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4 Conducting a survey or experiment

4.1 Surveys, questionnaires and interviews

Quick reminder

Data for an investigation is often collected by completing a **survey**. This can be done either through **observation**, **questionnaire** or an **interview**. Choosing the correct method for the investigation is essential.

A **pilot survey** (trial) is often completed to check that the questions are correct and will give the required information before the main survey is undertaken. Questions need to be clear with no **bias**.

Survey type	Advantages	Disadvantages
Observation	Easy to collect data Potentially large amount of data can be collected	Limited data can be collected No follow up Lack of detail Observer may need to be trained – cost
Questionnaire	Low cost Large numbers of participants Easy analysis Can be done online	Low response rate from mail surveys Lack of detail
Interview	Personal contact Ability to probe and ask follow-up questions Detailed answers	Time consuming High cost, including training the interviewer People don't like unsolicited telephone interviews

Definitions

A **respondent** is someone who takes part in a survey.

A **pilot survey** is conducted on a small sample to test the design and methods of the survey.

A **questionnaire** is a set of questions designed to obtain data.

An **open question** is one that has no suggested answers.

A **closed question** has a set of answers for the respondent to choose from. This may be through, for example, tick boxes or a sliding scale.

Exercise 4A

F

E

1 A council included this question in a questionnaire:

'Do you agree that the new one way system is a good idea?'

Give one criticism of this question.

2 The council want to know how many people use each type of recycling bin provided in a local car park. There are bins for glass, tins, paper and plastic.

Design a data collection sheet that will allow you to capture data while at the car park. Remember to include the number of people as well as the type of recycling.

3 Ellie is writing a questionnaire about people's ages. This is one question from her questionnaire.

How old are you?

☐ Young ☐ Middle aged ☐ Old

a Give one criticism of this question?

b Rewrite the question to make it a good question.

4 Edward is carrying out a survey about rugby teams. This is one question from his survey.

How often do you watch a rugby match?

☐ Less than once a week ☐ Once a week ☐ Whenever I can

a Give a reason why this is not a good question.

b Rewrite the question to make it a good question.

EQ 5 Krishan receives a questionnaire in the post about a new local leisure centre.

Three of the questions are shown below.

Give **one** criticism of each question.

Question 1:

How often have you exercised in the last 6 months?

Question 2:

How much do you earn each year? Please tick one box.

☐ Less than £10 000 ☐ £10 000 up to £20 000 ☐ More than £20 000

Question 3:

If you have already used our leisure centre, give one reason why you enjoyed using it.

D

6 Write down **three** of the things you need to consider when writing a question for a questionnaire.

7 **a** Criticise the following questionnaire question:

> Approximately how tall are you?

b Rewrite the question to include response boxes.

8 Give **two** advantages and **two** disadvantages of using an interview to gather data.

C

9 Write a question for a questionnaire designed to find out how much people weigh.

10 A report in a medical journal claims that people weigh more in the morning than in the evening. Design a simple statistical experiment to test this claim.

EQ 11 Max wants to open a shop in the village where he lives.

To find out the views of local people, he delivers a questionnaire to every house in the village.

a The questionnaire includes a closed question about the respondent's age.

i Explain what is mean by a *closed question*.

ii Give one advantage of using a closed question for age.

b Only 14% of the questionnaires are returned to Max.

How might Max have improved the response rate?

c The returned questionnaires showed that some of his questions had been badly worded.

What should Max have done before he delivered his questionnaire to avoid this problem?

d One of Max's questions was:

'How often do you go shopping?'

Give **two** criticisms of this question.

B

12 A large sports company with 170 shops wants to obtain information about sales.

They decide to send out a questionnaire to all shops, but first carry out a pilot survey.

What are the advantages of conducting a pilot survey?

13 You need to carry out a survey to find out how much money people will spend on a holiday.

a Give one reason why you might choose to carry out a personal interview rather than a postal survey.

b Give one reason why you might not choose to conduct a personal survey.

c Give one advantage and one disadvantage of conducting an online survey about holidays.

A

14 Forty white van drivers were asked to complete this questionnaire.

> Throw a coin.
>
> If it shows a HEAD, tick the YES box below.
>
> If it shows a TAIL, answer the question 'DO YOU EVER SPEED WHEN DRIVING FOR WORK?'
>
> ☐ Yes ☐ No

a How many HEADS would you expect?

b If all the drivers speed, how many forms will have the 'YES' box ticked?

c If no drivers speed, how many forms would you expect to have the 'YES' box ticked?

d When the forms are returned, 32 have the 'YES' box ticked. Estimate the number of drivers who speed when driving for work.

e What is the advantage of using a questionnaire like this?

4.2 Census data

Quick reminder

What's the difference between a census and a survey?

A census collects data from everyone or everything in a population, whereas a survey collects data from a sample of the population as a whole.

