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INTERNATIONAL A LEVEL MATHEMATICS • STATISTICS 2 (WST02)

Statistics 2 Practice Paper 2

Edexcel IAL Statistics 2

AIMING FOR A

Written in the style of the Pearson Edexcel International Advanced Level paper (WST02/01) • Calculator allowed

A full 75-mark paper, harder than a typical real series, with fewer steps given and chapters combined in every question

Time	Total	You must have
1 hour 30 minutes	**75 marks**	**Mathematical Formulae and Statistical Tables, calculator**

Instructions

- Use black ink or ball-point pen. Pencil may be used for diagrams and sketches.
- Answer **all** questions, in the spaces provided.
- Show enough working to make your method clear. Answers without working may not gain full credit.
- Give inexact answers to **three significant figures** unless the question says otherwise.

Information

- There are 7 questions in this paper. The total mark is 75.
- The marks for each question are shown in brackets.

Advice

- Sit the paper in one go, in 1 hour 30 minutes, with the mark scheme closed.
- Read each question carefully and try every question. Check your answers if you have time.
- Then mark it line by line with the mark scheme and fill in your score.

Track your score

Q	Topic	Marks	Score
1	A binomial probability and an approximation	9	
2	A two-tailed Poisson test	10	
3	The sampling distribution of a range	10	
4	A uniform distribution with unknown limits	11	
5	A normal approximation in a Poisson test	11	
6	A piecewise probability density function	12	
7	A two-tailed binomial test	12	
	Total	**75**	

Rough grade guide (out of 75): A* **61** • A **54** • B **45** • C **37**

Based on recent WST02 grade boundaries. Real boundaries change every series, so treat this as a guide, not a grade.

Mark scheme | Exam questions by topic | More practice papers

Name ..... Date .....

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1. Each email that arrives at an office is spam with probability p, independently of all other emails. The probability that neither of two emails is spam is 0.9025

(a) Find the value of p

(2)

(b) Find the probability that, of 10 emails, at least 2 are spam.

(3)

On one day, 120 emails arrive at the office.

(c) Using a suitable approximation, find the probability that more than 8 of these emails are spam.

(3)

(d) Give a reason why the approximation in part (c) is suitable.

(1)

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Question 1 continued

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(Total for Question 1 is 9 marks)

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2. In the past, accidents at a road junction have occurred at a mean rate of 4 per month. The junction is redesigned, and the council wishes to test whether the mean rate of accidents has changed. The number of accidents in the two months after the redesign is recorded.

(a) Give two conditions, in context, under which a Poisson distribution is a suitable model for the number of accidents.

(2)

(b) Write down suitable hypotheses for the test.

(1)

(c) Using a 10% level of significance, find the critical region for the test. The probability in each tail should be less than 0.05

(4)

(d) Write down the actual significance level of the test.

(1)

In the two months after the redesign, 3 accidents occur at the junction.

(e) Comment on whether the mean rate of accidents has changed, giving a reason for your answer.

(2)

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Question 2 continued

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(Total for Question 2 is 10 marks)

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3. A large bag contains counters, each with a number written on it. Of the counters, 40% show the number 1, 40% show the number 2 and 20% show the number 5. A random sample of three counters is taken from the bag, and R is the range of the three numbers.

(a) Find the sampling distribution of R

(6)

(b) Find E(R)

(2)

Eight such samples are taken.

(c) Find the probability that exactly two of the samples have a range of 0

(2)

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Question 3 continued

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(Total for Question 3 is 10 marks)

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4. The continuous random variable X is uniformly distributed over the interval $[a, b]$. Given that $\mathrm{E}(X) = 7$ and $\mathrm{Var}(X) = 12$

(a) find the value of a and the value of b

(4)

(b) find $\mathrm{E}\big(X(X-1)\big)$

(3)

(c) Find $\mathrm{P}(X > 10)$

(1)

Twenty independent observations of X are taken.

(d) Find the probability that at least 8 of the observations are greater than 10

(3)

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Question 4 continued

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(Total for Question 4 is 11 marks)

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5. A shop sells umbrellas at a mean rate of 30 per week, and the number sold in a week is modelled by a Poisson distribution.

(a) Using a suitable approximation, find the probability that more than 36 umbrellas are sold in a week.

(4)

(b) Explain why the approximation used in part (a) is suitable.

(1)

After an advertising campaign, the manager believes that the mean rate of sales has increased. In the week after the campaign, 40 umbrellas are sold.

(c) Using a suitable approximation, test the manager's belief at the 5% level of significance. State your hypotheses clearly.

(6)

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Question 5 continued

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(Total for Question 5 is 11 marks)

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6.

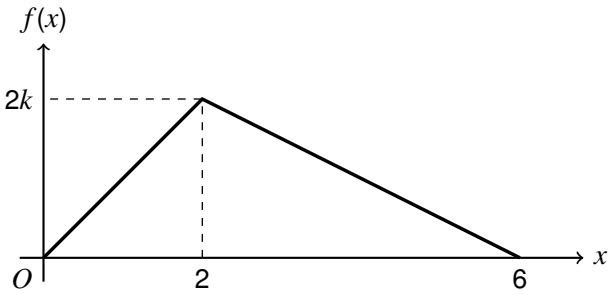

Figure 1

The continuous random variable X has probability density function

$$f(x) = \begin{cases} kx & 0 \leqslant x \leqslant 2 \\ \frac{1}{2}k(6-x) & 2 < x \leqslant 6 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant, as shown in Figure 1.

(a) Find the value of k

(2)

(b) Find the cumulative distribution function F(x) for all values of x

(4)

(c) Find the lower quartile of X

(2)

(d) Find P$(X > 4)$

(2)

Five independent observations of X are taken.

(e) Find the probability that exactly two of the observations are greater than 4

(2)

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Question 6 continued

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(Total for Question 6 is 12 marks)

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7. A spinner is claimed to land on red with probability 0.25. Asha thinks that the probability is not 0.25, and she plans to spin the spinner 30 times and record the number of times, X, that it lands on red.

(a) Write down suitable hypotheses to test Asha's belief.

(1)

(b) Using a 5% level of significance, find the critical region for a two-tailed test. The probability in each tail should be as close as possible to 0.025 without exceeding it.

(4)

(c) Write down the actual significance level of the test.

(1)

The spinner lands on red 12 times.

(d) State whether or not there is evidence to support Asha's belief, giving a reason for your answer.

(2)

Ben carries out the same two-tailed test, at the 5% level of significance, but spins the spinner n times. He wants a result of no reds at all to be significant.

(e) Find the smallest possible value of n

(4)

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Question 7 continued

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(Total for Question 7 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

END

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