Sampling Methods

SCAN ME

REVISE THIS TOPIC

1 A car manufacturer produces 30 cars. Each car is fitted with 5 seat belts.

The car manufacturer wishes to test the seat belts to ensure that they function correctly.

(a) Identify the population. **(1)**

(b) Explain what is meant by the term census. **(1)**

(c) Explain what is meant by the term sample. **(1)**

(d) Should the car manufacturer complete a census or a sample? Give a reason for your answer. **(1)**

(a) All of the seatbelts in the 30 cars.

(b) When all of the items of the population are observed or measured.

(c) When a subset of the population is observed or measured.

(d) They should complete a census. Seat belts are for car safety so even if one does not function properly then this presents a serious problem. In total there are 150 seat belts which isn't a particularly large number to test.

(Total for Question 1 is 4 marks)

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2 A chess club has 220 members, of which 125 are male and 95 are female.

The club chair wishes to sample the members of the club to see what their chess ratings are.

(a) Identify the population. **(1)**

(b) Suggest a suitable sampling frame. **(1)**

(c) Identify the sampling units. **(1)**

The club chair decides to take a sample of 20 members of the chess club.
They wish to ensure that the proportion of males and females in the sample is the same as that in the entire club.

(d) State the type of sampling method that the club chair should use. **(1)**

(e) Work out how many male and female members should be included in the sample. **(1)**

(a) All of the members of the chess club.

(b) A list of the names of all of the members of the chess club.

(c) A member of the chess club.

(d) Stratified sampling.

(e) $\frac{125}{220} \times 20 = 11.36\ldots$ $\frac{95}{220} \times 20 = 8.636\ldots$

11 males and 9 females

(Total for Question 2 is 5 marks)

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3 A sports company produces trainers for athletes who compete in long distance running races.

The sports company produces 1000 units of a new type of trainer and wishes to know how many miles athletes can run in the trainer before it needs replacing. The company takes a sample of the 1000 units and gives them to athletes to test.

(a) Explain why the sports company uses a sample and not a census. **(1)**

(b) Describe how the sports company could produce a sample of size 20 using simple random sampling. **(3)**

Instead the sports company uses the following method to sample 20 of the units of trainers.

- Number each of the units from 1 to 1000.
- Use a random number generator to select a random number between 1 and 50.
- Include the unit corresponding to this number in the sample.
- Include every 50^{th} unit after the unit sampled in the previous step.

(c) Name the type of sampling method used by the sports company. **(1)**

(a) After each trainer is tested it will no longer be useful and cannot be sold.

If all are tested there would be no trainers to sell.

(b) Number each of the units from 1 to 1000.

Randomly generate numbers between 1 and 1000 e.g. using a calculator

Ignore any repeated numbers and continue until 20 different numbers have been selected.

Include the units corresponding to these 20 randomly generated numbers in the sample.

(c) Systematic sampling

(Total for Question 3 is 5 marks)

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4 A headteacher wishes to sample students in the sixth form to find out how they travel to school.

The headteacher decides to sample 30 students, stratified by year group.

There are 148 students in Year 12 and 112 students in Year 13 at the school's sixth form.

(a) Work out how many students there should be in the sample from each of the year groups. **(2)**

(b) State one advantage of using this sampling method. **(1)**

A teacher at the school suggests it would be much easier to simply sample the first 30 students that arrive to school in the morning.

(c) State the sampling technique suggested by the teacher. **(1)**

(d) Explain why this sampling technique would not be suitable for this investigation. **(1)**

(a) $\frac{148}{260} \times 30 = 17.07\ldots$ $\frac{112}{260} \times 30 = 12.92\ldots$

17 students from Year 12 and 13 students from Year 13

(b) It ensures that the sample has the same proportions as the population

(c) Opportunity Sampling (convenience sampling)

(d) Bias/non-random.

Students arriving to school first may tend to come by a particular travel method. E.g. if there are roadworks students who come by car/bus may be late compared to those who walk/bike.

(Total for Question 4 is 5 marks)

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5 Amy wishes to know whether people who listen to Taylor Swift music enjoyed her most recent album.

(a) Identify the population. **(1)**

(b) Give a reason why it may not be possible for Amy to use simple random sampling. **(1)**

Amy wants to sample 60 people and wishes to ensure that she has a range of ages in the sample.
She samples people as they arrive for a Taylor Swift concert and ensures that she samples:

20 people in the age range 0 – 15 years
20 people in the age range 16 – 30 years
20 people in the age range 31 years and above

If the person sampled does not listen to Taylor Swift music she does not include them.
If the person sampled has not listened to Taylor Swift's most recent album she does not include them.
If the person being sampled is in an age range where Amy already has 20 people she does not include them.

