OCR
Oxford Cambridge and RSA

GCE

Statistics (MEI)

Unit **G241**: Statistics 1 (Z1)

Advanced Subsidiary GCE

Mark Scheme for June 2017

Annotations and abbreviations

Annotation in RM Assessor	Meaning
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	Meaning
E1	Mark for explaining Use B1 in RM assessor
U1	Mark for correct units
G1	Mark for a correct feature on a graph Use B1 in RM assessor
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Subject-specific Marking Instructions for GCE Mathematics (MEI) Statistics strand

Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E

A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.

Candidates are expected to give numerical answers to an appropriate degree of accuracy. 3 significant figures may often be the norm for this, but this always needs to be considered in the context of the problem in hand. For example, in quoting probabilities from Normal tables, we generally expect *some* evidence of interpolation and so quotation to 4 decimal places will often be appropriate. But even this does not always apply – quotations of the standard critical points for significance tests such as 1.96, 1.645, 2.576 (maybe even 2.58 – but not 2.57) will commonly suffice, especially if the calculated value of a test statistic is nowhere near any of these values. Sensible discretion *must* be exercised in such cases.

Discretion must also be exercised in the case of small variations in the degree of accuracy to which an answer is given. For example, if 3 significant figures are expected (either because of an explicit instruction or because the general context of a problem demands it) but only 2 are given, loss of an accuracy ("A") mark is likely to be appropriate; but if 4 significant figures

are given, this should not normally be penalised. Likewise, answers which are slightly deviant from what is expected in a very minor manner (for example a Normal probability given, after an attempt at interpolation, as 0.6418 whereas 0.6417 was expected) should not be penalised. However, answers which are *grossly* over- or under-specified should normally result in the loss of a mark. This includes cases such as, for example, insistence that the value of a test statistic is (say) 2.128888446667 merely because that is the value that happened to come off the candidate's calculator. Note that this applies to answers that are given as final stages of calculations; intermediate working should usually be carried out, and quoted, to a greater degree of accuracy to avoid the danger of premature approximation.

The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

Genuine misreading (of numbers or symbols, occasionally even of text) occurs. If this results in the object and/or difficulty of the question being considerably changed, it is likely that all the marks for that question, or section of the question, will be lost. However, misreads are often such that the object and/or difficulty remain substantially unaltered; these cases are considered below.

The simple rule is that *all* method ("M") marks [and of course all independent ("B") marks] remain accessible but at least some accuracy ("A") marks do not. It is difficult to legislate in an overall sense beyond this global statement because misreads, even when the object and/or difficulty remains unchanged, can vary greatly in their effects. For example, a misread of 1.02 as 10.2 (perhaps as a quoted value of a sample mean) may well be catastrophic; whereas a misread of 1.6748 as 1.6746 may have so slight an effect as to be almost unnoticeable in the candidate's work.

A misread should normally attract *some* penalty, though this would often be only 1 mark and should rarely if ever be more than 2. Commonly in sections of questions where there is a numerical answer either at the end of the section or to be obtained and commented on (eg the value of a test statistic), this answer will have an "A" mark that may actually be designated as "cao" [correct answer only]. This should be interpreted *strictly* – if the misread has led to failure to obtain this value, then this "A" mark must be withheld even if all method marks have been earned. It will also often be the case that such a mark is implicitly "cao"

even if not explicitly designated as such.

On the other hand, we commonly allow "fresh starts" within a question or part of question. For example, a follow-through of the candidate's value of a test statistic is generally allowed (and often explicitly stated as such within the marking scheme), so that the candidate may exhibit knowledge of how to compare it with a critical value and draw conclusions. Such "fresh starts" are not affected by any earlier misreads.

A misread may be of a symbol rather than a number – for example, an algebraic symbol in a mathematical expression. Such misreads are more likely to bring about a considerable change in the object and/or difficulty of the question; but, if they do not, they should be treated as far as possible in the same way as numerical misreads, *mutatis mutandis*. This also applied to misreads of text, which are fairly rare but can cause major problems in fair marking.

