OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4767**: Statistics 2

Advanced GCE

Mark Scheme for June 2014

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation in scoris	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓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
U1	Mark for correct units
G1	Mark for a correct feature on a graph
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

a 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.

b 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.

c 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.

d 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.

e 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.

f 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.

g 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.

h 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)			

Diastolic	60	61	62	63	73	76	84	87	90	95
Systolic	98	121	118	114	108	112	132	130	134	139
Rank dias	1	2	3	4	5	6	7	8	9	10
Rank sys	1	6	5	4	2	3	8	7	9	10
d	0	4	2	0	-3	-3	1	-1	0	0
d^2	0	16	4	0	9	9	1	1	0	0

M1 For attempt at ranking (allow all ranks reversed)

M1 For d^2

$\Sigma d^2 = 40$

A1 For 40 soi e.g. can be implied by 0.242 seen.

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)} = 1 - \frac{6\times 40}{10\times 99} = 1 - \frac{240}{990} = 1 - 0.242$$

M1 For method for r_s using their Σd^2

= 0.758 (to 3 s.f.) [*allow* 0.76 to 2 s.f.]

A1 For 0.758 or 25/33 or 0.75 recurring
f.t. their Σd^2 provided $|r_s| < 1$
Do not allow 0.7575
NB No ranking scores 0/5

[5]

Question			Answer	Marks	Guidance
1	(ii)		H_0: no association between diastolic blood pressure and systolic blood pressure in the population of young adults	B1	
			H_1: **positive** association between diastolic blood pressure and systolic blood pressure in the population of young adults	B1	NB Hypotheses must be in context. H_0: no association, H_1: positive association, earns SC1 Hypotheses must **not** be given in terms of ρ or mention correlation. Ignore references to ρ if hypotheses also given in words.
				B1	For **population of young adults** seen at least once. Do **not** allow **underlying population**. B0 for population correlation coefficient.
			One tail test critical value at 5% level is 0.5636	B1*	for 0.5636 cv from pmcc test = 0.5494 gets B0
			Since 0.758 > 0.5636, there is sufficient evidence to reject H_0,	M1dep*	For a sensible comparison, leading to a conclusion, of their r_s with 0.5636, provided $0 < r_s < 1$ The comparison may be in the form of a diagram. See additional notes on sensible comparisons.
			i.e. conclude that there is sufficient evidence to **suggest** that there is positive association between diastolic blood pressure and systolic blood pressure (in the population of young adults).	A1	For **non-assertive,** correct conclusion in context. f.t. their r_s. Allow "support" in place of "suggest". Do not allow "show", "imply", "conclude" or "prove" in place of "suggest". See additional notes. If a two-tailed test is carried out then award maxB1B0B1B1(for 0.6485)M0A0
				[6]	
1	(iii)		The scatter diagram does not appear to be roughly elliptical	E1	For not elliptical. Allow "not oval".
			so the (population) may not have a bivariate Normal distribution.	E1	For not bivariate Normal. Do not allow "not Normal bivariate". Do not allow "the **data** does not have a bivariate Normal distribution".
				[2]	

Question			Answer	Marks	Guidance
1	(iv)		H_0: $\rho = 0$ H_1: $\rho > 0$	B1	Do not allow other symbols unless clearly defined as population correlation coefficient. Do not allow hypotheses solely in words.
			where ρ is the (population) correlation coefficient	B1	For defining ρ
			For $n = 10$, 1% critical value = 0.7155	B1*	For 0.7155
			Since 0.707 < 0.7155 the result is not significant	M1dep*	For sensible comparison leading to a conclusion. Conclusion soi.
			There is insufficient evidence at the 1% level to **suggest** that there is **positive** correlation between diastolic blood pressure and systolic blood pressure (in this population).	A1 **[5]**	For **non-assertive** correct conclusion in context. If a two-tailed test is carried out then award maxB0B1B1(for 0.7646)M0A0
2	(i)		'Independently' means that the occurrence of one defect does not affect the **probability** of another defect occurring.	E1	Allow e.g. "event" for "defect"
			Poisson distribution	E1 **[2]**	Allow Po(…)
2	(ii)		P(2 defects) = $\frac{e^{-1.7}1.7^2}{2!}$ **OR** from tables P(2 defects) = 0.7572 – 0.4932	M1	For calculation of P(X = 2)
			= 0.2640	A1 **[2]**	CAO Allow 0.264 Do not allow 0.2639
2	(iii)		New $\lambda = 7 \times 1.7 = 11.9$	B1	For mean (SOI)
			P(12 defects) = $\frac{e^{-11.9}11.9^{12}}{12!}$	M1	For calculation with their $\lambda \neq 1.7$
			= 0.1143 cao	A1 **[3]**	Allow 0.114 www **Note** B0M1A0 for 0.114 from use of $\lambda = 11.7$

