Probability & Statistics

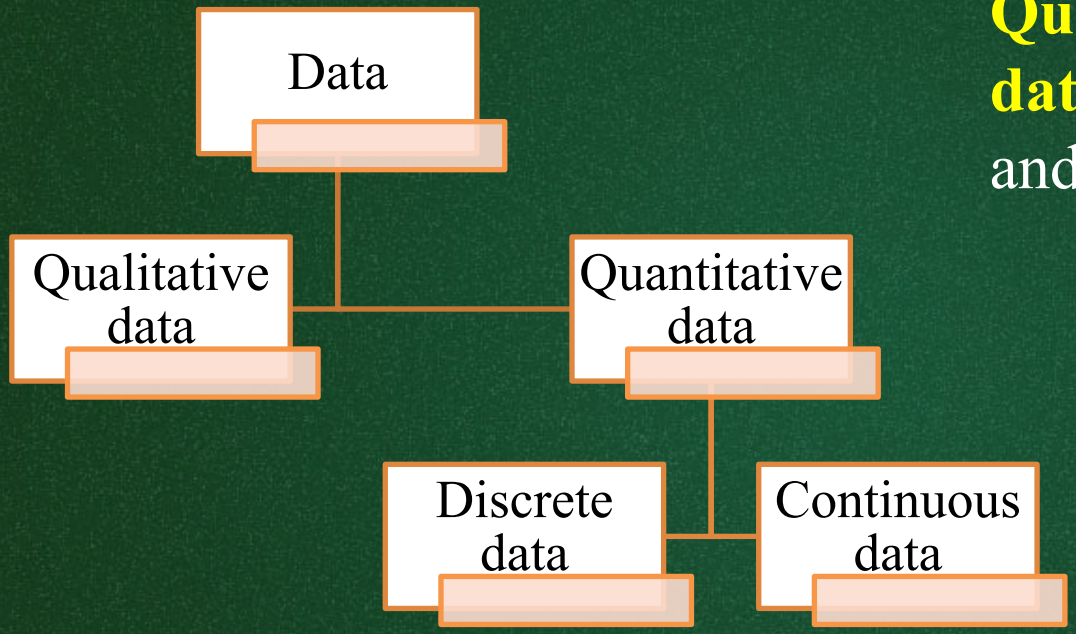
Chapter 1

Representation of data

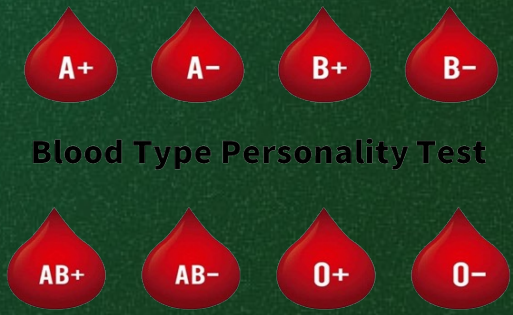
Cambridge AS level

1.1 TYPES OF DATA

There are two types of data.



Qualitative (categorical) data are described by words and are non-numerical.