The situation regarding any particular cases that arise while you are marking for which you feel you need detailed guidance should be discussed with your Team Leader.
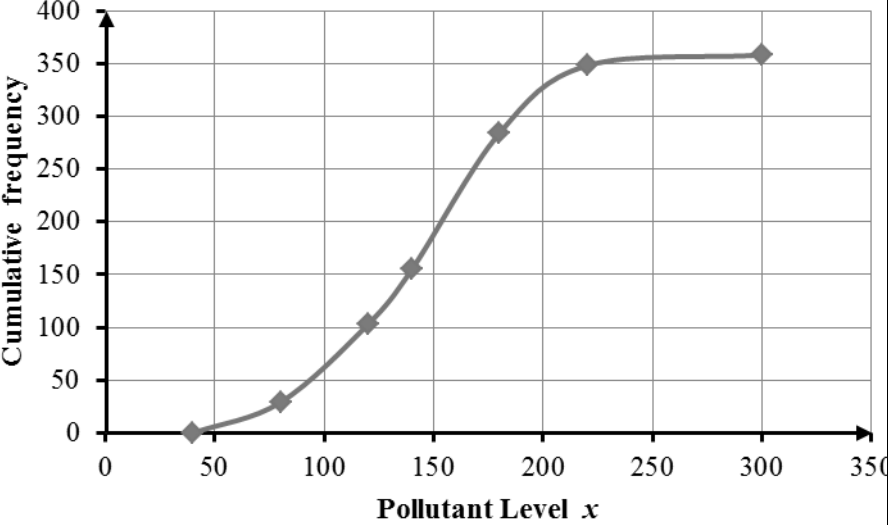
Note that a miscopy of the candidate's own working is not a misread but an accuracy error.
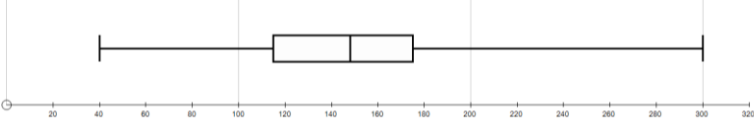
Question			Answer	Marks	Guidance
1	(i)		$\text{Mean} = \dfrac{17100}{50} = 342$	B1	Ignore units CAO
			$Sxx = 6115108 - \dfrac{17100^2}{50} = 266908$	M1	For Sxx M1 for 6115108 - 50 × their mean^2 BUT NOTE M0 if their $S_{xx} < 0$
			$s = \sqrt{\dfrac{266908}{49}} = \sqrt{5447.10} = 73.8 \ (73.8044\ldots)$	A1 **[3]**	CAO ignore units M1A0 for RMSD = 73.1 (73.062…)
1	(ii)		New mean = (0.108 × 342) + 7.2 = £44.14	B1	FT their mean Allow £44.1 or better provided answer is positive
			New sd = 0.108 × 73.8 = £7.97	M1 A1 **[3]**	FT their sd (unless negative)for M1 and A1 NB If candidate 'starts again' only award marks for CAO
			Using RMSD gives £7.89 Using variance gives 588.29		Do not penalise lack of units in mean or sd Deduct at most 1 mark overall in whole question for over-specification of either mean or SD or both
2	(i)		$\dbinom{50}{4} = \dfrac{50!}{4!46!} = 230300$	M1 A1 **[2]**	
2	(ii)		$\dfrac{17}{50} \times \dfrac{16}{49} \times \dfrac{15}{48} \times \dfrac{14}{47} = \dfrac{17}{1645} = 0.0103$	M1	17/50 × or 0.34× <u>NB</u> $\left(\dfrac{17}{50}\right)^4$ or 0.34^4 scores M1A0
			Or:	A1 **[2]**	But M0 if part of a binomial expression CAO Uncancelled fraction gets M1A0
			$\dbinom{17}{4} \div \dbinom{50}{4} = \dfrac{2380}{230300} = 0.0103$	M1 A1	Uncancelled fraction gets M1A0 Allow 0.010 with working but not 0.01

