

SMA0/02: AS Paper 2 Part A Statistics Mark scheme

Question	Scheme	Marks	AOs
1(a)	$[Q_2 =] (5+) \frac{12}{15} \times 5$	M1	1.1a
	$= 9$	A1	1.1b
	(2)		
(b)	$[\sigma_x =] \sqrt{\frac{5675}{30} - \left(\frac{355}{30}\right)^2} = \sqrt{49.14...}$	M1	1.1a
	$= \text{awrt } 7.01$	A1	1.1b
	Accept $\left(s_x = \sqrt{\frac{5675 - 30\left(\frac{355}{30}\right)^2}{29}} = 7.1294... \right)$		(2)
(c)	$x = \frac{t-15}{2}$ or $t = 2x + 15$	M1	3.1b
	Median = $2 \times "9" + 15 = 33$ (allow awrt 33.3 from "9.17" in (a))	A1ft	1.1b
	Sd = $2 \times "7.01" = 14.02...$ (awrt 14.0) [allow awrt 14.3 if s used]	A1ft	1.1b
	(3)		
(d)	The median time is "33" and "33" < 35 so 50% (30) should finish in 35 minutes.		
	ALT Probability of being < 35 mins is $\frac{18}{30} \setminus \frac{18}{30} \neq 60 = 36$ applicants to choose from.	M1	2.4
	It is likely that they will fill all 25 positions [providing those offered accept]	A1	2.2b
	(2)		
Notes:		(9 marks)	
(a) M1: For a suitable fraction $\times 5$ (ignore end points) A1: For 9 or awrt 9.17 if using $n + 1$			
(b) M1: For a correct expression for \bar{x} and s_x or s_x A1: For awrt $s_x = 7.01$ or $s_x = \text{awrt } 7.13$			
(c) M1: For realising $x = \frac{t-15}{2}$ and then rearranging to get a correct equation with t as the subject May be implied by a correct answer for the median of t . A1ft: ft their median A1ft: ft their s_x or s_x . NB using s gives awrt 14.3			
(d) M1: For a suitable comparison following through their value for the median of t . A1: A correct conclusion in context following through their value for the median of t .			

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Question	Scheme	Marks	AOs	
2(a)	$P(5 \leq X < 12) = P(X \leq 11) - P(X \leq 4)$	M1	1.1b	
	$= 0.8939 - 0.0495$ = awrt <u>0.844</u>	A1	1.1b	
		(2)		
(b)	$H_0: p = 0.25$ $H_1: p > 0.25$ (both correct in terms of p or p)	B1	2.5	
	$Y \sim B(40, 0.25)$	M1	3.3	
	<u>Method 1</u>	<u>Method 2</u>		
	$P(Y \geq 16) = 1 - P(Y \leq 15)$	$P(Y \geq 17) = 0.0116$	M1	1.1b
	$= 1 - 0.9738$	$P(Y \geq 18) = 0.0047$		
	$= 0.0262$	CR $Y \geq 18$	A1	1.1b
	$0.0262 > 0.01$ $16 < 18$ or 16 is not in the critical region or 16 is not significant, accept H_0 . There is no significant evidence that the proportion of people who bought organic eggs has increased	A1cso	2.2b	
	(5)			
(c)	There is evidence that the proportion of people who bought organic eggs has increased [since $0.05 > 0.0262$ or 16 is in critical region]	B1ft	2.2b	
		(1)		
(8 marks)				
Notes:				
(a) M 1: For dealing with $P(5 \leq X < 12)$ they need to use the cumulative prob. Function on the calc. A1: awrt 8.44 (from calculator).				
(b) B1: Both hypotheses correct using p or p and 0.25 M1: Realising that the model $B(40, 0.25)$ is to be used. This may be stated or used. M1: Using or writing $1 - P(Y \leq 15)$ or $1 - P(Y < 16)$ a correct CR or $P(Y \geq 17) = 0.0116$ and $P(Y \geq 18) = 0.0047$ A1: awrt 0.0262 or CR $Y \geq 18$ or $Y > 17$ A1cso: A fully correct solution with a correct conclusion in context to include the idea of proportion and increased plus referring to organic				
(c) B1ft: For $0.0262 < 0.05$ [ft their probability in part(b)] or a CR of $16 \geq 15$ (allow $16 > 14$) and a correct contextual conclusion.				

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Question	Scheme	Marks	AOs
3(a)	Pressure outliers are <1004.75 and >1018.75 Rainfall outliers are (<-3.05) and >82.95	M1	2.1
	$p = 1019$ and 1022 are outliers $w = 102.0$ is an outlier	A1cso	1.1b
		(2)	
(b)	e.g. was a negative correlation, now no (zero) correlation	B1	2.2b
		(1)	
(c)	e.g. there are a lot of zeros for rainfall in Perth and there are none in the sample. or e.g. these are the highest figures and you are unlikely to get these if the sample was random.	B1	2.4
		(1)	
(d)	On average, an increase of 1 hPa in daily mean pressure results in a decrease of 0.223 mm in daily rainfall.	B1	3.4
		(1)	
(e)	Unreliable, as the large data set does not cover December.	B1	2.4
		(1)	
			(6 marks)
Notes:			
(a) M1: At least one correct boundary point A1: both upper boundary points and correct conclusions			
(b) B1ft: A suitable description of correlation before and after.			
(c) B1: For a comment that supports the idea that the sample is unlikely to be random.			
(d) B1: For a suitable description of the rate : rainfall per number of hPa with reference to figures			
(e) B1: For correct conclusion with a reason explaining why it would be extrapolation. NB: B0 For out of range, extrapolation o.e. on their own without a reason.			

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Question	Scheme	Marks	AOs
4(a)	S and A since there is no intersection between A and S or the probability of S and A happening is zero	B1	1.2
		(1)	
(b)	$(0.1 + p) \times 0.25 = 0.1$ [$p = 0.3$]	M1	3.1b
	$q = 0.15$ or $1 - q = 0.85$	M1	1.1b
	$r = 1 - p - q = 0.25$	M1dd	3.1b
	$= 0.3$	A1	1.1b
		(4)	
(c)	Independent since $0.25 \times 0.2 = 0.05$	B1	2.2a
		(1)	
(d)	The teacher's belief would appear not to be justified as D and S are independent	B1ft	2.4
		(1)	
(7 marks)			
Notes:			
(a) B1: For S and A and a sensible reason			
(b) M1: For forming a correct equation in terms of p using the information given. M1: Writing or using $q = 0.15$ or $1 - q = 0.85$ M1dd: dependent on both previous M marks being awarded. For using their values for p and q to form a correct equation to enable them to find r A1: cao			
(c) B1: Yes and a suitable reason to support their answer bringing together the two pieces of information to draw the correct conclusion			
(d) B1: A correct comment following their answer to part (c) with reference to the teachers belief.			