Name: _____

GCSE Statistics

Random Response Method

Steps:
1. Find total number who answered questions.
2. Find probability of event happening.
3. Estimate number of times it happened – probability x total
4. Estimate number of "yes" answers that were truthful:
   Yes answer – answer to 3
5. Estimate proportion
   Answer to 4/answer to 3.

Total marks available: 25

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.
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Q1.

A film company employs Gary to investigate the film-watching habits of people living in the UK.

Gary is going to use a questionnaire.

Here is Question 1 on Gary's questionnaire.

Question 1

Spin a fair coin.

If you get **Heads**, tick box A.
If you get **Tails**, answer this question.

Have you downloaded a film illegally during the last month?

If **yes**, tick box A. If **no**, tick box B.

A ❑ B ❑

The method used to decide whether or not to answer a question by spinning a coin is called the random response technique.

(a) Explain why this method is used.

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(1)

Gary sends the questionnaire to a sample of people living in a town.

He uses a telephone directory as the sample frame.

For Question 1

743 people ticked box A

679 people ticked box B

(b) Calculate an estimate of the proportion of the people in the sample who had downloaded a film illegally during the last month.

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(3)

Gary is going to write a report on the outcome of Question 1.

He is going to use the answer to part (b) as an estimate of the proportion of all the people living in the UK who had downloaded a film illegally during the last month.

(c) Is it appropriate for Gary to use the answer to part (b)?

Give **two** reasons for your answer.

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(3)

(Total for question = 7 marks)

Q2.

A company wants to investigate the number of sick days its employees have off work.

The company uses a questionnaire.

Here is one of the questions on the questionnaire.

> Roll a fair dice.
>
> If you get 1, 2, 3 or 4 tick box A.
>
> If you get 5 or 6 answer this question.
>
> Have you ever taken a sick day off work when you weren't really sick?
>
> If yes, tick box A. If no, tick box B. A ☐ B ☐

(a) Assess the appropriateness of the method the company uses.

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(2)

All the company's employees completed the question.

615 ticked box A.

102 ticked box B.

(b) Show that an estimate of the number of employees who ticked box A because they answered yes to the question is 137

(1)

(Total for question = 3 marks)

Q3.

Remi wants to find out about the number of people that avoid paying tax.
He used a random response question to collect his data.

This is a suitable technique to use.

(a) Explain why.

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(1)

Here is the random response question that Remi used on a questionnaire.

> **Roll a fair dice.**
>
> If you get **1**, **2** or **3**, tick box A.
> If you get **4**, **5** or **6**, answer this question.
>
> **Have you ever avoided paying tax?**
>
> If **yes**, tick box A. If **no**, tick box B.
>
> A ❑ B ❑

Remi sent the questionnaire to a sample of people.

For this question,

426 people ticked box A
354 people ticked box B

A group of researchers also collected data on the number of people that avoid paying tax by directly asking people.

They found that 5.9% of the people they asked said that they had avoided paying tax.

(Source: *www.emeraldinsight.com*)

(b) Compare the results of Remi's questionnaire with the results obtained by the researchers.

You should consider whether the use of the random response technique was effective and you should give a limitation of your conclusion.

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(5)

(Total for question = 6 marks)

Q4.

Matthew is collecting information about road safety in his town.

He wants to collect information from drivers who live in his town.

Matthew plans to ask drivers at his local car park about their views on road safety.
He plans to collect a quota sample of 20 drivers from each of three age groups.

Matthew's three age groups of drivers are

39 years old or younger 40 years old to 59 years old 60 years old or older

(a) Comment on whether Matthew's plans are appropriate.

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(2)

Matthew wants to know how many drivers, who live in his town, drive faster than the speed limit on the motorway.

Matthew knows that he will have to ask a sensitive question so he plans to use the random response technique to find out this information.

(b) Design a random response question that Matthew could use on a questionnaire in order to collect this information.

(3)

(Total for question = 5 marks)

Q5.

A construction company employs three types of employee: builders, carpenters and electricians.

The table gives the number of each type of employee.

Type of employee	Number
Builders	48
Carpenters	26
Electricians	22

The owner of the construction company wants to find out what the employees feel about their jobs.

She plans to take a sample of 30 employees, stratified by type of employee.

(a) Calculate the number of carpenters that should be in her sample.

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(2)

The owner wants to know whether the employees in her sample believe that they work hard consistently. She knows that she will have to ask a sensitive question so she plans to use a random response question in order to find out this information.

(b) Design a random response question that the owner could use on a questionnaire in order to collect this information.

(4)

(Total for question = 6 marks)