Question	Answer	Marks	Guidance
2 **(iii)**	$1 - 4! \times \dfrac{17}{50} \times \dfrac{9}{49} \times \dfrac{13}{48} \times \dfrac{11}{47}$ $= 1 - 24 \times 0.0003958..$ $= 1 - 0.09500217 = 0.905 \ (0.904997\ldots)$ Or: $1 - \left[\dbinom{17}{1} \times \dbinom{9}{1} \times \dbinom{13}{1} \times \dbinom{11}{1} \div \dbinom{50}{4} \right] = 1 - 0.09500 = 0.905$	M1 M1 M1 A1 **[4]** M1 M1 M1 A1	For correct product For ×4! For 1 − with product of four fractions but with or without a coefficient CAO If denominators all 50 then max M0M1M1A0 Allow 0.90 with working For product of four correct nCr terms For division of product of four nCr terms by 50C4 For 1 - product of four nCr terms divided by 50C4
3 **(i)**	Possibilities are (1,2), (2,3), (3,4), (2,1), (3,2), (4,3) So 6 out of 16 or $^3/_8$ **NB ANSWER GIVEN**	M1 A1 **[2]**	Or M1 for table showing scores on both dice and differences SC1 for stating 3 different ways of getting diff of 1 and 2 ways round for each and 16 possibilities altogether so $^3/_8$ or similar
3 **(ii)**	$E(X) = \left(0 \times \dfrac{1}{4} \right) + \left(1 \times \dfrac{3}{8} \right) + \left(2 \times \dfrac{1}{4} \right) + \left(3 \times \dfrac{1}{8} \right) = \dfrac{10}{8} = \dfrac{5}{4} = 1.25$ $E(X^2) = \left(0 \times \dfrac{1}{4} \right) + \left(1 \times \dfrac{3}{8} \right) + \left(4 \times \dfrac{1}{4} \right) + \left(9 \times \dfrac{1}{8} \right) = \dfrac{10}{4} = 2.5$ $Var(X) = 2.5 - 1.25^2 = 0.9375$ or $\dfrac{10}{4} - \left(\dfrac{5}{4} \right)^2 = \dfrac{15}{16} = 0.9375$ Allow 0.938. Condone 0.94	M1 A1 M1* M1* dep A1 **[5]**	For Σrp (at least 3 terms correct) CAO For Σr²p (at least 3 terms correct) for − their (E(X))² FT their E(X) provided Var(X) > 0 Use of E(X-μ)² gets M1 for attempt at (x-μ)² should see (-1.25)², (-0.25)², (0.75)², (1.75)² (if E(X) wrong FT their E(X)) (all 4 correct for M1), then M1 for Σp(x-μ)² (at least 3 terms correct) Division by 4 or other spurious value at end and/or rooting final answer gives max M1A1M1M1A0, or

Question			Answer	Marks	Guidance
					M1A0M1M1A0 if E(X) also divided by 4. Unsupported correct answers get 5 marks (Probably from calculator)
4	(i)		Probability $= (1 - 0.4) \times 0.8 = 0.48 \left(= \dfrac{12}{25} \right)$	M1 A1 **[2]**	
4	(ii)		*Either:* $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= 0.4 + 0.8 - 0.4 \times 0.8$ $= 0.88 \left(= \dfrac{22}{25} \right)$ *Or:* $P(A \cup B) = 0.4 \times 0.8 + 0.6 \times 0.8 + 0.4 \times 0.2$ $= 0.32 + 0.48 + 0.08 = 0.88$ *Or:* $P(A \cup B) = 1 - P(A' \cap B')$ $= 1 - 0.6 \times 0.2 = 1 - 0.12 = 0.88$	M1 M1 A1 CAO **[3]** M1 M1 A1 M1 M1 A1	for use of formula for 0.4×0.8 For any two terms For all three terms For 0.6×0.2 For complete method
4	(iii)		$P(A\|B) = \dfrac{P(A \cap B)}{P(B)} = \dfrac{0.32}{0.88} = \dfrac{4}{11} = 0.364 = (0.3636...)$	M1 M1 A1FT **[3]**	For numerator As part of fraction (with denominator) For denominator As part of fraction (with numerator) FT their answer to part (ii) Accept $0.3\dot{6}$ (dots above) Accept 0.36 with correct working
5	(i)		$0.55^3 = 0.166$ (0.166375) $\left(= \dfrac{1331}{8000} \right)$	M1 A1 **[2]**	For 0.55^3 Accept 0.17 with working Condone answer of 0.166375 (over-specified)
5	(ii)		P(Wins in 3 games) $= 0.45^3 = 0.091125$ P(Wins in 4 games) $= 3 \times 0.45^2 \times 0.55 \times 0.45 = 0.150356$ P(Wins in 5 games) $= 6 \times 0.45^2 \times 0.55^2 \times 0.45 = 0.165392$ NB Answer if no coefficients used is 0.168809… $= 0.091125 + 3 \times 0.05011875 + 6 \times 0.0275653125$ P(Emily wins) $= 0.407$ $(0.406873..)$ $1 - $ P(Sakura wins) can get all marks (use similar scheme) so eg $1 - 0.55^3$ gets M1M0M0M0A0	M1 M1 M1 M1 A1 **[5]**	For P(Wins in 3 games) P(Wins in 4 games) with any or no coefficient P(Wins in 5 games) with any or no coefficient For either coefficient correct CAO SC2 for P(Sakura wins) $= 0.593$ $(0.593126…)$

