

Monday 10 June 2013 – Morning

AS GCE MEI STATISTICS

G243/01 Statistics 3 (Z3)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book G243/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- This Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

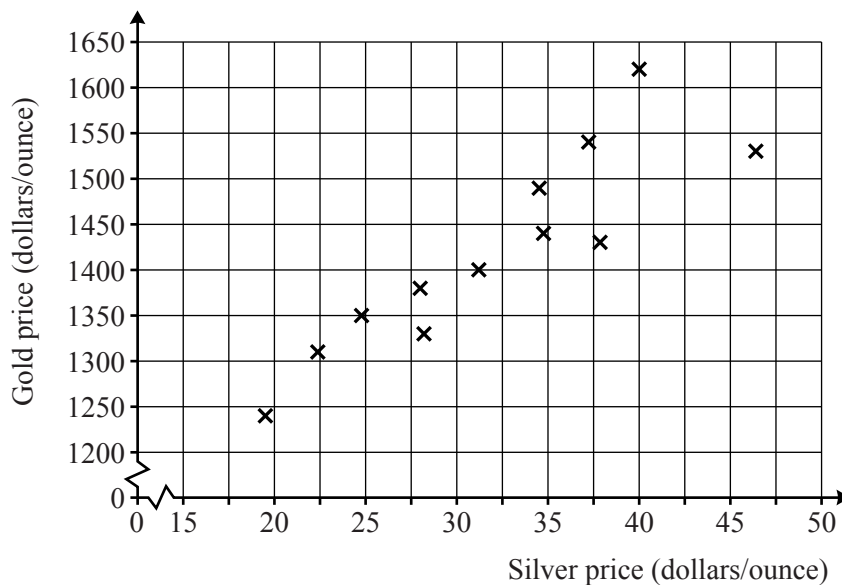
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Section A (45 marks)

- 1 (i) A test is to be carried out to examine the relationship between two variables. Explain briefly why, provided that the conditions for its use are satisfied, it is preferable to carry out a test based on the product moment correlation coefficient, rather than a test based on Spearman's rank correlation coefficient. [2]

A student is investigating the prices of gold and silver over a period of one year. He randomly chooses 12 days over the course of the year and records the prices of both metals, in dollars per ounce, on those days. The prices are given below, together with a scatter diagram to illustrate the data.

Silver price	19.5	22.3	28.2	24.7	28.0	31.2	37.9	34.7	34.5	46.3	37.2	40.0
Gold price	1240	1310	1330	1350	1380	1400	1430	1440	1490	1530	1540	1620



- (ii) State a condition which is required for the use of a test based on the product moment correlation coefficient. Explain why, in the light of the scatter diagram, it may not be appropriate to carry out such a test. [2]
- (iii) Calculate the value of Spearman's rank correlation coefficient. [5]
- (iv) Using your answer to part (iii) carry out a test, at the 5% level of significance, to determine whether it is reasonable to assume that prices of gold and silver are positively associated. [6]

- 2 A scientist from a company which manufactures baby milk is investigating whether babies fed with two different brands of baby milk from birth gain the same amount of weight, on average, in their first year of life. He randomly selects 100 babies who have been fed Brand A and another 100 babies who have been fed Brand B. The weight gains in kilograms have the following means and variances.

Brand A:	Sample mean 5.834	Sample variance 1.272
Brand B:	Sample mean 5.920	Sample variance 1.318

- (i) Explain why, even though the distributions of the underlying populations are unknown, a test based on the Normal distribution is appropriate. [2]
- (ii) Carry out a test, at the 5% level of significance, to examine whether there appears to be a difference in average weight gain between the two brands. [11]
- (iii) Suppose instead that samples each of only 10 babies had been selected, and that the distributions of the underlying populations were unknown. Name another test which could have been used. State the null hypothesis which would have been tested. [2]
- 3 A university psychologist is investigating whether the time taken to complete a sudoku puzzle is affected by consumption of a small quantity of alcohol. She believes that consumption of alcohol will increase the median time taken. She randomly chooses 12 students from her classes who regularly do sudoku puzzles. Each student is given a particular puzzle to do; the time, in minutes, taken to complete it is recorded. Each student is then given a single unit of alcohol and required to complete a second puzzle of similar standard; the time taken to complete it is again recorded. The times are as follows.

Student	A	B	C	D	E	F	G	H	I	J	K	L
Time – no alcohol	6.2	13.7	15.5	11.0	11.6	9.6	14.6	10.2	19.8	12.9	5.9	14.7
Time – with alcohol	7.1	13.3	13.8	13.2	13.0	11.2	13.4	13.9	18.0	16.4	4.8	16.0

- (i) Carry out a test, at the 5% level of significance, to examine whether the psychologist's belief concerning the median time taken appears to be correct. [11]
- (ii) Explain why the psychologist has used a paired design. [2]
- (iii) Explain briefly one improvement which could be made to the design of this experiment. [2]

Section B (27 marks)

4 (i) State two requirements for systematic sampling to be a sensible method for selecting a sample for a survey. [2]

(ii) Describe how to choose a systematic sample of 8 potato plants from a single row of 80 potato plants. [2]

A researcher is running a trial of two new varieties of potato, P and Q. A field contains 20 rows of each variety, with 80 plants in each row; the varieties are planted in alternate rows. The researcher intends to dig up 8 plants of each variety and measure the weight of potatoes produced by each plant. He considers the following methods of choosing a sample for each variety.

- A Choose plants near the field entrance to avoid disturbing the rest of the crop.
- B Systematically select 8 plants from one row of each variety in the field.
- C Number all of the plants and then randomly select 8 of each variety.

(iii) Discuss advantages and disadvantages of these methods. [6]

(iv) Name the types of sampling described in methods A and C. [2]

The researcher wishes to compare the weights in kilograms of potatoes in the two samples to test whether the population mean for variety P is equal to the population mean for variety Q. He selects a random sample of 8 potatoes of each variety.

(v) State the assumptions which are required for a t test to examine whether the means appear to be equal. Given that these assumptions are valid, use the data below to carry out the test at the 5% significance level.

Variety P:	Sample mean 1.824	Sample variance 0.124
Variety Q:	Sample mean 2.191	Sample variance 0.230

[15]

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