

General Certificate of Education  
January 2008  
Advanced Subsidiary Examination



**STATISTICS**  
**Unit Statistics 3**

**SS03**

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.

<b>Golfers</b>	10	11	12	14	17	18	20	21
<b>Rugby players</b>	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
<b>Robbery</b>	112	108
<b>Burglary</b>	146	96
<b>Arson</b>	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
<b>Aggravated assault</b>	5	4
<b>Simple assault</b>	12	19
<b>Intimidation</b>	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)*

**Turn over ►**

- 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**

**Turn over ►**

- 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.

<b>Normal memory function</b>	<b>Depression</b>	<b>Mild Alzheimer's disease</b>
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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