Question			Answer	Marks	Guidance
6	**(i)**		Upper bound / Cumulative frequency table and cumulative frequency graph	B1	Cumulative frequencies All correct. May be implied from graph. Condone omission of 0 at this stage.
				G1	For points Plotted as (UCB, their cf). Ignore (40,0) at this stage. No midpoint or LCB plots or non-linear scales Plotted within ½ small square If cf not given then allow B1G1 for all correct
				G1	For joining points (within ½ a square) For joining all of 'their points' (line or smooth curve) AND now including (40,0) Not for midpoint or LCB plots or non-linear scales
				G1	For scales Linear horizontal scale. Allow if start at 40 (no inequality scales - Not even <40, <60, <80 …) Linear vertical scale Allow full credit if axes reversed correctly
			NB If you receive a script where the graph is drawn on lined paper, rather than on the grid, please mark it and then refer it to your team leader <u>BEFORE</u> you submit it.	G1 **[5]**	For labels Pollutant level or x and Cumulative frequency or just CF or similar but not frequency or fd nor cumulative fd All four dep on attempt at cumulative frequency. Mid-point or LCB plots or cum freq bars may score first and last two marks **NOTE With one error in cfs last 4 marks still available (EG 0, 29, 103, 145, 274, 338, 348)**
6	**(ii)**		Estimate from curve is 327 Proportion = 327/358 = 0.913 or 91.3% 315/368 = 87.99% 316/358 = 88.3% NB Linear interpolation gives 284 + ½×64 = 316	M1 A1 **[2]**	**Allow 315 to 330 without checking graph (unless non-linear scales in which case allow 316 by LI)** **Otherwise FT their graph** within one square (allow a slight slip in scales - contact TL if unsure) **Max M1A0 if final answer given as a fraction**

The table within the answer:

Upper bound	40	80	120	140	180	220	300
Cumulative frequency	0	29	103	155	284	348	358

Question		Answer	Marks	Guidance
6	**(iii)**	Median =148 **Allow 145 to 152 without checking graph** No marks if $Q_1 = 115$ **Allow 110 to 115 without checking graph** non-linear $Q_3 = 175$ **Allow 175 to 180 without checking graph** scales IQR = 60 If quartiles not specified give B1B0 for 'IQR is $115 < x < 175$' or similar If answer only for IQR, check if quartiles given in part (iv) or (v) – if not then check graph	B1 B1 B1 **[3]**	For Q1 or Q3 For IQR FT their cf graph for all 3 marks within one square (on both scales) (allow a slight slip in scales - contact TL if unsure)
6	**(iv)**	Lower limit $Q_1 - 1.5 \times IQR$ '115 – (1.5 × 60)' (= 25) Upper limit $Q_3 + 1.5 \times IQR$ '175 + (1.5 × 60)' (= 265) There are definitely no outliers at the lower end as the lowest data value is 40 which is below the lower limit. It is uncertain whether there are outliers at the upper end as the highest class includes the upper limit. Use of mean= 145.08 and sd = 45.09 gives 54.9 and 235.26 for M2 So could be some outliers at lower and could be some at upper end but not sure. E1E1	M1 M1 A1 A1 **[4]**	FT their quartiles provided between 40 and 300 Allow 'No values below (their) 25' for first A1 Allow 'Lower limit = (their) 25 so no outliers' You must be convinced that comments about no outliers refer to **lower tail only**. Allow <u>additional</u> comment that since some data is lost there could be one or more outliers If their lower limit >40 then A0 Do not allow 'There <u>IS</u> at least one outlier.' oe There must be an element of doubt. However, condone 'There is probably at least one outlier.' You must be convinced that comments about some outliers refer to upper tail only. If their upper limit <220 or >300 then A0
6	**(v)**	 Pollution level	G1* G1*dp G1*dp	FT their median and quartiles provided between 40 and 300 and $Q_1 <$ median $< Q_3$ Can restart from graph For linear scale shown. Dep on attempt at box and whisker plot with at least a box and one whisker. Condone lack of label. For boxes (Q_1, median, Q_3) in correct positions, within half a square

