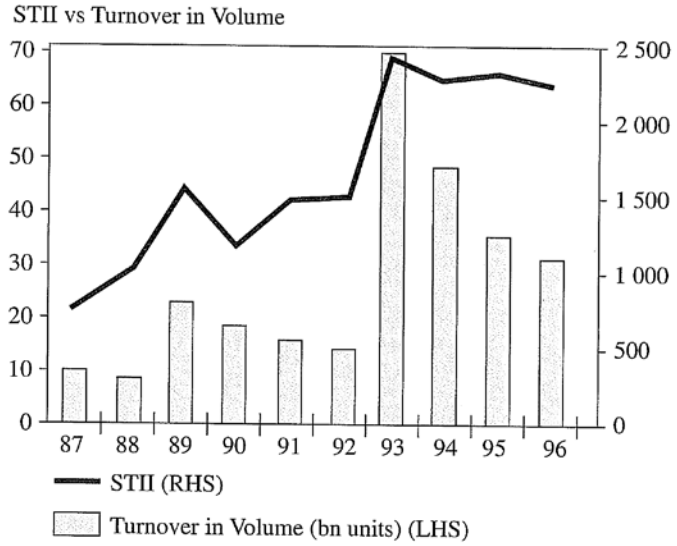
Chapter 11

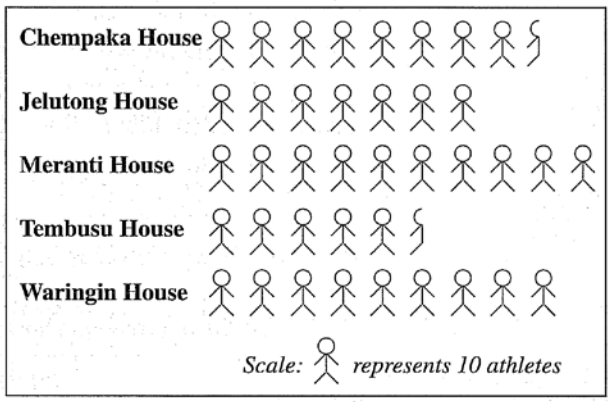
11.1 Statistical Presentations

Mrs Fung has to handle her family's finances now. She finds that she has to invest some of their savings as the interest paid by banks hardly covers the increase in the cost of living due to inflation. She has to consult her stockbroker and browse through newspapers and company reports. It is not an easy task and she laments the fact that she was not taught statistics during her schooldays. Statistical data presented graphically, as shown below, confound her.
Mrs Fung's problem is a common one that many of us face in this modern world. Studying statistics helps us to tackle this problem.



1. In pictograms, pictures are used to represent data. The pictures attract immediate attention as they depict the objects under discussion. However, they are not accurate as the fractional parts of the pictures are only approximations.

Pictogram of the number of athletes in various Houses.



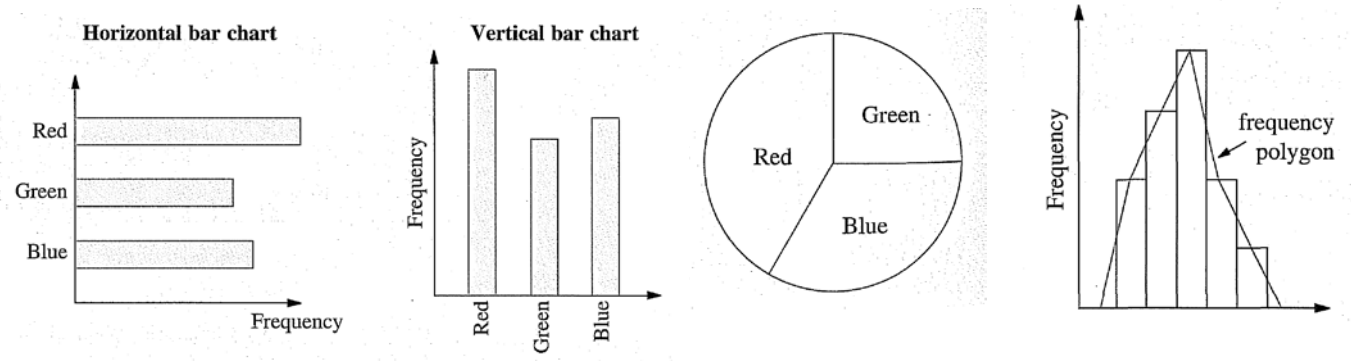
2. Bar charts can be horizontal or vertical. The bars or columns must be of equal width.

The length of a bar or the height of a column represents the frequency. The lengths give a better comparison of values than the sectors in a pie chart.

3. In a pie chart, the angle of the sector is proportional to the frequency of the category represented by the sector.

4. In a histogram, the area of each column represents the frequency of each class. If all the columns are of equal widths, we can use the height of the column to represent the frequency.

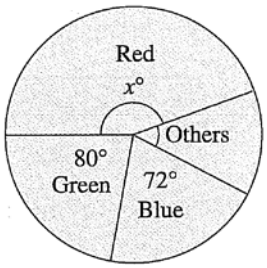
5. A frequency polygon is formed by joining the midpoints at the top of the rectangular columns in a histogram by straight lines.



