

**ADVANCED SUBSIDIARY GCE**  
**MEI STATISTICS**  
Statistics 3 (Z3)

**G243**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- Graph paper
- MEI Examination Formulae and Tables (MF2)

**Other Materials Required:**

None

**Thursday 11 June 2009**  
**Morning**

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that 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 graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- 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 document consists of **4** pages. Any blank pages are indicated.

**Section A (47 marks)**

- 1** For a piece of coursework in psychology, students were asked to analyse reaction times. One student found a piece of software on the internet that measures the time taken to react to a stimulus by pressing a key. She used this with a random sample of 10 friends, recording times, in milliseconds, for their non-dominant and dominant hands. The data were recorded as follows.

Friend	Non-dominant	Dominant
1	485	336
2	356	381
3	450	348
4	402	329
5	376	329
6	409	346
7	419	344
8	289	327
9	420	342
10	410	356

- (i) Use a  $t$  test to investigate whether people have a shorter reaction time, on average, with their dominant hand. Use a 5% level of significance and state your hypotheses clearly. State the required distributional assumption for the test to be valid. **[14]**
- (ii) Explain why the student should not measure the times taken with non-dominant and dominant hands in the same order for all the 10 friends. **[2]**

- 2 A nationally known retailer is investigating the effectiveness of its TV advertising. In the North-West, the retailer ran a major TV advertising campaign late in 2008. The sales (£ thousands) for January to March 2009 in a random sample of 10 of its stores in the North-West are as follows, listed in ascending order.

2159 2361 2570 2985 3012 5442 5756 5825 6023 6078

- (i) Suggest why it might not be appropriate to compare these data with corresponding sales figures for January to March 2008. [1]

From historical data, the retailer believes that sales at its stores in the North-East are generally comparable with those in the North-West. However, there was no advertising campaign in the North-East.

A random sample of 8 stores in the North-East gives the following sales figures (£ thousands) for January to March 2009, listed in ascending order.

1951 2077 2193 2286 2780 2983 4912 5629

- (ii) Use a suitable test, at the 5% significance level, to examine whether the median sales figure in the North-West for this period is greater than that in the North-East. What does your conclusion suggest about the effectiveness of the TV advertising campaign? [11]
- (iii) The retailer has 30 stores in the North-East. Explain how to choose a random sample of 8 of these stores. [4]
- 3 In the course of a medical treatment, random samples of male and female patients have their temperatures,  $x$  °C, recorded. For the 36 males, the mean is 36.8 °C and the standard deviation is 0.247 °C. For the 34 females,  $\Sigma x = 1252.9$  and  $\Sigma x^2 = 46\,172.85$ .

- (i) Calculate the mean and standard deviation for the females. [3]

A doctor uses these data to test whether there is a difference between the population mean temperatures of males and females undergoing this treatment.

- (ii) Explain why it is appropriate to use a test based on the Normal distribution in this case. [1]
- (iii) Carry out the test, at the 1% level of significance, stating your hypotheses. [11]

[Question 4 is printed overleaf.]

**Section B** (25 marks)

- 4 For employees working in a noisy environment, companies arrange for annual hearing tests in order to monitor whether hearing function decreases with years of service. Data for a random sample of 10 such employees, for one company, are given in the following table.

Employee	A	B	C	D	E	F	G	H	I	J
Years of service	12	3	27	5	2.5	4	8	9	10	14
% Hearing function	90	91	84	97	92	94	88	85	98	89

- (i) Draw, on graph paper, a scatter diagram of these data. [3]
- (ii) The product moment correlation coefficient for these data is  $r = -0.5711$ . Test at the 5% level of significance whether or not there is negative correlation between years of service and hearing function in the underlying population. State your hypotheses clearly. [6]
- (iii) Explain why it might not be appropriate to carry out a test based on the product moment correlation coefficient for these data. [2]
- (iv) Calculate Spearman's coefficient of rank correlation between years of service and hearing function. [4]
- (v) Conduct a hypothesis test based on this new coefficient, stating your hypotheses clearly. [4]
- (vi) Comment on the outcomes of the two tests. [2]
- (vii) In order to focus further research, suggest two other factors that might affect hearing function, apart from years of service. [2]
- (viii) Another company, operating on six sites, wishes to select a sample of employees for hearing tests, ensuring that each site is represented in the sample. Explain why simple random sampling would not be appropriate. Suggest a sampling method that would be appropriate. [2]

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