Question			Answer	Marks	Guidance
				[3]	For whiskers at 40 and 300 within half a square Upper whisker could be partially dotted
6	**(vi)**		The readings from Tower Hamlets show (stronger) positive skewness	E1	
			The readings from Marylebone Road show little evidence of skewness Accept 'No skewness' For 2 marks must suggest that TH has higher positive skew than MR	E1 **[2]**	Allow '<u>slight</u> positive skewness' Do <u>not</u> FT their diagram but must have boxplot in part (v) to get second mark 'TH shows more evidence of positive skewness than MR' gets E2
7	**(i)**	(**A**)	$X \sim \text{B}(12, 0.75)$ $P(X = 9) = \dbinom{12}{9} \times 0.75^9 \times 0.25^3 = 0.258 \ (0.258103\ldots)$ Or: From tables $P(X \le 9) - P(X \le 8) = 0.6093 - 0.3512 = 0.2581$	M1 M1 A1 M2 A1 **[3]**	For $0.75^9 \times 0.25^3$ For $\dbinom{12}{9} \times p^9 \times q^3$ With $p + q = 1$ Also for $220 \times 0.00117\ldots$ Allow 0.26 or better with working CAO For $0.6093 - 0.3512$ CAO
7	**(i)**	(**B**)	$P(X \ge 9) = 1 - P(X \le 8) = 1 - 0.3512 = 0.6488$	M1 A1 **[2]**	For 0.3512 CAO Accept 0.649 and 0.65 with working For $P(X=9) + P(X=10)+ P(X=11)+ P(X=12)$ allow M1A1 for awrt 0.649. Otherwise M0A0.
7	**(ii)**		(Let $X \sim \text{B}(18, 0.75)$) Let p = probability of dog having allergy relieved by the new shampoo (for population) H_0: $p = 0.75$ H_1: $p > 0.75$ H_1 has this form as the test is to determine whether the new shampoo relieves	B1 B1 B1 E1	For definition of p (in context) Do NOT allow <u>number</u> in place of probability. See below for additional notes For H_0 For H_1 Dep on > 0.75 used in H_1

Question			Answer	Marks	Guidance
			the symptoms of a higher proportion of dogs who suffer from the allergy.	**[4]**	E0 for simply stating H_1 in words
					Condone number instead of proportion.
			For use of B(18, 0.25), please consult your Team Leader		Do Not allow just 'proportion will be higher' or similar.
7	**(iii)**	**(A)**	$P(X \geq 16) = 1 - P(X \leq 15) = 1 - 0.8647 = 0.1353$	M1*	For sight of 0.1353 or 0.135
			$0.1353 > 0.1$	*M1dep	For (explicit) comparison with 10% or 0.1
			So not significant. Accept H_0	A1*	Do NOT FT wrong H_1 but first mark available if H_1 or H_0 wrong
			Conclude that there is not enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy.	E1dep **[4]**	For A1 need $P(X \geq 16)$ somewhere oe eg $P(\geq 16)$
					Allow SC2 for clearly indicating use of B(18, 0.75) but with no mention of 0.1353 with convincing reasoning and final answer correct
			$0.8647 < 0.9$ scores M2 and can get A1 E1 if $P(X \leq 15)$ oe seen and all correct		No marks if point probabilities used.
					Do not condone number instead of proportion
					Must include 'not enough evidence' oe
			ALTERNATIVE METHOD Provided they are using CR method		
			$P(X \geq 16) = 0.1353$	B1	For both probabilities Do not insist on correct notation as candidates have to work out two probabilities for full marks.
			$P(X \geq 17) = 0.0395$		
			OR 0.8647 and 0.9605		
			$0.1353 > 0.1$ or $0.0395 < 0.1$	M1	For at least one comparison with 10% Allow comparison in form of statement 'critical region at 10% level is …'
			OR $0.8647 < 0.9$ or $0.9605 > 0.9$		
			So critical region is {17, 18} so not significant. or 16 not in CR so not significant	A1*	CAO dep on the two correct probabilities
					Ignore any work on lower critical region
			Conclude that there is enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy.	E1* dep	No marks if CR not justified. However SC2 above still applies
					Condone $X \geq 17$, , oe but not $P(X \geq 17)$ etc
					Assume using first method unless you are convinced that candidate is using CR method.
					No marks if point probabilities used

