General Certificate of Education
January 2008
Advanced Subsidiary Examination

STATISTICS **SS03**
Unit Statistics 3

Tuesday 15 January 2008 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 blue or black ink or 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 maximum mark for this paper is 75.
- The marks for questions are shown in brackets.

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

Answer **all** questions.

1 During 2005, the weekly amounts of pocket money given to a random sample of 14-year-old children living in Brighton were:

£ 5.50	£6.30	£7.50	£15.00	£10.00	£12.50
£12.00	£6.00	£7.75	£10.50	£ 5.00	£ 7.15

During 2003, the median weekly amount of pocket money given to 14-year-old children living in Brighton was £5.60 .

Carry out a sign test to determine whether there is support for the claim that the median weekly amount of pocket money given to 14-year-old children living in Brighton has changed since 2003. Use the 10% level of significance. *(7 marks)*

2 As part of a Psychology research project, a student carried out a personality test on eight golfers and seven rugby players.

All players involved in the project were selected at random.

The scores achieved are given in the table, with a higher score indicating a more outgoing personality.

Golfers	10	11	12	14	17	18	20	21
Rugby players	13	16	17	19	22	23	24	

Carry out a distribution-free test, at the 5% level of significance, to investigate whether rugby players have more outgoing personalities than golfers.

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

3 The USA collects information on many types of criminal offence.

(a) For crimes against property, the type of victim and the type of offence involved are recorded. The details for a random sample of 526 such crimes which occurred during 2004 are summarised in **Table 1**.

Table 1

Type of victim / Type of offence	Individual	Business
Robbery	112	108
Burglary	146	96
Arson	44	20

Test, at the 5% level of significance, whether the type of victim is independent of the type of offence.

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

(b) For crimes against people, the age of the offender and the type of offence are recorded. Information collected for one city in the USA for a random sample of 88 crimes committed during 2004 is summarised in **Table 2**.

Table 2

Age of offender / Type of offence	Under 25 years	25 years and over
Aggravated assault	5	4
Simple assault	12	19
Intimidation	16	32

A test for association is to be carried out on the data given in **Table 2**.

(i) Calculate the expected values for the contingency table. *(3 marks)*

(ii) Give a reason why it is necessary to pool two categories. *(1 mark)*

(iii) Give a reason for your choice of categories to pool. *(1 mark)*

(iv) Using the 5% significance level, examine whether the age of the offender is associated with the type of offence. *(7 marks)*

4 National statistics on teenage conceptions were obtained for 1999 and 2003. The conception rates per 1000 teenagers for a random sample of 10 regions in England and Wales are given in the table.

Region	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
1999	51.1	55.3	48.8	51.0	43.5	49.3	36.4	50.5	35.9	34.1
2003	45.7	52.1	45.0	46.8	41.1	47.2	33.3	50.8	33.1	37.5

(a) Carry out a Wilcoxon signed-rank test, at the 5% significance level, to investigate whether the average teenage conception rate decreased between 1999 and 2003.

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

(b) Explain the advantages of using a matched-pairs design for a test such as the one carried out in part (a). *(2 marks)*

(c) Explain, in the context of this question, the meaning of a Type I error. *(2 marks)*

5 The gate receipts, x, and the player costs, y, during 1990 for a random sample of eleven US baseball teams are given in the table.

All values for x and y are given in millions of US dollars.

Team	x	y
A	25.3	22.7
B	25.2	22.2
C	24.6	22.3
D	22.5	20.4
E	20.8	19.6
F	19.7	13.8
G	19.0	22.5
H	18.1	8.1
I	16.0	14.2
J	16.0	23.6
K	11.1	16.8

(a) Calculate the value of Spearman's rank correlation coefficient between x and y.

(6 marks)

(b) Carry out a hypothesis test, at the 10% level of significance, to determine whether the value that you calculated in part (a) indicates a positive association between x and y.

Interpret your conclusion in context. *(5 marks)*

Turn over for the next question

6 A study was carried out to assess the ability of recall tests to distinguish between adults with normal memory function, with depression or with mild Alzheimer's disease.

Nineteen adults participated in a recall test, where the maximum possible score was 60.

The results are given in the table.

Normal memory function	**Depression**	**Mild Alzheimer's disease**
29	24	10
42	30	17
46	31	20
47	33	22
50	39	25
52	40	28
55		

Carry out a Kruskal-Wallis test, using the 1% significance level, to investigate whether there is any difference in average score for adults with normal memory function, with depression or with mild Alzheimer's disease. *(12 marks)*

END OF QUESTIONS

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