Example 1

A class of 36 pupils was asked to name their favourite colour. Their choices are represented on a given pie chart.

(a) If 16 said they liked red, calculate the value of x°.
(b) Find the number who said they liked green.
(c) Find the percentage of the class who said they liked blue.



11.2 Statistical Averages

The **mean** of a distribution is found by dividing the sum of the values by the number of values.
The **median** of a distribution is the value below which half the data lies.
The **mode** of a distribution is the value that occurs most frequently.

Example 2
Find the mean, the mode and the median of 2, 7, 6, 6, 2, 4, 5, 6.

Example 3
A six-sided die is thrown 19 times. The results are tabulated as shown.

No. shown on die	1	2	3	4	5	6
Frequency	6	5	3	2	1	2

(a) Write down (i) the mode, (ii) the median.

(b) The die is thrown one more time. If the mean of the 20 throws is 2.8, find the number shown on the die.

Example 4

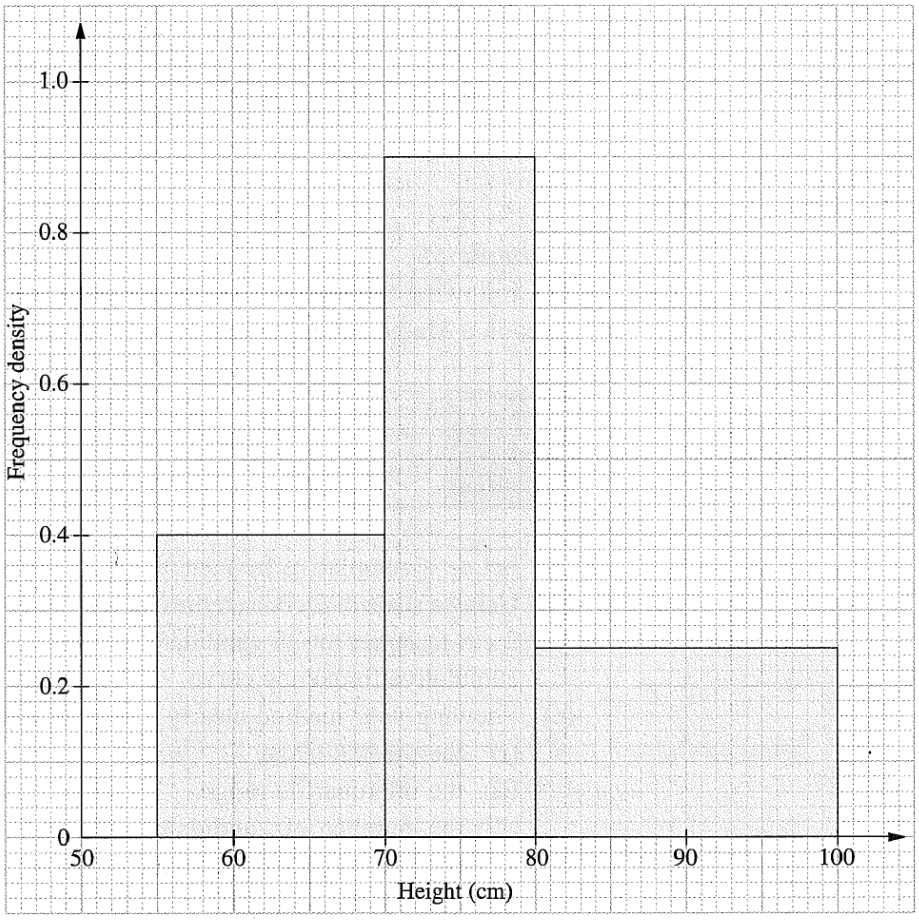
The heights of 20 children are shown in the table below.

Height (x cm)	$55 < x \leqslant 70$	$70 < x \leqslant 80$	$80 < x \leqslant 100$
No. of children	6	9	5

Draw a histogram to represent this distribution.

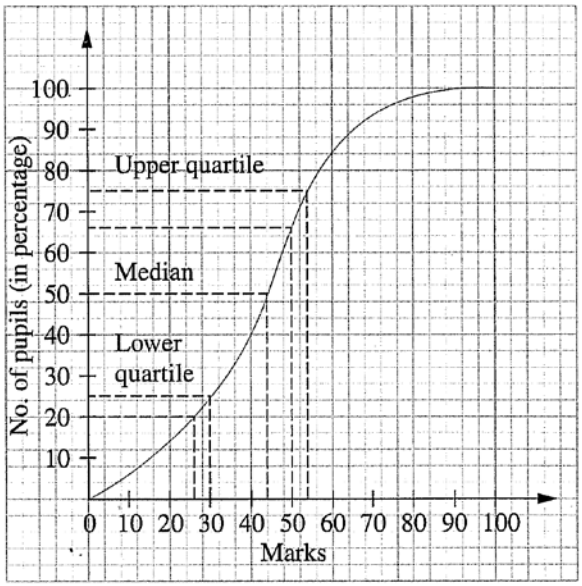
Solution

Height (x cm)	$55 < x \leqslant 70$	$70 < x \leqslant 80$	$80 < x \leqslant 100$
No. of children	6	9	5
Class size	15	10	20
Frequency density	$\frac{6}{15} = 0.4$	$\frac{9}{10} = 0.9$	$\frac{5}{20} = 0.25$



Example 5

A class of 50 pupils sat for a Physical Science examination. The marks obtained by the pupils were tabulated and a cumulative frequency curve was drawn as shown in figure below.