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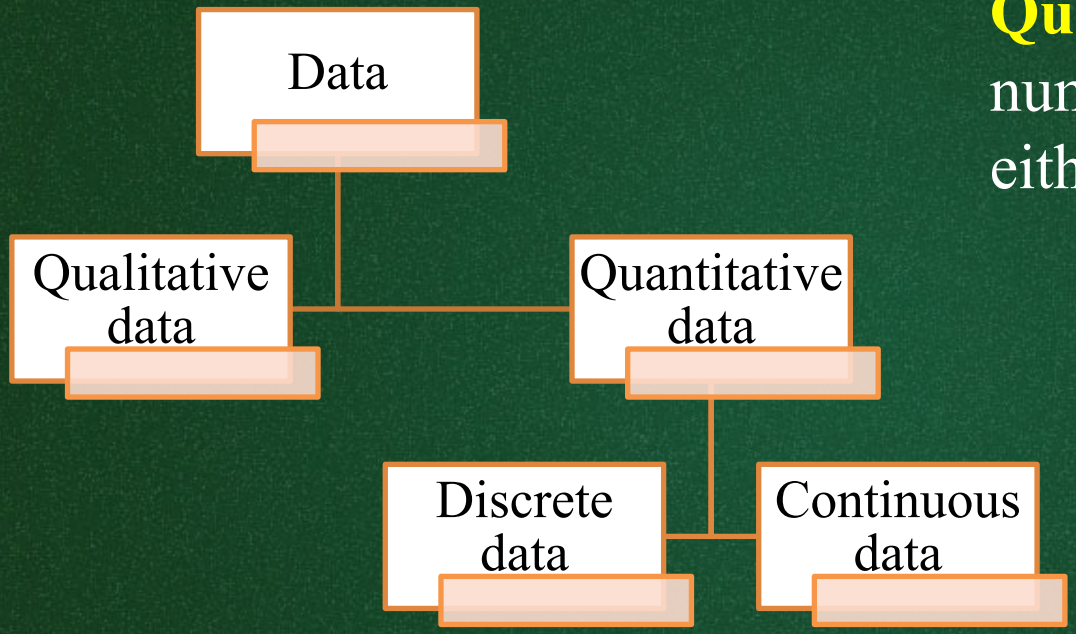
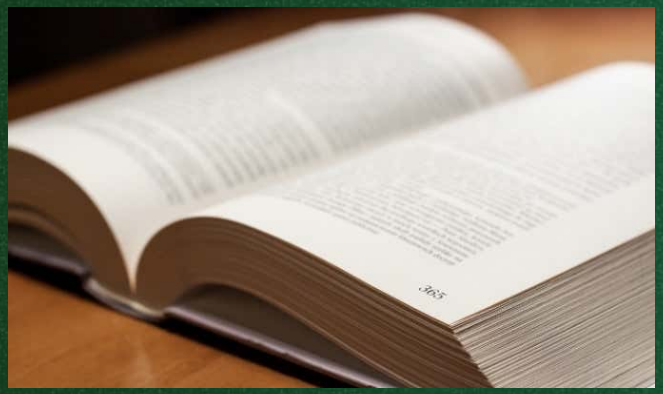


Quantitative data take numerical values and are either discrete or continuous.

1.1 TYPES OF DATA

Discrete data are counted and cannot be more precise. Discrete data can take only certain values.



Discrete quantitative data can take non-integer values.

1.1 TYPES OF DATA

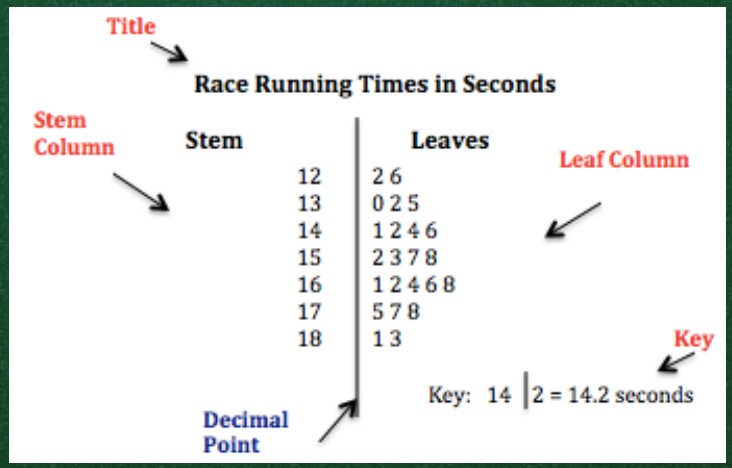
Continuous data can take any value (possible within a limited range).

1.2 REPRESENTATION OF DISCRETE DATA: STEM-AND-LEAF DIAGRAMS

A Stem-and-leaf is type of table best suited to representing small amounts of **discrete data**. The last digit of each data value appears as a *leaf* attached to all the other digits, which appear in a *stem*. The digits in the stem are **ordered** vertically, and the digits on the leaves are ordered horizontally, with the smallest digit nearest to the stem.

