



EXAMINATIONS OF THE ROYAL STATISTICAL SOCIETY

HIGHER CERTIFICATE IN STATISTICS, 2013

MODULE 1 : Data collection and interpretation

Time allowed: One and a half hours

*Candidates should answer **THREE** questions.*

Each question carries 20 marks.

The number of marks allotted for each part-question is shown in brackets.

Graph paper and Official tables are provided.

Candidates may use calculators in accordance with the regulations published in the Society's "Guide to Examinations" (document Ex1).

The notation \log denotes logarithm to base e .

Logarithms to any other base are explicitly identified, e.g. \log_{10} .

Note also that $\binom{n}{r}$ is the same as nC_r .

This examination paper consists of 4 printed pages.

This front cover is page 1.

Question 1 starts on page 2.

There are 4 questions altogether in the paper.

1. (i) What do you understand by the term *simple random sampling*? Describe conditions under which it may not be a suitable sampling procedure, or where it would be desirable to combine it with some other sampling method. (6)
 - (ii) Identify three different types of *non-sampling error*, and briefly describe circumstances in surveys that give rise to these errors. (9)
 - (iii) Outline the main disadvantages of telephone surveys. (5)
2. In a lifestyle survey of adults (persons aged 18 and over) in the UK, respondents were asked to estimate their average weekly leisure expenditure. The table below shows trends in the distribution of average weekly leisure expenditure during the period 2008–2011.

Average weekly leisure expenditure (in £) by sex and age: 2008–2011

Persons aged 18 and over

		2008	2009	2010	2011
<i>Males</i>	18–24	20.10	24.30	24.90	21.30
	25–44	21.20	23.80	24.40	20.00
	45–64	16.50	17.90	17.60	14.50
	65 and over	10.70	11.00	10.20	8.30
	Total	17.30	19.40	19.50	16.20
<i>Females</i>	18–24	18.40	21.10	21.40	18.60
	25–44	19.30	20.90	21.00	18.10
	45–64	13.90	16.20	15.70	12.80
	65 and over	9.80	10.30	9.50	7.70
	Total	15.50	17.20	17.00	14.40
<i>All Persons</i>	18–24	19.30	23.10	23.40	20.10
	25–44	20.90	22.50	22.90	19.20
	45–64	15.40	17.20	16.70	13.70
	65 and over	10.10	10.50	9.80	7.90
	Total	16.50	18.40	18.30	15.40

- (i) Using the data given in the table, draw suitable diagrams to illustrate
 - (a) the overall trend in leisure expenditure amongst males and amongst females aged 18 and over during the period 2008–2011, (5)
 - (b) the similarities and differences between the 2011 age-specific leisure expenditure for males and for females aged 18 and over. (5)
- (ii) Write a short report, suitable for publication in a serious newspaper, based on the diagrams you have produced in part (i) and on other information in the table that you consider relevant. (10)

3. A draft questionnaire for a survey of pocket money and expenditure is shown below. It is intended that the questionnaire will be distributed to a sample of students (aged 11–18) at a large secondary school on a given day, and that students will return completed questionnaires at school the following day.

Considering each question in turn, comment on the strengths and weaknesses of this questionnaire. Suggest alternative wording for the title and for any instructions or questions which you think could be improved.

(20)

POCKET MONEY, HOMEWORK AND EXPENDITURE SURVEY								
In Questions 2–7, please give the answers that apply to you by putting an "X" in the appropriate boxes.								
1	What is your date of birth?	<input type="text"/>	<input type="text"/>	<input type="text"/>				
		Day	Month	Year				
2	Are you a)	<input type="checkbox"/> Male	b)	<input type="checkbox"/> Female?				
3	How much pocket money do you receive?							
	<input type="checkbox"/> Up to £1	<input type="checkbox"/> £1 to £5	<input type="checkbox"/> £5 to £10	<input type="checkbox"/> Over £10				
4	On average , how do you spend your pocket money? Write 1, 2, 3, etc. in the boxes, in descending order of the amount of money spent.							
	Sweets & Ice Cream	Soft Drinks Coffee	Clothes Fashion Shoes	Sport	Toys & Games	CDs/DVDs & Videos	Mobile Phone	Other
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	How many hours per week on average do you spend helping around the house?							
	<input type="checkbox"/> None	<input type="checkbox"/> Up to 1 hour	<input type="checkbox"/> 1–2 hours	<input type="checkbox"/> 2–5 hours	<input type="checkbox"/> Over 5 hours			
6	How many hours per week on average do you spend doing homework?							
	<input type="checkbox"/> None	<input type="checkbox"/> Up to 1 hour	<input type="checkbox"/> 1–2 hours	<input type="checkbox"/> 2–5 hours	<input type="checkbox"/> Over 5 hours			
7	Do your parents usually pay for any of the following? Code Y for "yes", N for "no" in each box that applies.							
	Sweets & Ice Cream	Soft Drinks	Clothes Fashion	Sport	Toys & Games	CDs/DVDs & Videos	Mobile Phone	Other
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. A motor manufacturer has drawn a simple random sample of 50 dealerships from a large number of dealerships in a country. The numbers y of staff in each dealership sampled were as follows.

7 8 5 5 4 5 5 5 6 6 5 4 9 6 5 7 6 6 5 5 6 5 5 3 4
6 5 6 4 6 8 5 5 5 6 4 7 6 6 4 6 5 3 6 6 4 8 5 7 5

You are given that $\Sigma y = 275$ and $\Sigma y^2 = 1589$.

- (a) (i) Construct a frequency distribution of y and display it in a suitable graphical form. (4)
- (ii) Estimate the mean number of staff per dealership in the country, and calculate the estimated variance of your estimator. (5)
- (iii) Estimate the proportion of dealerships with more than 5 staff, and calculate the estimated variance of your estimator. (5)
- (b) (i) Explain why the 18 dealerships with exactly 5 staff in the above sample constitute a simple random sample of all dealerships in the country that have exactly 5 staff. (2)
- (ii) 20 of the dealerships in the above sample have one or more female staff. State whether these 20 dealerships constitute a simple random sample of all dealerships in the country that have one or more female staff. Give a reason for your answer. (2)
- (iii) 18 of the dealerships in the above sample have exactly one female staff member. Explain why the female staff in these dealerships do not constitute a simple random sample of all female staff working in this manufacturer's dealerships in the country. (2)