

Sampling Random, Stratified etc

Q1

Andrew wishes to estimate the number of seals in a body of water.

He plans to use the capture/recapture method to do this.

- (a) What three assumptions must Andrew make to use the capture/recapture method?

No seals can escape from the water

No seals die between the samples

No seals are born in the time between the samples

The seals marked with mix well with the unmarked seals. [3]

One day, Andrew catches 90 seals, marks their skin with a harmless dye and releases them back into the water.

The following day, he catches 40 seals and finds that 7 of them have been marked with dye.

- (b) Use this information to estimate the number of seals in the body of water.

Capture = Recapture

$$\frac{90}{?} = \frac{7}{40}$$

Equal fractions $\times \frac{90}{7}$

$$\frac{90}{514} = \frac{7}{40}$$

$\times \frac{90}{4}$

Answer Approx 514 [4]

Q2

A supermarket chain has 93 stores in the United Kingdom with a total of 4502 employees. Each store is either a large store or a small store.

The directors of the supermarket chain are proposing to make changes to the employees' working hours. The directors want to survey a sample of 450 employees from the total workforce in order to ask them for their views on the proposed changes.

Three possible sampling methods in order to select the employees to be in the survey are suggested.

Method A The directors will choose two employees from each small store and six employees from each large store.

Method B All 4502 employees are allocated a number from 0001 to 4502. Start with number 0010 and take every 10th employee so that the sample consists of employees with the numbers 0010, 0020, 0030, ... and 4500.

Method C Each employee in each store will be given a raffle ticket and 10% of the number of employees in each store will be chosen at random by taking raffle tickets out of boxes, one box for each store.

For each of the three methods, identify the sampling method and discuss whether the sampling method is an appropriate way to select the employees to be in the survey.

As part of your discussion you should also state, with reasons, which of the three sampling methods is the most appropriate method for the directors to use.

Method A is QUOTA SAMPLING

The population is split into groups and you interview a quota from each

METHOD B IS RANDOM SAMPLING

Every employee has the same chance of being picked

METHOD C IS STRATIFIED SAMPLING

The size of store is reflected in the number of employees chosen for sample

Huge Store has huge representation the sample
Small Store has small representation in sample

Most appropriate to use.

Paul uses the Petersen capture recapture method in order to find an estimate for the number of trout living in a lake.

Q3

To do this, Paul catches an initial sample of 50 trout from the lake and he tags each trout. He then releases the trout back into the lake.

For his second sample, Paul catches a sample of 80 trout from the lake. He finds that 16 of these trout have tags.

- (a) Explain what needs to be true about his two samples for them to be valid for the capture recapture method.

Initial sample must stay within the lake
Must mix well with all the other fish in lake
No marked fish will die (1)

Using his results, Paul is able to work out an estimate for the number of trout living in the lake.

- (b) Find Paul's estimate for the number of trout and discuss the validity and the reliability of his estimate.

Sample 50

$$\begin{array}{ccc} \text{capture} & \xrightarrow{\times 3.125} & \text{recapture} \\ \frac{50}{\text{population}} & = & \frac{16}{80} \end{array}$$

$$\frac{50}{250} = \frac{16}{80}$$

Ans
250 living
in the lake.

Q4

A researcher wants to get the opinions of a town's residents about proposed changes to the traffic system.

The council decides to carry out a sample survey to gather residents' opinions instead of a census.

(a) Give two advantages to carrying out a sample survey rather than a census.

1. Much quicker
_____ [1]

2. Much cheaper
_____ [1]

Before using the questionnaire with the sample of residents, the researcher decides to conduct a pilot survey.

(c) Give two reasons why this is a good idea.

1. Test the design of the questionnaire to
make sure ^{questions} answers are understood [1]

2. It make prompt you to include
other questions in full survey [1]

A sample of 300 people is chosen in the town centre for the survey.

(d) Suggest a reason why this would not be a suitable sampling method.

Sample was only people in the town centre.
The town has residents who may not
go to the centre but are still [1]
impacted by the proposed change.
These residents should also be in the sample.

Q5

Peter and Helen want to collect information about how much time pupils at their school spend on homework every week. They attend a large post-primary school with 1400 pupils.

Peter is planning to use systematic sampling to select 50 pupils.

(a) Describe how Peter could select his sample.

Systematic sampling means Peter could choose every 10th person who passes him in the corridor.

OR Using the whole alphabetic list of [3] students he could choose every 20th person on that list

Helen is planning to select 50 pupils from outside the canteen.

(b) Name the method of sampling which Helen is planning to use.

Opportunity Sampling --- They are [1] available at the time