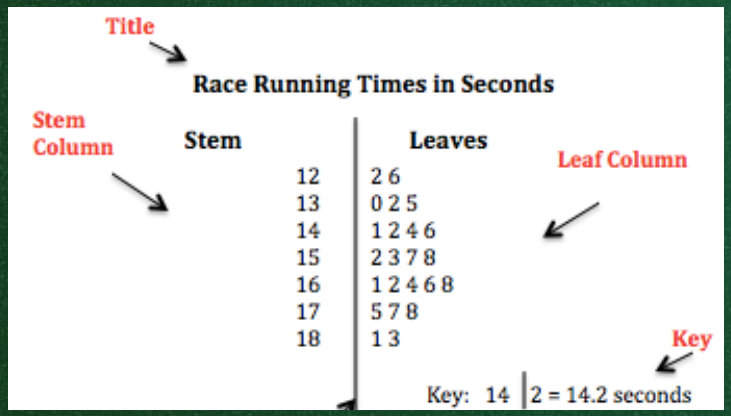
10, 15, 22, 25, 28, 23, 29, 31, 36, 45, 48

Stem	Leafs
1	0 5
2	2 5 8 3 9
3	1 6
4	5 8



1.2 REPRESENTATION OF DISCRETE DATA: STEM-AND-LEAF DIAGRAMS

Each row in the table forms a **class** of values. The rows should have intervals of equal width to allow for easy visual comparison of sets of data. A **key** with the appropriate unit must be included to explain what the values in the diagram represent.



Key: 1 | 4 means 14

Stem	Leaf
1	4 9
2	2 4 9
3	2 5 5 6 8
4	1 7

1.2 REPRESENTATION OF DISCRETE DATA: STEM-AND-LEAF DIAGRAMS

Stem-and-leaf diagrams are particularly useful because **raw data** can still be seen, and two sets of related data can be shown **back-to-back** for the purpose of making comparisons.

Before		After
9	1	1 8
6 5 5 4 0	2	2 3 5 8 9
9 8 6 2 1 0	3	0 0 2 2 2 5 9
8 8 7 5 5 2 2 0	4	0 3 4 5 7 7
8 6 6 5 5 4 2	5	0 1 1 3 6
8 3 2 2 1	6	2 4 5 7
1	7	3

Girls (12)		Boys (13)
4 1	8	2
8 6 6	8	5 9
3 2 1 0	9	0 1 3 3 4 4
8 7 7	9	5 6 6 9

Key: 1 | **8** | 2 represents 81% for a girl and 82% for a boy

In a back-to-back stem-and-leaf diagram, the leaves to the right of the stem ascend left to right, and the leaves to the left of the stem ascend right to left.

Example 1:

Consider the raw percentage scores of 15 students in a Physics exam, given in the following list: 58, 55, 58, 61, 72, 79, 97, 67, 61, 77, 92, 64, 69, 62 and 53.

5	8 5 8 3
6	1 7 1 4 9 2
7	2 9 7
8	
9	7 2

5	3 5 8 8
6	1 1 2 4 7 9
7	2 7 9
8	
9	2 7

Key: 5|3 represents a score of 53.

Example 2:

The number of days on which rain fell in a certain town in each month of 2016 and 2017 are given.

Year 2016					
Jan: 17	Feb: 20	Mar: 13	Apr: 12	May: 10	Jun: 8
Jul: 0	Aug: 1	Sep: 5	Oct: 11	Nov: 16	Dec: 9

Year 2017					
Jan: 9	Feb: 13	Mar: 11	Apr: 8	May: 6	Jun: 3
Jul: 1	Aug: 2	Sep: 2	Oct: 4	Nov: 8	Dec: 7

Display the data in a back-to-back stem-and-leaf diagram and briefly compare the rainfall in 2016 with the rainfall in 2017.

