



Pearson
Edexcel

Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCE
In Statistics (9ST0)
Paper 01: Data and Probability

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General Marking Guidance

Total marks

The total number of marks for the paper is 80.

Mark types

The Edexcel Statistics mark schemes use the following types of marks:

- **M** **Method** marks, awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
- **A** **Accuracy** marks can only be awarded if the relevant method (M) marks have been earned.
- **B** **Unconditional accuracy** marks are independent of M marks
- **E** **Explanation** marks

NOTE: Marks should not be subdivided.

Abbreviations

These are some of the marking abbreviations that will appear in the mark schemes.

- ft follow through
- PI possibly implied
- cao correct answer only
- cso correct solution only
(There must be no errors in this part of the question)
- awrt answers which round to
- awfw answers which fall within (a given range)
- SC special case
- nms no method shown
- oe or equivalent
- dep dependent (on a given mark or objective)
- dp decimal places
- sf significant figures
- * The answer is printed on the paper

Further notes

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied **positively**. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is **no ceiling** on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- All A marks are 'correct answer only' (cao), unless shown, for example, as A1ft to indicate that previous wrong working is to be followed through.
- All M marks are 'possibly implied' (PI) unless specifically stated otherwise in the 'Notes' column.
- After a **misread**, the subsequent A marks affected are treated as A1ft, but manifestly absurd answers should never be awarded A marks.
- **Crossed out** work should be marked UNLESS the candidate has replaced it with an alternative response.
- If **two solutions** are given, each should be marked, and the resultant mark should be the mean of the two marks, rounded down to the nearest integer if needed.

Question	Scheme	Marks	AO	Notes
1(a)	Winning time in men's 100 metres decreases by 0.0106 seconds per year...	E1	2.1a	
	so decreases by 0.0424 seconds per Olympic games	E1	2.1a	
1(b)	10.45 seconds	B1	1.2	cao
1(c)	Linear trend can't continue forever	E1	2.1b	oe e.g. extrapolation
	Data from 100 years ago has been used in his calculation which didn't take into account more modern changes so likely to be inaccurate	E1	2.1b	
Total		5		

Question	Scheme	Marks	AO	Notes
2(a)(i)	A game with 0 goals must be a draw	E1	2.1a	
2(a)(ii)	$0.1 + 0.3 + 0.1 + 0.05$ $\{ P(\text{Draw}) \leq \} 0.55$	M1 A1	1.2 1.2	PI
2(b)	<p>Upper limit of six goals per game is not realistic as more than 6 goals are scored in some football games.</p> <p>You cannot tell from total scores if it was a win or not e.g. 4 could be 4-0, 3-1, or 2-2</p> <p>You don't know how Leona probabilities were estimated</p>	E1	3.1a	Either
2(c)	$n = 64$ $p = 0.45$	B1 B1	2.1a 2.1a	PI if B(64,0.45)
2(d)	$Y \sim N(28.8, 15.84)$ $P(X \geq 30) = P(Y > 29.5)$ 0.430	M1 A1 M1 A1	1.2 1.2 1.2 1.2	Normal approximation written or used PI Correct mean and variance PI Continuity correction, PI awrt
Special case SC1 no continuity correction used results in 0.381-0.382 scores M1A1M0A1 SC2 incorrect continuity correction results in 0.334-0.335... scores M1A1M0A1 SC3 no normal approximation used 0.429 scores M0A0M0A1				
2(e)	Reliable	E1dep	3.1b	Dep on attempt at explanation
	n is large and p is close to 0.5	E1	3.1b	o.e.large sample, CLT applies, or $n > 30$ and $np > 10$

Question	Scheme	Marks	AO	Notes
2(f)	Teams will score different number of goals so probability is unlikely to be the same in every game	E1	3.1a	Some teams score more goals etc.
	Probabilities are unlikely to be independent from one game to another as a player(s) may get injured	E1	3.1a	o.e.
	Total	14		

Question	Scheme	Marks	AO	Notes
3(a)	For each student he needs their grade in a specific physics exam and the number of activities in categories	E1	1.1	
	Ned could obtain this data via a survey or questionnaire	E1	1.1	Or other suitable method 2 comments on gathering data
	Sample should be chosen at random	E1	1.1	
	Sample should be reasonably large	E1	1.1	Accept 30+ students 2 comments on sample
	Test on Spearman's Rank Correlation Coefficient (or PMCC)	E1	2.1a	Or Chi-squared test on contingency table Accept
	H ₀ : No association between number of sports played per week and Physics grade ($\rho_s = 0$) H ₁ : An association between number of sports played per week and Physics grade ($\rho_s \neq 0$)	E1	1.3	H ₀ : Physics grade and number of sports played are independent H ₁ : Physics grade and number of sports played are not independent
3(b)	$X \sim B(70, 0.25)$	M1	2.1a	PI For selection of binomial model
	$70 \times 0.3 = 21$	M1	1.2	PI 21 seen anywhere oe
	$P(X > 21) = 0.136$	A1	1.2	
	Special case: Use of normal approximation leads to 0.204 or 0.167 scores M1, M1, A0			

