A Level Statistics

AQA Past Exam Questions

TOPIC: Hypothesis Testing
Paired Sample Sign Test

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have retrievable mathematical formulae stored in them.

Instructions

• Use **black** ink or ball-point pen.

• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.

• **Fill in the boxes** at the top of this page with your name, centre number and candidate number.

• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.

• Answer the questions ***on paper***

• You should show sufficient working to make your methods clear. Answers without working may not gain full credit.

• Unless otherwise stated, statistical tests should be carried out at the 5% significance level.

• When a calculator is used, the answer should be given to three significant figures unless otherwise stated.

Information

• ***You may use the*** booklet 'Statistical Formulae and Tables'

• There are **6** questions in this question paper. The total mark for this paper is ***47***

• The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.

• Try to answer every question.

• Check your answers if you have time at the end.

• If you change your mind about an answer, cross it out and put your new answer and any working underneath.

• Check your answers if you have time at the end.

AQA_JUNE_2013_2

A country requires all students in Year 7 to take a Cognitive Assessment Test (CAT). An educational psychologist is interested in the difference in performance in this test between students who have autumn birthdays and those who have summer birthdays.

Nine pairs of siblings, where one sibling has an autumn birthday and the other a summer birthday, are selected.

The score achieved by each of these eighteen students in their Year 7 CAT test is given in the table. Assume that the pairs of siblings form a random sample.

	Sibling pair								
	1	2	3	4	5	6	7	8	9
Autumn	82	76	62	58	74	65	60	53	81
Summer	81	61	49	49	68	51	65	60	72

(a) Explain the purpose of using sibling pairs in this comparison of CAT scores.

(2 marks)

(b) Carry out a sign test, at the 10% significance level, to investigate whether, on average, students with autumn birthdays gain higher CAT scores than those with summer birthdays.

(6 marks)

AQA_JUNE_2018_6b

(b) A different investigation was carried out into the incidence and level of hearing loss in flight attendants with more than five years' service. Each of eleven randomly selected flight attendants was paired by age, sex and general health, with a server who had more than five years' service in a busy restaurant.

The level of hearing, in decibels (dB), was measured for each person in the investigation. A person with normal hearing has a measurement of between –10 dB and +15 dB. A higher dB measurement indicates a greater hearing loss.

The results are given in Table 2.

Table 2

Pair	A	B	C	D	E	F	G	H	I	J	K
Flight Attendant	18	28	20	12	8	43	15	55	18	21	15
Server	14	12	31	7	10	19	–1	17	32	11	–5

Carry out a sign test, at the 10% level of significance, to investigate whether flight attendants suffer, on average, from greater hearing loss than servers in busy restaurants.

[5 marks]

AQA_JUNE_2010_1a

Information was recorded about football teams in a competition.

(a) Part of this information included, for each team, the number of shots at goal that were on target and the number of shots at goal that were off target.

The results for a random sample of 10 teams in this competition are given in Table 1.

Table 1

Team	A	B	C	D	E	F	G	H	I	J
On target	51	72	61	35	46	53	39	34	46	30
Off target	50	44	40	31	28	52	38	35	44	36

Carry out a sign test, at the 5% significance level, to investigate whether, on average, teams have more shots on target than off target. Interpret your conclusion in context.

(6 marks)

AQA_JUNE_2017_5b

(b) The effectiveness of the social competence training (SCT) offered at the clinic was also investigated. A sample of 12 patients undertaking SCT was selected.

Each patient was assigned a social competence score before the training and again after the training. Social competence scores are on a scale of 0 to 7, where 7 indicates the highest level of social competence.

The scores are given in the table.

	Score	
Patient	Before	After
A	3	2
B	5	6
C	2	3
D	5	7
E	4	6
F	5	7
G	4	4
H	1	3
I	3	3
J	2	4
K	3	5
L	4	3

(i) Carry out a sign test, at the 5% level of significance, to investigate whether a patient's social competence score increases, on average, following SCT.

[6 marks]

(ii) State the assumption that was necessary, regarding the patients involved in this investigation, for the test carried out in part (b)(i) to be valid.

[2 marks]

AQA_JUNE_2007_3

A study was carried out into mortality ratios at hospitals. Hospital standardised mortality ratios were obtained for weekdays and weekends during 2004.

The ratios are given in the table for each of 10 randomly selected major teaching hospitals.

Hospital	Weekday	Weekend
A	95	100
B	95	98
C	96	97
D	99	98
E	97	98
F	98	97
G	98	101
H	95	99
I	96	99
J	96	101

(a) Carry out a sign test, using the 10% level of significance, to investigate whether major teaching hospitals, on average, have a higher standardised mortality ratio during weekends than during weekdays. Interpret your conclusion in context.

(7 marks)

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

(2 marks)

AQA_JUNE_2009_4

An eye clinic treats a large number of adult patients who have one normal eye but suffer from glaucoma in the other eye. The thickness, in microns, of the cornea of each eye was measured for each of a random sample of 8 such patients.

The results are given in the table.

Patient	1	2	3	4	5	6	7	8
Normal eye	488	478	492	444	436	398	464	476
Eye with glaucoma	484	478	480	426	440	410	458	460

(a) Carry out a sign test, at the 10% level of significance, to investigate whether there is any difference in the average cornea thickness between the normal eye and the eye with glaucoma.

(6 marks)

(b) Later it was discovered that the measurements from 5 other randomly selected adult patients had been lost. However, it is known that all 5 patients had a lower cornea thickness in the eye with glaucoma than in the normal eye. Use this additional information, together with the information given in the table, to carry out a sign test, at the 5% level of significance, to investigate whether there is evidence that the average cornea thickness of the normal eye is greater than that of the eye with glaucoma.

(5 marks)