GCSE Maths – Statistics

Sampling

Notes

WORKSHEET

Sampling

When studying statistics, population and sampling are very important.

Population

A population is all the **people, events or items** which are of interest to be questioned, surveyed, or experimented on.

Example populations include:
- All the fish in a pond.
- British storms from 1990-2010.
- GCSE students at a local school.

Using an entire population in a study has advantages and disadvantages:
- Advantage – **everyone's opinion** is accounted for.
- Disadvantage – takes a **long time** and can be **expensive**.

Census

A census **collects information** from **all** members of a population.

A teacher wanted to find out which candidate her class of 25 students voted for in the student elections. The teacher carries out a *census* by creating a simple questionnaire for all 25 students to fill out and collected the results. The *population* is the 25 students in her class.

Questionnaires

Questionnaires are used to **collect responses** from people in a population by asking questions. They should be simple and easy to understand. The options need to be clear, and account for all possibilities.

Example: Identify two problems with the question and rewrite it to improve the responses.
Sarah wants to find out how often people go for a run each week. She uses this question in a questionnaire:
"How many times do you go for a run?"
O. Not very often   O. Sometimes   O. A lot

Identify two problems
There are no numerical values. One person's definition of 'a lot' may be different to another's.
There are insufficient options - for example, there is no option for someone who doesn't run at all.

Improve the questionnaire
Add numerical values and add an option for people who don't run at all:

How many times do you usually go for a run each week (of at least 1km in distance)?
O None   O 1-3   O 4-5   O 6+

This questionnaire could be improved further. Sarah could repeat the survey over multiple weeks, asking how many runs the participants had completed at the end of each week. She could then take an average herself, rather than relying on the participants definition of 'usually'.

Sampling

Sampling involves selecting a **smaller sub-group** of people or objects from a **population** to test a theory or idea (a hypothesis) about the population.

For example: a teacher wants to find out the average test score for the year 11 maths exam. She can't ask all 150 students, so she selects 50 of them and uses their average score to reflect the population's average score as a whole.

Using a sample in a study has advantages and disadvantages:
- Advantage – **quicker to conduct** and **cost-effective.**
- Disadvantage – **smaller range of opinions** and could cause **bias**.

Bias

A sample should represent everyone. Bias is when one person, group, or opinion is favoured over the others.

If a teacher chose to take results from students in the top set only, her average result wouldn't be very representative of the whole school year. This sample would be biased towards higher scores.

Example: Will the following sample produce a bias result?

10 people at a gardening centre were asked about the importance of home-grown vegetables.

People at a garden centre are more likely to feel that home grown vegetables are very important. Therefore, the sample is biased.

Example: Identify three issues with the following sampling method used.

The town butcher wanted to estimate the number of people who buy meat from his store. He telephoned 100 people one morning to ask:
'Did you buy meat from the butchers or supermarket this week?'.
14 people chose the butchers. The butcher concludes that 14% of people in the town buy meat from the butchers each week.

*1. 100 people is not enough to represent a town. **Towns can have 500-100,000 inhabitants. This is not a large enough sample to represent the whole town.***

*2. People might have shopped at the butchers this week as a one-off. **They might usually shop at the supermarket. The survey should be repeated over multiple weeks to reduce the effect of one-off shoppers.***

3. People might have been shopping at the butchers when the call took place.
They would not have been included in the investigation.

Sampling - Practice Questions

1. Asim wants to find out how much exercise people do. He asks the members of his football club to complete a questionnaire.

a) This may not be a suitable sample. Explain why.

b) Suggest a better sampling method and describe how Asim should collect this sample.

2. The local sports club wants to build a new hockey pitch. The council needs to get the views of local people. Counsellor Washington suggests taking a sample of the local sports teams.

a) Explain what is wrong with this sampling method.

b) Counsellor Taylor suggests taking a random sample of 200 people instead. Describe how the council could take a simple random sample.

3. Bonnie wants to find out more about the people in her school. She writes a questionnaire which contains the following questions:

"How much do your parents earn?"

O Less than £12,000

O £12,000-£30,000

O £30,000-£50,000

O More than £50,000

a) Why is this question not appropriate?

b) Is she using good response boxes? Explain your answer.

Worked solutions for the practice questions can be found amongst the worked solutions for the corresponding worksheet file.