Study the graph and answer the following.

(a) Find the following:

(i) the lower quartile, (ii) the median, (iii) the upper quartile,

(iv) the interquartile range.

(b) If 75% of the pupils passed the test, what was the passing mark?

(c) If not more than 20% failed, what was the passing mark?

(d) How many pupils passed the test if the passing mark is 50?

Example 6

A survey of 30 Secondary schools is shown as follows:

Mode of travel	Walk	Bicycle	Bus	Car	MRT
No. of students	6	2	10	4	8

(a) Draw a bar chart to show the information.

(b) Draw a pie chart to show the information.

TUTORIAL 11

1. The Intelligence Quotients (I.Q.) of 80 students are tabulated as follows:
   (a) Which class of I.Q. scores is the most common?
   (b) Calculate the percentage of students whose I.Q. is greater than 114.
   (c) Draw a histogram and a frequency polygon to illustrate this distribution.

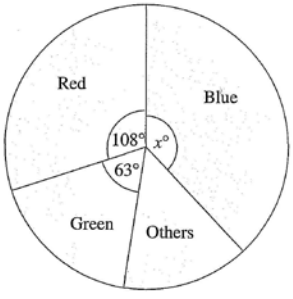
Scores	Frequency
95—99	5
100—104	11
105 —109	13
110—114	16
115—119	12
120—124	8
125—129	8
130—134	7

2. The heights (in cm) of 50 randomly selected students were measured to give the following data:

162 165 158 171 169 163 162 165 158 155
154 170 158 158 155 154 152 160 170 159
154 172 162 170 164 170 151 162 160 159
159 157 159 167 160 159 155 172 154 155
173 166 158 156 175 155 165 159 153 163

   (a) State the height of the tallest student.
   (b) State the height of the shortest student.
   (c) What is the range of the heights?
   (d) Draw up a frequency table using a class width of 4 cm starting with 150 cm.
   (e) Draw a histogram to display this distribution.

3. Each member of a class of 40 girls was asked to name her favourite colour. Their choices are represented on the given pie chart.
   (a) If 15 said they liked blue, calculate the value of x.
   (b) Find the number who said they liked green.
   (c) Find the percentage of the class who said they liked red.



4. The mass x g of each 90 oranges of a certain variety was recorded. The data obtained was illustrated as shown in the table.

Mass x (g)	No. of oranges
60< x ≤80	4
80< x ≤90	9
9O< x ≤100	28
100<x ≤110	37
110<x ≤120	8
120< x ≤130	4

(a) Copy and complete the following cumulative frequency table.

Mass	x(g)	60	80	90	100	110	120	130
No.	of oranges of this mass or less	0	4					90

(b) Using a horizontal scale of 1 cm to represent a mass of 10 g and a vertical scale of 1 cm to represent 10 oranges, draw, a smooth cumulative frequency curve for this distribution.

(c) Use your graph to estimate the following for this distribution.
(i) the median, (ii) the interquartile range.

5. Find the mean, median and mode for the set of numbers :

(a) 3, 5, 2, 6, 5, 9, 5, 2, 8, 6

(b) 51.6, 48.7, 50.3, 49.5, 48.9

6. The ages of 10 girls are 13, 19, 15, 12, 19, 14, 17, 17, 19 and 15 years old.
Find: (a) the mode ;
(b) the median ; and
(c) the arithmetic mean.

Challenging Problem

1.* **Answer the whole of this question on a sheet of graph paper.**

The following table gives the frequency distribution of marks obtained by 80 candidates in examinations in Mathematics and English.

Mark	$0 \leq x \leq 20$	$20 < x \leq 40$	$40 < x \leq 60$	$60 < x \leq 80$	$80 < x \leq 100$
Mathematics	8	12	18	25	17
English	2	10	33	31	4

(a) Copy and complete the table below showing the cumulative frequency distribution in each subject.

	Mark	20	40	60	80	100
Number of children with this mark or less	Mathematics	8	20			80
	English					

(b) Using a scale of 2 cm to represent 20 marks on the horizontal axis and 2 cm to represent 20 candidates on the vertical axis, draw separate cumulative frequency diagrams for each of the subjects Mathematics and English.

Showing your method clearly, use your graph to estimate

(i) the median mark in Mathematics,

(ii) the interquartile range in English,

(iii) the number of candidates who will obtain a distinction in English, if the minimum mark for a distribution is 76,

(iv) how many more candidates will fail to achieve a credit in Mathematics than in English if the minimum mark for a credit is 60 in each subject.