in seconds, for the breathing rate to return to normal for a group of regular gym users and a group of people who do not exercise regularly.

> **Key:** 8 | 4 | 3 means 48 seconds for those who do not exercise regularly and 43 seconds for the regular gym users.

People who do not exercise regularly		Regular gym users	
	2	7 9	(2)
	3	0 2 3 6	(4)
(1) 8	4	3 5 6 8 9 9	(6)
(2) 9 4	5	1 3 5 7 7	(5)
(3) 7 1 0	6	0 2 4 4	(4)
(5) 8 7 4 2 1	7	3 5 8	(3)
(5) 9 9 9 5 3	8	1 1 5	(3)
(3) 6 4 0	9	2 6	(2)
(4) 9 7 7 4	10		
(2) 8 5	11		
(2) 1 0	12		
(1) 3	13		

(i) Find the median and quartiles for the regular gym users.

(ii) Find the median and quartiles for the people who do not exercise regularly.

(iii) Draw two box-and-whisker plots on the same diagram to represent the data.

(iv) Compare the times taken by the groups to return to normal breathing rate.