A Level Statistics

AQA Past Exam Questions

TOPIC: Hypothesis Testing
One 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 **8** questions in this question paper. The total mark for this paper is **60**

• 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_2012_1

After an intensive advertising campaign for a particular brand of breakfast cereal, a market research company asked 12 households who regularly purchase breakfast cereal to record the number of packets of this brand that they had purchased.

(a) The numbers of packets purchased per household during the three months following the campaign are

           4   8   7   12   11   10   6   7   0   6   0   15

The median number of packets of this particular brand of breakfast cereal purchased per household over a similar time period before the campaign was 5 .

Carry out a sign test, using the 10% level of significance, to investigate whether the median number of packets purchased per household increased following the campaign.

(6 marks)

(b) Name another distribution-free test that could be used to investigate whether the median number of packets purchased per household increased following the campaign.

(1 mark)

AQA_JUNE_2013_1

Each day, Jamal completes a crossword puzzle from a particular newspaper and records his completion time, to the nearest minute. For 2011, his median completion time for a crossword puzzle from this newspaper was 32 minutes. Jamal's completion times, to the nearest minute, for a random sample of 12 crossword puzzles, selected from those that he completed from the same newspaper during 2012, were as follows.

        40   20   18   11   27   36   38   35   22   14   12   21

Use a sign test, with the 10% significance level, to examine whether Jamal's median completion time for crossword puzzles from this newspaper during 2012 had decreased from that for 2011.

(6 marks)

AQA_JUNE_2014_5

A Human Resources department in a large company wished to investigate the attitude of middle-level managers to a proposed new company structure.

The department selected, at random, 30 middle-level managers. These managers were asked to state whether they preferred or did not prefer the proposed new company structure to the old company structure or whether they had no opinion on the proposed new company structure.

Out of the 30 managers selected, 5 stated that they had no opinion, 17 stated that they preferred the proposed new company structure to the old company structure and the remainder stated that they did not prefer the proposed new company structure to the old company structure.

The Human Resources department claimed that middle-level managers preferred the proposed new company structure to the old company structure.

(i) Use a sign test, with the 5% level of significance, to investigate this claim.

[6 marks]

(ii) Explain why it would not be possible to use a Wilcoxon signed-rank test to investigate the claim.

[1 mark]

AQA_JAN_2008_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)

AQA_JAN_2010_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)

AQA_JAN_2011_6

A trial is carried out in which each of a sample of 15 women is asked to taste two granola bars, one of which is made to a new recipe and the other to an existing recipe.
Of these 15 women, 10 preferred the taste of the new recipe granola bar.

(a) The manufacturer of the granola bars wants to draw a conclusion from this trial to use in an advertising campaign.

(i) State null and alternative hypotheses which could be used to test whether women prefer the taste of the new recipe granola bar.

(2 marks)

(ii) Carry out a suitable hypothesis test at the 5% significance level. You may regard the sample as random*.*

(5 marks)

(b) The manufacturer decides to repeat the granola bar trial with a sample of 30 women. Find the smallest number of women needed, out of these 30, to prefer the taste of the new recipe granola bar in order for the manufacturer to conclude, at the 5% significance level, that women prefer the taste of the new recipe granola bar.

(4 marks)

AQA_JUNE_2007_4

Scientists carried out research in 2005 to investigate the extent of drug abuse in large Italian towns. Waste water from each of a random sample of nine large Italian towns was analysed. For each town, the estimated cocaine use, measured as the number of 100 g daily doses per 1000 young adults, was calculated.
Results from the research gave the following estimates for cocaine use:

9   26   17   18   21   16   19   13   15

The average estimated cocaine use in large Italian towns during the year 2000 was 14 daily doses per 1000 young adults.

(a) Carry out a sign test, at the 10% level of significance, to investigate the claim that the median cocaine use in large Italian towns has increased since the year 2000. Interpret your conclusion in context.

(7 marks)

AQA_JUNE_2008_5b

The median LDL cholesterol level, for males aged between 35 years and 64 years living in the USA, is known to be 223 mg/dl. A random sample of 9 males, aged between 35 years and 64 years, living in China, each had their LDL level, in mg/dl, measured with the following results:

158   225   164   178   182   184   191   195   231

Carry out a sign test, at the 10% level of significance, to investigate the claim that the median LDL cholesterol level for males aged between 35 years and 64 years is greater for those living in the USA than for those living in China. Interpret your conclusion in context.

(7 marks)