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INTERNATIONAL A LEVEL MATHEMATICS • STATISTICS 1

Statistics 1

Exam Questions by Topic

Pearson Edexcel International Advanced Level (WST01/01) • Calculator and Statistical Tables allowed

Multi-step exam questions at the difficulty of the real WST01 paper, with a full mark scheme

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Mathematical Modelling Not examined on its own: modelling ideas are tested within Chapters 2 to 7	—	—	Not applicable	
2 Measures of Location and Spread Averages, quartiles, interpolation, standard deviation, coding	10	83	own PDF	
3 Representations of Data Histograms, stem and leaf, box plots, outliers, skewness, comparisons	10	80	own PDF	
4 Probability Venn and tree diagrams, conditional probability, independence	10	80	own PDF	
5 Correlation and Regression PMCC, least squares regression, interpretation, coding	10	84	own PDF	
6 Discrete Random Variables Probability and cumulative distributions, $E(X)$, $\text{Var}(X)$, uniform	10	82	2	
7 The Normal Distribution Standardising, tables, finding μ and σ , conditional problems	10	83	own PDF	

[Full mark scheme](#)

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6

CHAPTER 6 • KEY SKILLS

Discrete Random Variables

Specification S1: discrete random variables • 10 questions • 82 marks • about 100 minutes

1 Probability distributions

All probabilities are between 0 and 1 and add to 1: $\sum P(X = x) = 1$ finds an unknown.

2 Probability functions

$P(X = x) = k(x + 1)$: substitute each value of x , add, and set equal to 1

3 Cumulative distribution

$F(x) = P(X \leq x)$.
 $P(X = x) = F(x) - F(x - 1)$; $F(2.7) = F(2)$
 for whole-number X

4 Expectation

$E(X) = \sum xP(X = x)$,
 $E(X^2) = \sum x^2P(X = x)$

5 Variance

$\text{Var}(X) = E(X^2) - [E(X)]^2$. $E(X^2)$ is not $[E(X)]^2$

6 Linear functions

$E(aX + b) = aE(X) + b$
 $\text{Var}(aX + b) = a^2 \text{Var}(X)$: b disappears, a is squared

7 Discrete uniform

n equally likely values $1, 2, \dots, n$:

$$E(X) = \frac{n+1}{2}, \quad \text{Var}(X) = \frac{n^2 - 1}{12}$$

8 Unknown probabilities

Sum to 1 and a given $E(X)$ give two simultaneous equations.

9 Combining observations

Independent observations multiply; list every pair that gives the event (a sample space helps).

Skills map every skill above is tested at least once; interleaved skills come from GCSE or other chapters

Skill	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Marks	5	5	5	5	5	12	12	11	10	12
1 Probability distributions	•	•	•			•	•	•	•	•
2 Probability functions	•									
3 Cumulative distribution			•			•	•			•
4 Expectation	•	•		•	•	•	•	•	•	•
5 Variance				•	•	•		•	•	•
6 Linear functions				•	•	•		•		•
7 Discrete uniform					•		•	•		
8 Unknown probabilities		•				•		•		•
9 Combining observations						•	•		•	
Interleaved: conditional probability (Chapter 4)							•		•	
Interleaved: simultaneous and quadratic equations (P1)		•						•		•
Interleaved: linear inequalities (P1)					•					•

Exam difficulty. Questions 1 to 5 check each skill on its own. Questions 6 to 10 are multi-part questions built like the 11 to 14 mark questions on a real WST01 paper, where one part leads into the next and skills are combined.

Must learn. Give exact answers as fractions when the probabilities are fractions. Show $E(X^2)$ before finding $\text{Var}(X)$.



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1. The discrete random variable X has probability function

$$P(X = x) = k(x + 1) \quad x = 1, 2, 3, 4$$

where k is a constant.

(a) Show that $k = \frac{1}{14}$

(2)

(b) Find the exact value of $E(X)$.

