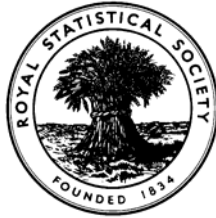


EXAMINATIONS OF THE ROYAL STATISTICAL SOCIETY
(formerly the Examinations of the Institute of Statisticians)



ORDINARY CERTIFICATE IN STATISTICS, 2007

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 5 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 holiday tour operator wishes to obtain feedback from those of its customers who have been on one or other of its guided package tour holidays. Design a self-completion questionnaire, to be given to each holidaymaker, to obtain the following information from respondents. [You should try to use "closed" questions where possible.]

- Which particular holiday they took
- Their sex and age group
- How satisfied they were with the accommodation
- How satisfied they were with the programme of excursions
- How satisfied they were with the tour leader
- Whether they would recommend the holiday to others
- What they liked best about the holiday
- What they liked least about the holiday.

(12)

2. In the context of question 1, a similar questionnaire contains an open-ended question asking respondents what kinds of holiday activities they like best. Some respondents will name just one kind of activity, but others will name several. Many respondents will name the same kinds of activity as others, but not necessarily using the same terms.

(i) By giving examples of the kinds of responses that might be given to this question, discuss what decisions are needed when coding the responses and how the responses will help determine the coding system.

(7)

(ii) Explain how responses to this question in this open-ended form can help you reword the question in a closed form for use at a later date.

(2)

3. The manager of a hotel has been asked to find out what people staying there think about its facilities. The hotel is used mainly for group bookings made by several travel firms, but also by independent travellers. Groups travelling with different firms might arrive on different days, but those in a given group register on their arrival at approximately the same time as one another. The manager is considering two ways of choosing a sample of people to interview.

- Taking a quota sample of residents during a particular week
- Taking a systematic sample of those who arrived during a particular week from the registration records. These records are in order of registration.

(i) Write a clear list of instructions for the manager to use in order to carry out each of these methods. [You may assume that the manager has been told how large the samples should be.]

(6)

(ii) Outline any potential advantages and disadvantages each method has for obtaining a sample of people staying at the hotel and for achieving a desired number of interviews.

(8)

4. An administrator at a large hospital wishes to carry out a survey of the in-patients (i.e. those who stayed at least one night) who are in the hospital on the night of 31 May 2007. Patients are allocated to beds in one of three types of ward, Observation, Surgical Care, or Intensive Care. Two methods of choosing a sample of patients, who will be asked to complete a short questionnaire, have been proposed.

(A) Take a simple random sample of wards, and then take a simple random sample of patients from the selected wards.

(B) Considering the wards of each type to be a single group of patients, take a simple random sample of patients from each of the three groups.

(i) Give the technical name of each sampling method.

(2)

(ii) For each sampling method (A) and (B), state the conditions which would help ensure that the method works well.

(3)

(iii) For each sampling method, state one advantage and one disadvantage of using it for this survey.

(4)

5. There are three wards for patients requiring intensive nursing care in a particular hospital. Wards A and B are in the main hospital building, and ward C is at a remote site. Samples of patients are to be taken from each ward and interviewed about various aspects of their stay. The table below shows the number of patients (N_i) in each ward, and the estimated cost (c_i) in dollars of interviewing a patient in that ward. It also shows the standard deviation (s_i) of the length of time (in minutes) that patients waited to see a nurse on admission to the ward, obtained from a survey of patients who were in that ward in May last year (none of these patients is still in the hospital).

<i>Ward</i>	<i>Number of patients</i> (N_i)	<i>Cost of sampling one patient</i> (c_i)	<i>SD of length of time waited</i> (s_i)
A	50	5	1.81
B	25	5	3.23
C	10	10	2.18

- (i) Using a uniform sampling fraction, calculate the required number of patients to sample from each of the wards to achieve an overall sample of about 36 patients. What is the total cost of sampling patients using these sample sizes?
(4)
- (ii) The optimum allocation method of choosing sample sizes n_i to estimate a mean minimises the variance of the estimator, and, in order to obtain this, the n_i must be taken proportional to $N_i s_i / \sqrt{c_i}$. Calculate the required number of patients in the sample from each ward using this method if the total cost of sampling patients is to be no more than 200 dollars.
(9)
- (iii) Which of the two methods of estimating sample sizes used in parts (i) and (ii) do you think is better for selecting the sample of patients, and why?
(4)
6. (i) Present arguments in favour of conducting interviews over the telephone instead of face to face.
(6)
- (ii) Why might telephone interviews be less successful in some circumstances than face to face interviews?
(6)

7. A careers advisor at a university is interested in finding out details relating to the occupations of the university's graduates one, five, and ten years after graduation. State the advantages and disadvantages of collecting this information by
- (i) a longitudinal study of a sample of last year's graduates, (7)
 - (ii) sample surveys of those who graduated one, five, and ten years ago. (6)
8. (i) Explain why non-response is a problem in social surveys. (6)
- (ii) List five reasons for non-response in a postal survey. By addressing these reasons, suggest ways in which non-response might be reduced. (8)