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INTERNATIONAL A LEVEL MATHEMATICS • STATISTICS 1

Statistics 1

Exam Questions by Topic: Mark Scheme

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

Every question in the booklet, marked line by line the way an examiner marks it

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	3	
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	own PDF	
7 The Normal Distribution Standardising, tables, finding μ and σ , conditional problems	10	83	own PDF	

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How to use this mark scheme

The same marking rules Pearson examiners use for WST01.

Mark every line, not just the answer. Method marks are given for a correct method even when the final answer is wrong. If you lost marks, find the *first* line where your working differs from the scheme. That is the thing to fix.

Code	Meaning
M1	Method mark: for knowing a correct method and attempting to apply it. Small slips in the working do not lose this mark.
dM1	Dependent method mark: can only be given if the method mark before it has been given.
A1	Accuracy mark: for a correct answer or line of working. It can only be given if the method mark it depends on has been given.
B1	Independent mark: for a correct result or statement, whatever method was used.
*	The answer is given in the question. Every step must be shown, and the answer must follow from correct working (cso).
cao	Correct answer only.
cso	Correct solution only: no errors anywhere in the working.
ft	Follow through: the mark can be given for correct work using your own earlier (wrong) answer.
oe	Or equivalent: any correct equivalent form is accepted.

“Solutions relying on calculator technology are not acceptable.” When a question says this, a correct final answer with no algebraic working scores **no marks**. The notes under each scheme line say when this applies.



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Chapter 4: Probability

Mark scheme. Marks are shown on the right of each line.

Question 1

5 marks

Part	Scheme	Marks
(a)	$\frac{29}{80}$	B1 (1)
(b)	$\frac{12}{12+16}$ $\frac{3}{7}$	M1 A1 (2)
(c)	$P(A)P(M) = \frac{35}{80} \times \frac{28}{80} = 0.153\dots$ and $P(A \cap M) = \frac{12}{80} = 0.15$ $0.15 \neq 0.153$, so not independent <i>Alternatively $P(A M) = \frac{3}{7} = 0.429 \neq P(A) = 0.4375$.</i>	M1 A1 (2)
Total for Question 1: 5 marks		

Question 2

5 marks

Part	Scheme	Marks
(a)	$0.61 = 0.4 + 0.35 - P(A \cap B)$ $P(A \cap B) = 0.14$	M1 A1 (2)
(b)	$P(A) \times P(B) = 0.4 \times 0.35 = 0.14$ $= P(A \cap B)$, so A and B are independent *	M1 A1* (2)
(c)	$0.35 - 0.14 = 0.21$	B1 (1)
Total for Question 2: 5 marks		



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Question 3

5 marks

Part	Scheme	Marks
(a)	First counter: $\frac{3}{8}$ for blue	B1
	Second counter: $\frac{4}{7}$, $\frac{3}{7}$ after red; $\frac{2}{7}$ for blue after blue	B1
		(2)
(b)	$\frac{5}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{2}{7}$	M1
	$\frac{13}{28}$	A1
		(2)
(c)	$1 - \frac{5}{8} \times \frac{4}{7} = \frac{9}{14}$	B1
		(1)
Total for Question 3: 5 marks		

Question 4

5 marks

Part	Scheme	Marks
(a)	$P(A \cup B) = 3p + p - 3p \times p$ (addition rule with independence)	M1
	$4p - 3p^2 = 0.68$, so $3p^2 - 4p + 0.68 = 0$ *	A1*
		(2)
(b)	$p = \frac{4 \pm \sqrt{16 - 8.16}}{6} = 0.2 \text{ or } 1.13 \dots$	M1
	$P(B) = 0.2$: $p = 1.13$ is rejected because a probability cannot exceed 1	A1
		(2)
(c)	$1 - 0.68 = 0.32$	B1
		(1)
Total for Question 4: 5 marks		



Question 5

5 marks

Part	Scheme	Marks
(a)	$P(A) = 0.3 + x$ and $P(B) = 0.2 + x$ Independence: $x = (0.3 + x)(0.2 + x)$ $x = 0.06 + 0.5x + x^2$, so $x^2 - 0.5x + 0.06 = 0$ *	B1 M1 A1* (3)
(b)	$(x - 0.2)(x - 0.3) = 0$, and $P(A \cup B) = 0.5 + x$ $0.5 + x < 0.75$, so $x = 0.2$ <i>Both roots are valid probabilities; the condition on $P(A \cup B)$ rejects $x = 0.3$ (which gives 0.8).</i>	M1 A1 (2)
Total for Question 5: 5 marks		