(2)

(c) Find $P(X \geq 3)$

(1)

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Question 1 continued

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2. The discrete random variable X has the probability distribution

x	1	2	3	4
$P(X = x)$	0.1	a	0.3	b

where a and b are constants. Given that $E(X) = 2.9$

- (a) write down two equations involving a and b , (2)
- (b) find the value of a and the value of b , (2)
- (c) find $P(1 < X \leq 3)$ (1)



Question 2 continued

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3. The discrete random variable X has cumulative distribution function $F(x)$ given below.

x	1	2	3	4	5
$F(x)$	0.15	0.35	0.6	0.85	1

- (a) Find the probability distribution of X .

(2)

- (b) Write down $F(2.7)$

(1)

- (c) Find $P(2 \leq X < 5)$

(2)

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Question 3 continued

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4. The random variable X has $E(X) = 2.4$ and $\text{Var}(X) = 1.3$

Find

(a) $E(5 - 2X)$

(1)

(b) $\text{Var}(5 - 2X)$

(2)

(c) $E(X^2)$

(2)

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Question 4 continued

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5. A fair 12-sided die has faces numbered 1 to 12. The random variable X is the score when the die is rolled once.

(a) Write down the name of the distribution of X , and find $E(X)$ and $\text{Var}(X)$.

(2)

The random variable $Y = 4X - 3$

(b) Find $E(Y)$ and $\text{Var}(Y)$.

(2)

(c) Find $P(Y > 30)$

(1)

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Question 5 continued

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6. The discrete random variable X has probability function $p(x)$ and cumulative distribution function $F(x)$ given in the table below.

x	1	2	3	4	5
$p(x)$	0.1	a	0.25	b	0.15
$F(x)$	0.1	0.3	c	0.85	1

- (a) Find the values of a , b and c .

(3)

- (b) Find $E(X)$.

(2)

- (c) Show that $\text{Var}(X) = 1.46$

(3)

The random variable $Y = 3X - 1$

- (d) Find $E(Y^2)$

(2)

Two independent observations, X_1 and X_2 , are taken from the distribution of X .

- (e) Find the probability that X_1 and X_2 are both odd.

(2)



Question 6 continued

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7. A red die has four faces numbered 1, 2, 3 and 4. A blue die has four faces numbered 2, 4, 6 and 8. Both dice are fair.

The random variable R is the score on one roll of the red die and B is the score on one roll of the blue die. The dice are rolled together.

- (a) Find $P(R + B \leq 5)$ (2)

- (b) Find $P(R^2 < B)$ (3)

The random variable $D = |R - B|$ is the size of the difference between the two scores. Its cumulative distribution function is shown below.

d	0	1	2	3	4	5	6	7
$F(d)$	$\frac{1}{8}$		$\frac{1}{2}$	$\frac{5}{8}$		$\frac{7}{8}$	$\frac{15}{16}$	1

- (c) Complete the table. (2)

- (d) Find $E(D)$. (3)

- (e) Given that $R + B \leq 5$, find the probability that $D \leq 1$ (2)



Question 7 continued

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Question 7 continued

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8. The discrete random variable X has the probability distribution

x	1	2	3
$P(X = x)$	p	0.5	p

- (a) Find the value of p . (1)

- (b) Show that $E(X) = 2$ and $\text{Var}(X) = 0.5$ (4)

The random variable Y has a discrete uniform distribution over the values 1, 2, 3, 4 and 5

- (c) Write down $E(Y)$ and find $\text{Var}(Y)$. (2)

The random variable $W = aX + b$, where a and b are constants and $a > 0$. Given that $E(W) = E(Y)$ and $\text{Var}(W) = \text{Var}(Y)$,

- (d) find the value of a and the value of b . (4)



Question 8 continued

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Question 8 continued

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x	0	1	3
$P(X = x)$	0.3	0.5	0.2

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Question 9 continued

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10. The discrete random variable X takes only the values 1, 2, 3 and 4 and has cumulative distribution function

$$F(x) = \frac{(x+k)^2}{36} \quad x = 1, 2, 3, 4$$

where k is a positive constant.

- (a) Show that $k = 2$ (2)
- (b) Find the probability distribution of X . (3)
- (c) Find the exact value of $E(X)$. (2)
- (d) Find $P(3X - 3 > X + 4)$ (2)
- (e) Find $\text{Var}(5 - 3X)$, giving your answer to 3 significant figures. (3)



Question 10 continued

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