	Advantages	Disadvantages
Census	Takes the whole population into account Accurate data Unbiased (as all asked)	Expensive Time consuming Can be difficult to make sure you have responses from the whole population Large quantity of data produced
Survey	Cheaper Less time consuming A more manageable amount of data produced	Not completely representative of whole population Sampling method may inadvertently introduce bias

6.4 Choropleth maps

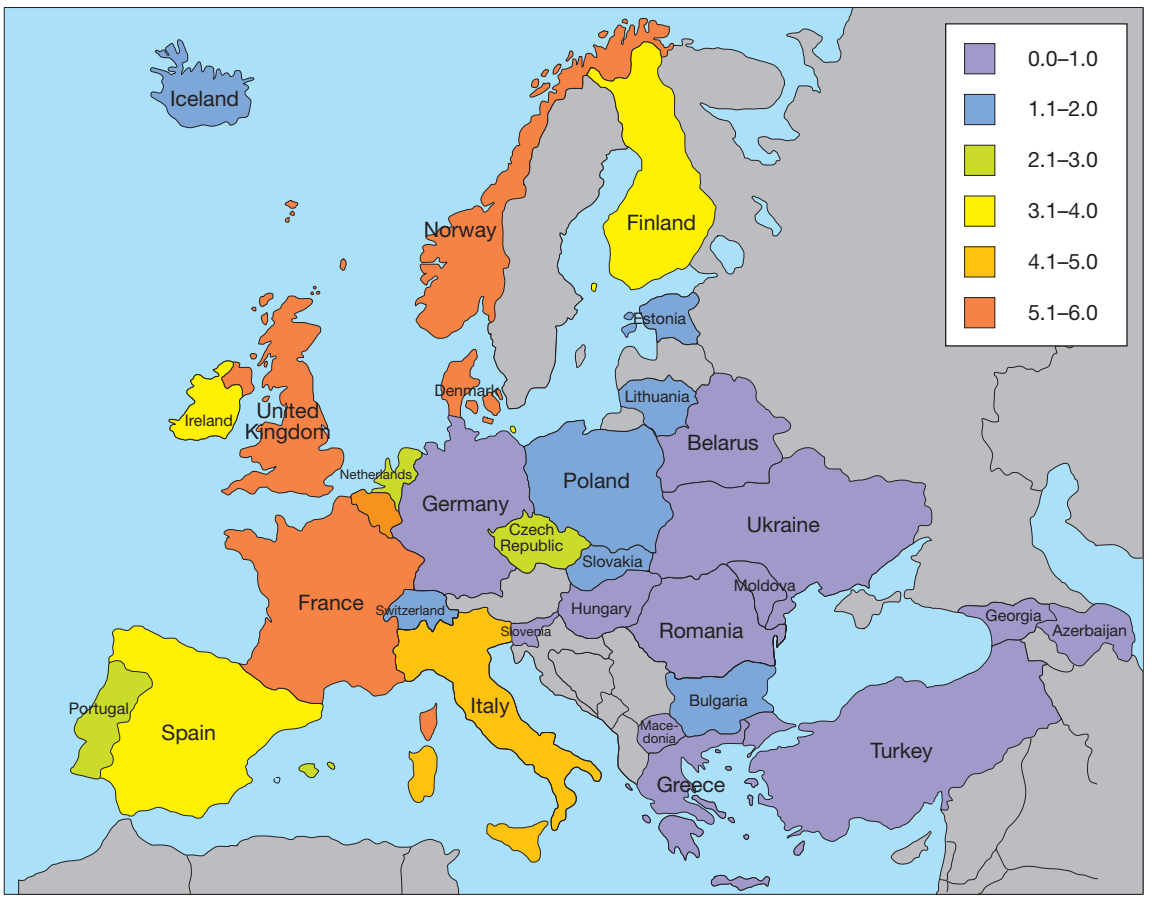
Quick reminder

Choropleth maps are maps in which areas are shaded differently, to illustrate a distribution.

Every map should have a 'key' that makes sense of the data. Remember to study this carefully before answering a question.

Exercise 6D

1 The Choropleth map shows the car thefts per 1000 people per country per year in Europe. **AO3**



a Which is the only country to have between 4.1 and 5.0 cars stolen per 1000 people?

b How many cars per 1000 people are stolen in Spain?

c How could you improve on the way the information is displayed on this map?

2 Part of a coral reef is subdivided into square sections.

The number of different species of fish passing each square in an hour is shown in the table below. **AO4**

24	20	23	22	18	19
26	23	19	21	10	18
39	33	30	22	9	6
25	21	24	21	17	19

a Use the key to produce a Choropleth map illustrating the data. **AO3**

Key

b Part of the coral reef has been damaged by fishermen using dynamite.