2016		2017
9 8 5 1 0	0	1 2 2 3 4 6 7 8 8 9
7 6 3 2 1 0	1	1 3
0	2	

Key: 5|0|6 represents 5 days in a month of 2016 and 6 days in a month of 2017.

In rained on more days in 2016 (122 days) than it did it 2017 (74 days).

Homework Page 4 – Exercise 1A

EXERCISE 1A

1 Twenty people leaving a cinema are each asked, "How many times have you attended the cinema in the past year?" Their responses are:

6, 2, 13, 1, 4, 8, 11, 3, 4, 16, 7, 20, 13, 5, 15, 3, 12, 9, 26 and 10.

Construct a stem-and-leaf diagram for these data and include a key.

2 A shopkeeper takes 12 bags of coins to the bank. The bags contain the following numbers of coins:

150, 163, 158, 165, 172, 152, 160, 170, 156, 162, 159 and 175.

a Represent this information in a stem-and-leaf diagram.

b Each bag contains coins of the same value, and the shopkeeper has at least one bag containing coins with dollar values of 0.10, 0.25, 0.50 and 1.00 only.

What is the greatest possible value of all the coins in the 12 bags?

3 This stem-and-leaf diagram shows the number of employees at 20 companies.

1	0 8 8 8 8 9 9	Key: 1 | 0
2	0 5 6 6 7 7 8 9	represents 10
3	0 1 1 2 9	employees

a What is the most common number of employees?

b How many of the companies have fewer than 25 employees?

c What percentage of the companies have more than 30 employees?

d Determine which of the three rows in the stem-and-leaf diagram contains the smallest number of:

i companies **ii** employees.

4 Over a 14-day period, data were collected on the number of passengers travelling on two ferries, A and Z. The results are presented to the right.

Ferry A (14)		Ferry Z (14)	Key: 3 | 5 | 0
8 7 6	2		represents 53
7 6 4 0	3	0 5 8	passengers on A
8 6 5 3	4	3 4 5 7 7 7	and 50 passengers
5 3 3	5	0 2 6 6 9	on Z

a How many more passengers travelled on ferry Z than on ferry A?

b The cost of a trip on ferry A is \$12.50 and the cost of a trip on ferry Z is \$$x$. The takings on ferry Z were \$3.30 less than the takings on ferry A over this period. Find the value of x.

c Find the least and greatest possible number of days on which the two ferries could have carried exactly the same number of passengers.

5 The runs scored by two batsmen in 15 cricket matches last season were:

Batsman P: 53, 41, 57, 38, 41, 37, 59, 48, 52, 39, 47, 36, 37, 44, 59.

Batsman Q: 56, 48, 31, 64, 21, 52, 45, 36, 57, 68, 77, 20, 42, 51, 71.

a Show the data in a diagram that allows easy comparison of the two performances.

b Giving a reason for your answer, decide which of the batsmen performed:

i better **ii** more consistently.

6 The total numbers of eggs laid in the nests of two species of bird were recorded over several breeding seasons.

The numbers of eggs laid in the nests of 10 wrens and 10 dunnocks are:

Wrens: 22, 18, 21, 23, 17, 23, 20, 19, 24, 13.

Dunnocks: 28, 24, 23, 19, 30, 27, 22, 25, 22, 17.

a Represent the data in a back-to-back stem-and-leaf diagram with rows of width 5.

b Given that all of these eggs hatched and that the survival rate for dunnock chicks is 92%, estimate the number of dunnock chicks that survived.

c Find the survival rate for the wren chicks, given that 14 did not survive.

7 This back-to-back stem-and-leaf diagram shows the percentage scores of the 25 students who were the top performers in an examination.

Girls (12)		Boys (13)	Key: 1 | 8 | 2
4 1	8	2	represents
2 6 6	8	5 9	81% for a
3 2 1 0	9	0 1 3 3 4 4	girl and 82%
8 7 7	9	5 6 6 9	for a boy

The 25 students are arranged in a line in the order of their scores. Describe the student in the middle of the line and find the greatest possible number of boys in the line who are not standing next to a girl.