(c) State the sampling technique used by Amy. **(1)**

(d) State one disadvantage of using this sampling method. **(1)**

(a) All people who listen to Taylor Swift music.

(b) Amy is unlikely to be able to identify all people who listen to Taylor Swift music. Apparently there are quite a lot of them…

(c) Quota Sampling

(d) It is not random and could be biased. Fans that arrive first might be more likely to favour the album.

(Total for Question 5 is 4 marks)

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6 A local council wishes to sample residents within the council area to ask their views on the condition of the road surfaces in the region.

The council wishes to take a sample of size 250 from the 95,000 residents within the council area.

(a) Describe how the council could obtain the sample using simple random sampling. **(3)**

(b) Describe how the council could obtain the sample using systematic sampling. **(3)**

The council estimates that the ratio of drivers to non-drivers in the council area is 5 : 1
A member of the council suggests that the sample should include the same proportion of drivers and non-drivers as the whole council does.

(c) State the sampling method that they should use. **(1)**

(d) Work out how many drivers and non-drivers should be in the sample using the council's estimate. **(1)**

(a) Number each of the residents from 1 to 95,000.

Randomly generate numbers between 1 and 95,000 e.g. using a calculator

Ignore any repeated numbers and continue until 250 different numbers have been selected.

Include the residents corresponding to these 250 randomly generated numbers in the sample.

(b) Number each of the residents from 1 to 95,000.

Randomly generate a number between 1 and 380 e.g. using a calculator

Sample the resident corresponding to this number then every 380th resident after this one.

(c) Stratified sampling

(d) $\frac{5}{6} \times 250 = 208.3\ldots$ $\frac{1}{6} \times 250 = 41.6\ldots$

208 drivers and 42 non-drivers.

(Total for Question 6 is 8 marks)

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7 A headteacher wants to investigate how much revision students do to prepare for mock exams.

There are 750 students who attend the school that are split into 25 tutor groups.

The headteacher considers three sampling methods:

Method A:
- Whilst on duty at lunchtime, sample the first 150 students that they meet.

Method B:
- Number all students in the school from 1 to 750.
- Randomly generate 150 different numbers between 1 and 750.
- Sample all 150 students that correspond to the numbers generated.

Method C:
- Number each of the tutor groups in the school from 1 to 25.
- Randomly generate 5 different numbers between 1 and 25 and sample all students within the tutor groups that correspond to these numbers.

(a) State the sampling technique used in Method A. **(1)**

(b) State **two** reasons why Method A might be biased. **(2)**

(c) State the sampling technique used in Method B. **(1)**

(d) State one advantage of Method A over Method B. **(1)**

(e) State the sampling technique used in Method C. **(AQA only)** **(1)**

(a) Opportunity Sampling (convenience sampling)

(b) Some students may be absent and therefore cannot be sampled

Students who spent lunchtime near to where the headteacher is on duty are more likely to be sampled.

(c) Simple random sampling.

(d) Quicker/easier to do.

(e) Cluster Sampling

(Total for Question 7 is 6 marks)

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8 A farm that grows potatoes only wants to harvest them once the potatoes have a mass of 120 g.

The farm has approximately 18000 potatoes that were planted at the same time.

The farmer selects 5 potatoes growing nearest to the farmhouse.
They remove them from the plant and check their masses.
The results are shown below:

126g 118g 120g 125g 121g

(a) Explain why the farmer should not use a census. **(1)**

(b) State the sampling technique used by the farmer. **(1)**

The farmer claims that this sample means they should harvest all of the potatoes. **(1)**

(c) Comment on this claim.

(d) Suggest two improvements the farmer could make to their sampling method. **(2)**

(a) If all of the potatoes are sampled by removing them from the plants then they cannot grow anymore. If the farmer finds they are below 120g then they cannot be sold so are wasted.

(b) Opportunity Sampling (convenience sampling)

(c) The mean mass of the potatoes sampled is 122g suggesting most potatoes may be above 120g One potato was below 120g though so the farmer may want to delay harvesting the potatoes.

(d) Sample more than just 5 potatoes

Sample potatoes from different areas and not just near to the farmhouse. Those near to the farmhouse are likely to have had similar growing conditions that might be different to those elsewhere.

(Total for Question 8 is 5 marks)

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