General Certificate of Education
Advanced Subsidiary Examination
January 2010

Statistics SS03

Unit Statistics 3

Tuesday 19 January 2010 9.00 am to 10.30 am

For this paper you must have:
- an 8-page answer book
- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The **Examining Body** for this paper is AQA. The **Paper Reference** is SS03.
- Answer **all** questions.
- Show all necessary working; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

Answer **all** questions.

1 A free newspaper advertises used caravans. During July 2008, ten caravans, all of the same make and model and all manufactured in 2006, were advertised for sale.

The asking prices, in £, for the caravans were as follows:

8 999 11 950 11 500 9 350 9 900 13 900 11 750 11 995 11 250 12 250

Assume that these ten prices are a random sample of the asking price for such caravans in July 2008.

(a) Using a sign test and the 10% level of significance, investigate the claim that the median asking price for such caravans in July 2008 was £11 250. *(6 marks)*

(b) Explain, in the context of the question, the meaning of a Type II error. *(2 marks)*

2 An investigation was carried out into the fat content and the energy content of 'medium-sized' chocolate milkshakes sold in fast-food outlets in the USA.

A 'medium-sized' chocolate milkshake was purchased from each of seven fast-food outlets. The number of calories, x, the fat content, y grams, and the volume, z fluid ounces, were measured for each milkshake. The results are given in the table.

Fast-food outlet	x	y	z
A	320	2	10.2
B	400	9	11.4
C	430	8	10.9
D	455	13	12.3
E	390	11	9.7
F	465	14	13.2
G	425	12	14.1

(a) Find the value of the product moment correlation coefficient between:

(i) x and y;

(ii) x and z. *(5 marks)*

(b) Carry out hypothesis tests, at the 5% level of significance, to determine whether the values of the two product moment correlation coefficients found in part (a) indicate a positive association between each of the pairs of variables. *(4 marks)*

(c) Summarise, in context, your findings in parts (a) and (b). *(2 marks)*

3 In October 2006, a large number of artists from England each entered a piece of their work into a competition.

From a random sample of 500 of these artists, 105 had their work selected to appear in an exhibition; the remaining artists had their work rejected.

Each artist was required to indicate their region of residence as North, South, East or West. From the sample, it was noted that 150 indicated North as their region of residence, 100 indicated South and 80 indicated East.

Of those artists who indicated North, 16% had their work selected to appear in the exhibition. The corresponding percentage for those who indicated South was 12% and that for those who indicated East was 15%.

(a) Copy and complete the following 4×2 contingency table, using this information.

Region \ Work	Selected	Rejected	Total
North	24	126	150
South			
East			
West			
Total	105		500

(4 marks)

(b) For an artist entering a piece of work into this competition, test, at the 1% level of significance, whether selection of their work to appear in the exhibition is independent of region of residence. *(9 marks)*

(c) Interpret, in context, your conclusion to the test in part (b). *(2 marks)*

4 A survey was carried out during July 2007 to investigate the amount of excise duty, in pence per litre, paid on unleaded petrol and diesel throughout Europe.

The results for a random sample of 10 European countries are given in the table.

Fuel type / Country	Unleaded petrol	Diesel
Cyprus	24	20
Romania	26	21
Sweden	29	32
Slovakia	33	32
Austria	36	28
Malta	38	26
Finland	47	25
France	48	34
Germany	52	37
UK	57	57

(a) (i) Calculate the value of Spearman's rank correlation coefficient between the excise duty paid on unleaded petrol and that paid on diesel. *(6 marks)*

(ii) Carry out a hypothesis test to determine whether this value indicates an association between the excise duty paid on unleaded petrol and that paid on diesel. Use the 5% level of significance. *(4 marks)*

(b) Carry out a Wilcoxon signed-rank test, at the 1% significance level, to investigate whether, in European countries, the average excise duty paid is lower on diesel than on unleaded petrol.

Interpret your conclusion in context. *(9 marks)*

5 Information was obtained on the fuel usage, in miles per gallon, for a random selection of three 1998 models of four-wheel-drive cars, C, D and E.

Table 1 gives the model and fuel usage for each of the cars selected.

Table 1

Model	Fuel usage
C	14.4
C	14.5
D	14.1
D	14.3
E	13.9
C	14.7
C	15.2
D	14.4
E	14.2
E	14.6
E	14.9
E	15.1
D	14.8
D	15.0
C	15.4

(a) Carry out a Kruskal-Wallis test, using the 10% significance level, to investigate whether there is any difference in average fuel usage between the three 1998 models of four-wheel-drive cars. *(12 marks)*

(b) Information was also obtained on the estimated city miles per gallon for a random selection of 1998 models of compact and mid-size cars.

The results are given in **Table 2**.

Table 2

Compact	20.1	25.6	22.4	24.3	26.3	21.9		
Mid-size	18.3	19.2	22.7	16.8	17.4	19.7	21.4	23.6

Carry out a distribution-free test, at the 5% level of significance, to investigate whether the average of city miles per gallon for compact cars is higher than that for mid-size cars.

Interpret your conclusion in context. *(10 marks)*

END OF QUESTIONS

There are no questions printed on this page

There are no questions printed on this page

There are no questions printed on this page

Copyright © 2010 AQA and its licensors. All rights reserved.