Draw a line around the area where you think the coral has been damaged.

c Explain your answer to part **b**.

d One area is regularly visited by divers who feed the fish they see.

Draw a line around this area.

e Explain your answer to part **d**.

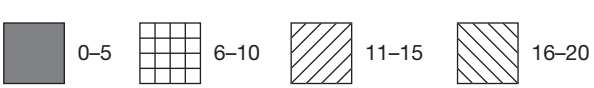
3 A forest is subdivided into square sections.

10	6	3	3	3	9
13	12	4	4	10	11
11	19	14	12	14	13
15	19	12	12	12	10

The number of different species of birds in each section is shown in each square of the table. **AO4**

a Use the key to produce a Choropleth map illustrating the data. **AO3**

Key



b Part of the forest has been cut down and the trees removed for their wood.

Draw a line around the area where you think the trees have been cut down and removed.

c Explain your answer to part **b**.

d One area of the forest has very fertile soil and a lot of trees grow there.

Draw a line around this area.

How are Statistics used by …

… Sports recruiters?

The job

Did you ever wonder who negotiated that deal for the new striker on your favourite football team? Behind those trades, deals and new teammates are professional agents, scouts, and managers. These strategists work to source players for clubs and teams using their knowledge of the industry, the players, the club and the world of sport.

You could be:

- An agent
- A scout
- A manager
- A coach

The maths

Sports recruiters, athletic agents and even team coaches use maths every day. Player and team statistics are valuable resources for recruiters to make suitable club/player pairings. These stats are analysed, compared, deconstructed, used to forecast and serve to rank each player within a pool of candidates.

The profile

Chris has a BSc in Sports Science. He began coaching a local football team when he graduated from university. Under his guidance, the team went from only 12 players to over 25 and within two years he had led them to a regional championship. That is when Chris began to consider a career in recruitment. Today, Chris is the leading international scout for a major premiership team.

GIVE IT A TRY!

Chris is charged with filling an urgent position on a premiership football team. The coaches and managers have asked for an attacking player who can also fit into midfield and create chances. The table opposite shows three premiership players available to purchase in the January transfer window along with their cost and performance statistics from the previous season. Use the data to produce graphs and calculations that Chris can present to the manager in order for him to make an informed choice. After the presentation, the manager buys one of the players. Which player did Chris recommend the manager buy and why?

Players	Fernando	Joe	Jamie
Goals	19	16	23
Assists	10	16	12
Appearances out of 38 possible	36	25	37
Cost in Millions £	30	18	21
Tackles made	50	200	150
Yellow cards	5	2	0
Red cards	3	1	0
Pass completion %	72	89	80

The manager is impressed with Chris' recommendations and asks him to do a detailed analysis of two of his current strikers' performances over several years because he is thinking of selling one of them. Do a statistical analysis of both players and produce a presentation.

Wayne

Year	Age	Apps	Goals	Assists
2006/7	21	35	14	20
2007/8	22	27	12	13
2008/9	23	30	12	9
2009/10	24	32	26	11
2010/11	25	16	4	10

Didier

Didier				
Year	Age	Apps	Goals	Assists
2006/7	28	36	20	3
2007/8	29	19	8	8
2008/9	30	24	5	5
2009/10	31	32	29	12
2010/11	32	24	10	10

Did you know that SPORT was so dependent upon STATISTICS?

How are Statistics used by …

… Intelligence agencies?

The job

There is a constant stream of information or 'intelligence' to be considered where economic and national security are concerned. Those professionals who are charged with finding, understanding, interpreting and assessing secret information are called Intelligence Analysts. They handle the biggest threats to the UK and provide important support to the armed forces.

You could be:

- An intelligence officer
- An intelligence analyst
- An operational officer
- A language specialist
- A security consultant

The maths

Intelligence information does not always reach an analyst's desk in an organised and straight-forward way They must clearly assemble all the facts so they can analyse it efficiently and precisely. Analysts constantly use probability, approximations, sampling, etc. to take what little they know and determine the likely implications.

The profile

Armin is an intelligence officer. His specialty is signals intelligence, where he helps decode and understand messages intercepted from all over the world. With an MA in Modern Languages, Armin never thought he was much of a maths person. However, his fluency in several languages is a vital resource for his work. Since joining the intelligence world, Armin has travelled all over the globe and been involved in projects directly responsible for counteracting terrorism and organised crime within the UK and abroad.

GIVE IT A TRY!

1 a Armin is investigating complaints that a new satellite phone is not working in temperatures of above 50 °C. He knows that there are 20 areas where the phones are being used with approximately 200 phones in each location. Describe how he could determine a sample of phones to test whether or not the complaints are valid.

b If Armin finds that 5% of phones fail in these conditions, find the probability that if ten phones are used to make calls, no more than three of them fail.

Did you know that SECURITY was so dependent upon STATISTICS?

Mapping chart

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