Question	Scheme	Marks	AO	Notes
3(c)	Probability will not be constant as Zamira may be able to rule out some incorrect answers even if she doesn't know the correct answer	E1	3.1a	Accept prior knowledge may mean an answer is known. Some context must appear
	Answer selection may not be independent as some questions may give information which rules out an answer on other questions	E1	3.1a	Or another contextual reason to suggest a lack of independence
Total		11		

	Sampling improvement(s) Targeted sample in terms of blood glucose levels	E1, E1	1.1, 1.1	E1 for each sensible answer (max E2)
		Total	8	

5(d)	Possible suggestions (not exhaustive) Number of bicycles parked annually Annual footfall Total thefts in the area Number of attempted thefts in the area Times bicycle thefts occurred Types of bicycles stolen Damage taken by bicycles in unsuccessful theft attempts Location at station bicycles stolen from Cost of parking bicycle Security at station	E1,E1, E1	1.1, 1.1, 1.1	E1 for each sensible suggestion
Total		9		

Question	Scheme	Marks	AO	Notes
6(a)	A discrete distribution can only take certain values	E1	1.1	
	A continuous distribution can take every value within a certain range	E1	1.1	
6 (b)(i)	$\frac{2}{8} = \frac{1}{4}$	B1	1.2	
6(b)(ii)	$\frac{\frac{3}{8}}{\frac{6}{8}}$	M1	1.2	$\frac{3}{8}$ divided by (1-‘their’ (b)(i))
	$= \frac{1}{2}$	A1	1.2	
6(b)(iii)	$p = 0.75$	B1	1.2	
	$X \sim B(20, 0.75)$	M1	1.2	Use of binomial with $n = 20$
	$P(X \geq 10) = 0.996$	A1	1.2	Correct answer only full marks
6(c)(i)	Comments in support As parcel is randomly selected it should be <u>equally likely</u> to be delivered at any time during the 8 hour shift.	E1	3.1b	Should indicate understanding of equal likelihood
6(c)(ii)	Comments against Start of range at 0 is probably unrealistic as there must be time travelling from depot			
Total		10		

Question	Scheme	Marks	AO	Notes
7(a)(i)	0.0341 awrt	A1	1.1	
7(a)(ii)	$P(X \geq 12) = 1 - P(X \leq 11)$ $= 0.873$	M1 A1	1.1 1.1	PI
7(a)(iii)	$Y \sim Po(4)$ $P(3 \leq Y \leq 5) =$ $P(Y \leq 5) - P(Y \leq 2)$ $= 0.547$	M1 M1 A1	1.1 1.1 1.1	PI Seen or used PI
Special case SC If $Y \sim Po(16)$ then M0M1A0 for awrt 0.00137				
7(b)	The numerator should be the probability there are 30 major earthquakes with 13 in Year 1 and 17 in Year 2 not just 30 overall She could instead just calculate the probability there are 17 major earthquakes in the second year.	E1 E1	3.1a 3.1a	Correct explanation implied by 0.0934
7(c)	Any correct attempt at trial and improvement with Poisson	M1	2.1b	$\text{Exp}(\lambda)$ M0
	$\lambda = \frac{16}{365}, 0.0438$	A1	1.1	Accept $\lambda = 3$
	Clear strategy, including days seen with their probability and selecting a day with probability > 0.95	M1	1.1	oe.using probability < 0.5
	69 days	A1	1.1	
	Alternative			
	$\frac{\lambda^0 e^{-\lambda}}{0!} \leq 0.05$ $\lambda \leq 2.996$ No. of days $= \frac{2.996}{16} \times 365$ Rounds up to 69 days	(M1) (A1) (M1) (A1)		
Total		12		

Question	Scheme	Marks	AO	Notes
8(a)	$\frac{5}{15}$	B1	1.2	o.e.
8(b)	$\frac{3}{15} \times 0.45 + \frac{7}{15} \times 0.25 + \frac{5}{15} \times 0.15$ $= \frac{77}{300}$	M1,M1 A1	1.2, 1.2 1.2	1 ST M1 for any term correct 2 nd M1 for all three correct and added Awrt 0.257
8(c)	$\frac{3}{15} \times 0.15 \times \frac{7}{14} \times 0.25 \times \frac{5}{13} \times 0.45 \times 6$ $(0.03 \times 0.125 \times 0.173 \times 6)$ $= \frac{81}{20\,800} (= 0.00389 \dots)$	M1 M1 M1 A1	1.2 1.2 1.2 1.2	$3 \times 7 \times 5$ $15 \times 14 \times 13$ $0.15 \times 0.25 \times 0.45 \times 6$
8(d)	<p>Players classified as stronger are more likely to win their first game</p> <p>This decreases the probability Ingrid will be matched against players who are “weaker”</p> <p>So the probability in (c) would decrease.</p>	E1 E1 dE1	2.2 2.2 2.2	<p>She is more likely to meet stronger or similar in next rounds</p> <p>Dependent on either of the previous E marks</p>
Total		11		

