

Name: _____

GCSE Statistics

Petersen Capture-Recapture Method

Total marks available: 35

Total marks achieved: _____

Instructions

- Use black ink or ball-point pen.
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- Scientific calculators may be used.
- You must show all your working out with your answer clearly identified at the end of your solution.

Information

- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Q1.

Richard wants to find an estimate for the number of rabbits living in a section of woodland.

He caught a sample of 25 rabbits, attached a tag to each rabbit, and then released the 25 rabbits back into the same section of the woodland.

Four weeks later, Richard returned to the same section of woodland and caught a sample of 10 rabbits. Two of these rabbits were tagged.

Using these results, Richard estimated that there are 125 rabbits in the section of woodland.

(a) Show how Richard worked out his estimate of 125 rabbits.

(2)

(b) Considering Richard's statistical method, discuss the reliability of his estimate.

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(3)

(Total for question = 5 marks)

Q2.

Tania wants to estimate the number of snails in a pond.
She takes a sample of 10 snails from the pond.
She marks each snail with a waterproof dye and then puts the snail back in the pond.

Two weeks later, Tania takes another sample of 10 snails from the pond.
She finds that only one of the snails is marked with the dye.

Tania says,

"I estimate there are 100 snails in the pond."

How reliable is Tania's estimate?

Give reasons for your answer.

You are not required to check Tania's calculation.

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(Total for question = 2 marks)

Q3.

According to an internet site, an estimate of the number of reindeer in a region of Ontario is 5000

(Source: *www.ontario.ca*)

Giovani wants to verify this estimate.

He goes to the region of Ontario, captures a sample of 250 reindeer, attaches a tag to each reindeer and then releases the 250 reindeer back into the same region of Ontario.

Three days later, Giovani returns to the same region of Ontario and catches a sample of 98 reindeer.

He finds that 5 of these reindeer are tagged.

Giovani concludes that this information can be used to verify the estimate of 5000

Discuss the appropriateness of Giovani's method and of his conclusion.

As part of your discussion you should show your calculations and state any assumptions made.

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(Total for question = 5 marks)

Q4.

Margaret and Paul are collecting data on turtles.

Margaret wants to estimate the number of turtles in a lake.

She catches a sample of 100 turtles from the lake.
She tags each turtle and then puts them back into the lake.

Three days later Margaret catches 60 turtles from the lake.
She finds that 12 of them have been tagged.

(a) Work out an estimate of the total number of turtles in the lake.

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(2)

Margaret wants to use this estimate in a report about the turtles in this lake.

(b) How reliable is this estimate?

Give reasons for your answer.

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(2)

(Total for question = 4 marks)

Q5.

A scientist wants to estimate the number of fish in a disused canal.

He catches a sample of 30 fish from the canal.

He marks each fish with a dye and then puts them back in the canal.

The next day the scientist catches 20 fish from the canal.

He finds that 4 of them are marked with the dye.

(a) Estimate the total number of fish in the canal.

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(2)

(b) Write down any assumptions you made.

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(2)

(Total for Question = 4 marks)

Q6.

Tamiki wants to estimate the number of pigeons in a park.

He catches a sample of 48 pigeons in the park, tags each pigeon and then releases it.

A week later, Tamiki catches a sample of 20 pigeons in the park.

He uses the Petersen capture recapture formula to estimate that there are 240 pigeons in the park.

(a) Work out how many of the 20 pigeons in Tamiki's sample had tags.

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(2)

(b) Comment on the reliability of Tamiki's estimate by considering the assumptions that he needed to make in order to use the Petersen capture recapture formula.

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(3)

(Total for question = 5 marks)

Q7.

A scientist wants to estimate the number of geese living around a lake.

The scientist captures a sample of 45 geese and puts a tag on each one. He then releases the geese.

The scientist waits one day and captures a sample of 18 geese.

He finds that 2 of these geese each have a tag.

(a) Estimate the total number of geese living around the lake.

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(2)

(b) Give a statistical reason why the scientist waits one day before taking the second sample.

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(1)

The scientist returns to the lake 1 year later and captures a sample of 18 geese.

He finds that 1 of these geese has a tag.

(c) Discuss the reliability of using this sample to estimate the total number of geese now living around the lake.

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(2)

(Total for question = 5 marks)

Q8.

David is writing a project about iguanas.

He finds data on the internet posted by a biologist investigating iguanas on the Galapagos Islands.

The biologist captured and tagged a sample of iguanas in La Loberia.

The tagged iguanas were then released back from where they were captured.

After a few days the biologist captured at random a second sample of iguanas in La Loberia and recorded the number of tagged iguanas in this sample.

Here is the biologist's data.

Number of iguanas in first sample	Number of iguanas in second sample	Number of tagged iguanas in second sample
114	243	69

(Source: www.discoveringgalapagos.org.uk)

(a) Work out an estimate of the total number of iguanas in La Loberia.

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(2)

(b) Discuss the reliability of **using the biologist's data** to work out an estimate of the total number of iguanas in La Loberia.

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(2)

It is suggested that some of the tags might have fallen off the iguanas between the two samples.

(c) If this had happened, describe the effect it would have on the estimate worked out in part (a).

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(1)

(Total for question = 5 marks)