Question 6

11 marks

Part	Scheme	Marks
(a)	$P(F \cup G) = P(F) + P(G) - P(F \cap G)$ Independence: $P(F \cap G) = \frac{2}{5}P(G)$ $\frac{7}{10} = \frac{2}{5} + P(G) - \frac{2}{5}P(G)$, so $\frac{3}{5}P(G) = \frac{3}{10}$ $P(G) = \frac{1}{2}$ * <i>Using $\frac{1}{2}$ to show that $\frac{1}{2}$ works (a circular argument) scores at most M1 M1 M0 A0.</i>	M1 M1 M1 A1* (4)
(b)	K lies inside F : $P(K' \cap F) = \frac{2}{5} - \frac{1}{10} = \frac{3}{10}$, then $\div \frac{2}{5}$ $\frac{3}{4}$	M1 A1 (2)
(c)	K drawn inside F and not overlapping G ; F and G overlapping $F \cap G = \frac{1}{5}$ $K = \frac{1}{10}$ and the rest of F : $\frac{2}{5} - \frac{1}{5} - \frac{1}{10} = \frac{1}{10}$ G only: $\frac{1}{2} - \frac{1}{5} = \frac{3}{10}$ Outside all three: $1 - \frac{7}{10} = \frac{3}{10}$	B1 B1 B1 B1 (5)
Total for Question 6: 11 marks		



Question 7

11 marks

Part	Scheme	Marks
(a)	Good: 0.97 0.05 (faulty, not identified); 0.04 and 0.96 after good	B1 B1 (2)
(b)	$0.03 \times 0.95 + 0.97 \times 0.04$ <u>0.0673</u>	M1 A1 (2)
(c)	$\frac{P(\text{faulty} \cap \text{identified})}{P(\text{identified})}$ $\frac{0.0285}{0.0673}$ <u>0.423</u>	M1 M1 A1 (3)
(d)	Faulty and identified twice: $0.03 \times 0.95^2 = 0.027075$ Good and identified twice: $0.97 \times 0.04^2 = 0.001552$ $\frac{0.027075}{0.027075 + 0.001552}$ <u>0.946</u> <i>Each item has three stages on the tree: the numerator is a product of three probabilities.</i>	M1 M1 M1 A1 (4)
Total for Question 7: 11 marks		



Question 8

10 marks

Part	Scheme	Marks
(a)	Total: $0.08 + 0.12 + 0.04 + p + q + 0.3 = 1$, so $p + q = 0.46$ $P(A) = 0.24 + p$, $P(B) = 0.04 + p + q = 0.5$, $P(A \cap B) = 0.04 + p$ Independence: $0.04 + p = 0.5(0.24 + p)$ $p = 0.16$, $q = 0.3$	M1 M1 M1 A1 (4)
(b)	$P(A \cap B') + P(A' \cap B) = (0.08 + 0.12) + 0.3$ 0.5	M1 A1 (2)
(c)	$P(C) = 0.16$, $P(B) = 0.5$: $P(B)P(C) = 0.08$, but $P(B \cap C) = 0.04$ $0.04 \neq 0.08$, so not independent	M1 A1 (2)
(d)	$P(C) = 0.16$, so the survey has $\frac{96}{0.16} = 600$ people $P(A \cap B) = 0.2$: $0.2 \times 600 = 120$ $A \cap B$ includes the part of C inside B: $0.04 + 0.16 = 0.2$.	M1 A1 (2)
Total for Question 8: 10 marks		



Question 9

11 marks

Part	Scheme	Marks
(a)	$P(A): x + y + 0.05 + 0.05 = 0.4$, so $x + y = 0.3$ $P(A \cup B): x + y + z + 0.05 + 0.05 + 0.1 = 0.7$, so $z = 0.7 - 0.2 - 0.3 = 0.2$ *	M1 A1* (2)
(b)	$P(B) = y + z + 0.05 + 0.1 = y + 0.35$ and $P(A \cap B) = y + 0.05$ Independence: $y + 0.05 = 0.4(y + 0.35)$ $0.6y = 0.09$, so $y = 0.15$ $x = 0.15$	M1 M1 A1 A1ft (4)
(c)	$1 - (0.15 + 0.15 + 0.2 + 0.05 + 0.05 + 0.1 + 0.1) = 0.2$	B1 (1)
(d)	$P(B) = 0.5$, $P(C) = 0.3$ and $P(B \cap C) = 0.05 + 0.1 = 0.15$ $0.5 \times 0.3 = 0.15 = P(B \cap C)$, so B and C are independent	M1 A1 (2)
(e)	$P(B \cup C) = 1 - (x + r) = 0.65$ and $P(A \cap (B \cup C)) = y + 0.05 + 0.05 = 0.25$ $\frac{5}{13}$ (0.385)	M1 A1 (2)
Total for Question 9: 11 marks		



Question 10

12 marks

Part	Scheme	Marks
(a)	$P(\text{late}) = 0.4x + 0.1(1 - x)$ $0.4x + 0.1 - 0.1x = 0.19$ $0.3x = 0.09$, so $x = 0.3$ *	M1 M1 A1* (3)
(b)	$\frac{0.3 \times 0.4}{0.19}$ 0.632 $\left(\frac{12}{19}\right)$	M1 A1 (2)
(c)	$2 \times 0.19 \times 0.81$ 0.3078	M1 A1 (2)
(d)	$0.19 \times 0.5 + 0.81 \times 0.05$ 0.1355	M1 A1 (2)
(e)	Rain and Tom late: $0.3 \times 0.4 \times 0.5 + 0.3 \times 0.6 \times 0.05 = 0.069$ $\frac{0.069}{0.1355}$ 0.509 <i>Both routes through "rain" are needed: the bus late (then Tom walks) and the bus on time.</i>	M1 M1 A1 (3)
Total for Question 10: 12 marks		

