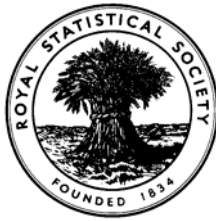


EXAMINATIONS OF THE ROYAL STATISTICAL SOCIETY



ORDINARY CERTIFICATE IN STATISTICS, 2008

Paper I

Time Allowed: Three Hours

*Candidates may attempt **all** the questions.*

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

The total for the whole paper is 100.

A pass may be obtained by scoring at least 50 marks.

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).

This examination paper consists of 4 pages, **each printed on one side only**.

This front cover is page 1.

Question 1 starts on page 2.

There are 8 questions altogether in the paper.

1. A professional organisation wishes to discover its members' opinions about its monthly newsletter. Suppose the organisation decides to mail a self-completion questionnaire to a random sample of members. Draft such a questionnaire, with instructions on how to complete it, and a suitable covering letter. Questions are to be asked on the following topics.

Year of joining

The member's sex and current employment status (e.g. student, full-time employee, etc.)

Whether the member reads the whole newsletter

What the member does with the newsletter when he or she has finished with it

What the member thinks of the special features

Whether advertisements should be included

Whether changes are needed to the frequency of publication and, if so, what changes

General satisfaction with the newsletter

Your questionnaire should include at least one closed question, at least one open question, and at least one question to which the response is to be given on a rating scale.

(13)

2. The organisation referred to in question 1 has approximately five thousand members. Instead of mailing the questionnaire to a random sample of them, it considers including the questionnaire as an insert in the newsletter, sent monthly to all members. Discuss the advantages and disadvantages of these two methods.

(12)

3. A professional organisation has three grades of member: student, ordinary, and retired. A spreadsheet gives an alphabetical list of members, along with the years they joined the organisation and their current membership grades. Two ways of taking a systematic sample of members are under consideration: the first uses the alphabetical list, the second uses the list re-ordered by year of joining.

(i) Describe, with examples, the potential advantages and disadvantages of each of the two possibilities.

(8)

(ii) Would there be any advantage in taking a systematic sample with the list ordered by grade of membership? Justify your answer.

(3)

4. The professional organisation referred to in question 3 is interested in monitoring the annual amount, Y euros, spent by members on conference attendance. The table below shows the number of members (N_i) in each grade and the standard deviations (s_i) of Y obtained in a survey two years ago. The cost of obtaining information from a member is the same for all grades, and there is sufficient money in the budget to sample up to 95 members.

<i>Membership grade</i>	<i>Number of members (N_i)</i>	<i>SD (s_i) of Y from previous study</i>
Student	141	226.21
Ordinary	782	550.12
Retired	239	303.60

- (i) How many members should be sampled from each grade if the sample sizes are to be in approximately the same ratio as the numbers of members in the three grades? (4)
- (ii) How many members should be sampled from each grade if the sample sizes are to be approximately proportional to $N_i s_i$ in each grade? (6)
- (iii) Why might the method described in part (i) be preferable to that of part (ii)? (4)
5. (i) Distinguish carefully between a pilot survey, a sample survey and a census, giving reasons why each might be done. (9)
- (ii) Give reasons why results from a census might differ from the true values in the population. Wherever possible, illustrate your answer with examples from a census with which you are familiar. (5)

6. The marketing director of a chain of supermarkets would like to set up an interview survey of a sample of customers. The supermarkets are located in several different regions, and are classified into three types according to size. A sample of supermarkets is to be taken, and samples of customers will be drawn from these supermarkets.
- (i) Suggest how cluster sampling could be used to choose the sample of supermarkets. Discuss any potential advantages and disadvantages of this method for the proposed survey. (5)
 - (ii) Suggest how stratified sampling could be used to choose the sample of supermarkets. Discuss any potential advantages and disadvantages of this method for the proposed survey. (6)
7. Customers in the supermarkets referred to in question 6 are to be interviewed in store. The interviewers are provided with a questionnaire, and are told how many customers to select. After they select the customers, the interviews will take place immediately.
- (i) What advice would you give the interviewers as regards **selecting** customers to interview? (7)
 - (ii) What advice would you give the interviewers as regards the **conduct** of the interview? (6)
8. Discuss how an observational study in supermarkets might be undertaken to find out what kinds of customers buy organic vegetables and fruit, and what particular organic vegetables and fruit they buy. Outline the advantages and disadvantages that this method has in this context over the use of a questionnaire. (12)