Question			Answer	Marks	Guidance
7	(iii)	(*B*)	$P(X \geq 42) = 1 - P(X \leq 41) = 1 - 0.9084 = 0.0916$ $0.0916 < 0.1$ or $0.9084 > 0.9$ So significant. Reject H_0 Conclude that there is enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy.	B1 M1* A1* E1*dep **[4]**	For use of $P(X \leq 41)$ For comparison with 10% dep on first two marks NB If more than one attempt please mark the final one. Do not penalise 'number' rather than 'proportion' twice in parts A and B NB No marks for critical region method unless find $P(X \leq 40) = 0.9084 - 0.0721 = 0.8363$ in which case follow above scheme for part (iii)(*A*) so should have 0.1637 >0.1 and 0.0916 < 0.1 or 0.8363 < 0.9 and 0.9084 > 0.9 etc (giving CR{42, 43, 44, 45, 46, 47, 48, 49, 50})

NOTE RE OVER-SPECIFICATION OF ANSWERS

If answers are grossly over-specified, deduct the final answer mark. Note in Q1 only deduct 1 mark altogether even if both mean and sd over-specified. Probabilities should also be rounded to a sensible degree of accuracy. In general final non probability answers should not be given to more than 4 significant figures. Allow probabilities given to 5 sig fig.(and condone 6 sig fig in Q5(i)). **You must highlight any over-specified answers.**

ANNOTATION RULES

See note 12 above and particularly 12a. Remember to put full annotation on all practice and standardisation scripts unless the candidate has scored full marks or zero. In addition for all marking in Q6(i) and Q6(v) if the candidate has not scored full marks then show which B marks have been awarded in the right hand margin, in the same order as they are given in the mark scheme. You should indicate any errors made.

Reminder of note 7 above which is a change from previous years:

Award No Response (NR) if:
  - there is nothing written in the answer space

Award Zero '0' if:
  - anything is written in the answer space and is not worthy of credit (this includes text and symbols).
  .

Additional notes re Q7 part ii

Minimum needed for B1 is p = probability allergy relieved
Allow p = P(allergy relieved)
Definition of p must include word probability (or chance or proportion or percentage or likelihood but NOT possibility, number or amount).
Preferably given as a separate comment. However can be at end of H_0 as long as it is a clear definition 'p = the probability that the allergy is relieved .'
Do NOT allow 'p = the probability that the allergy is relieved is greater'
Allow p=75%, allow only p or θ or π or ρ. However allow any single symbol <u>if defined </u>(including x)
Allow $H_0 = p$=0.75, Allow NH and AH in place of H_0 and H_1
Do not allow $H_0 : P(X=x) = 0.75$
Do not allow H_0: =0.75, =75%, P(0.0.75), p(x)=0.75, x=0.75 (unless x correctly defined as a probability)
Do not allow H_0 and H_1 reversed
For hypotheses given in words allow Maximum B0B1B1
Hypotheses in words must include probability (or chance or proportion or percentage or %) and the figure 0.75 oe
Thus eg H_0 : P(allergy relieved) = 0.75, H_1 : P(allergy relieved) > 0.75 gets B0B1B1

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