Question			Answer	Marks	Guidance
2	(iv)		New $\lambda = (2 \times 1.7) + (2 \times 0.8) = 5.0$ P(At least 8 defects) = 1 – P(7 or fewer defects) = 1 – 0.8666 (= 0.1334) **NB Answer given**	B1* B1* B1dep* **[3]**	For new mean = 5 seen For $1 - P(X \leq 7)$ or 1 - $P(X < 8)$ seen For 1 – 0.8666 seen
2	(v)		Binomial(100, 0.1334) or B(100, 0.1334)	B1* B1dep* **[2]**	For binomial. For parameters
2	(vi)		Mean = 13.34 Variance = 100 × 0.1334 × 0.8666 = 11.56 Using Normal approx. to the binomial, $X \sim N(13.34, 11.56)$ $P(X \geq 20) = P\left(Z \geq \frac{19.5-13.34}{\sqrt{11.56}}\right)$ = P(Z > 1.812) = 1 – Φ(1.812) = 1 – 0.9650 = 0.035	B1 B1 B1 M1 A1 **[5]**	For mean (soi) For variance (soi) For B(13.34, 11.56) seen, award B0B0 unless used correctly as part of a Normal calculation. For 19.5 seen For probability using correct tail and a sensible calculation with their mean and variance. e.g. using standard deviation = 11.56 or finding P(Z < 1.812) gets M0A0 CAO**, (**Do not FT wrong or omitted CC)
3	(i)		$P(X > 135) = P\left(Z > \frac{135-130.5}{\sqrt{11.84}}\right)$ = P(Z > 1.308) = 1 - Φ(1.308) = 1 – 0.9045 =0.0955 (3s.f.)	M1 M1 A1 **[3]**	For standardising. Penalise use of "continuity corrections" For correct structure i.e. finding the area to the right of their *z* CAO inc use of diff tables Allow 0.0954 and 0.0956 If numerator reversed, give BOD only if P(Z < - 1.308) is used

Question			Answer	Marks	Guidance
3	(ii)		From tables $\Phi^{-1}(0.99) = 2.326$	B1	±2.326 or (better) seen, not ±2.33
			$\frac{k-130.5}{\sqrt{11.84}} = 2.326$ oe	M1	For sensible equation in k with their ***z* value**. Note that use of $z = 0.8389$ from $\Phi(0.99)$ gets B0M0A0, as 0.8389 is clearly a **probability**. Allow use of -2.326 (or their negative z) with numerator reversed. Condone use of $\sigma = 11.84$ if also used in part (i). Condone use of "$k \pm 0.5$" for k in equation. 0/3 for trial and improvement
			$k = 130.5 + 2.326 \times \sqrt{11.84} = 138.50$	A1	CAO Allow 138.504. Accept 138.5 Do not accept final answers of 139 or 138.
				[3]	
3	(iii)		P(Wing length = 131) = $P\left(\frac{130.5-130.5}{\sqrt{11.84}} \le Z \le \frac{131.5-130.5}{\sqrt{11.84}}\right)$	B1	For both limits correct, soi. e.g. use of 0.5 in probability calculation implies correct lower limit.
			$= P(0 < Z < 0.2906)$ $= \Phi(0.2906) - \Phi(0)$ $= 0.6143 - 0.5$	M1	For **correct structure** using their standardised values. i.e. **Finding the area between their z values found using μ = 130.5** Condone use of $\sigma = 11.84$ if also used in part (i) or part (ii).
			$= 0.1143$	A1	CAO inc use of diff tables Allow 0.1145 Allow 0.114 www
				[3]	

Question			Answer	Marks	Guidance
3	(iv)		H_0: $\mu = 130.5$ H_1 : $\mu > 130.5$	B1	For both correct Hypotheses in words must refer to population. Do not allow other symbols unless clearly defined as population mean
			Where μ denotes the **mean wing length** (in the population) (of Scandinavian male blackbirds).	B1	For definition of μ in context. Do not allow "sample mean wing length" or "mean wing length of English blackbirds"
			Test statistic $= \frac{132.4-130.5}{\sqrt{11.84}/\sqrt{20}} = \frac{1.90}{0.7694}$	M1*	must include $\sqrt{20}$ Condone use of $\sigma = 11.84$ if also used in part (i), part (ii) or part (iii). Condone numerator reversed for max M1*A0B1M0depA0A0 (max 4/8)
			=2.469	A1	Allow 2.47
			Upper 5% level 1 tailed critical value of z = 1.645	B1	For 1.645. Must be positive. B0 if -1.645 seen. No further A marks from here if wrong.
			2.469 > 1.645	M1dep*	For sensible comparison leading to a conclusion.
			The result is significant. There is sufficient evidence to reject H_0	A1	For correct conclusion. e.g. for "significant" oe FT only candidate's test statistic if cv = 1.645
			There is sufficient evidence to **suggest** that the <u>mean wing length</u> (of this population of birds) <u>is greater</u> (than 130.5mm).	A1	For **non-assertive** conclusion in <u>context</u>, consistent with their result Condone use of "average" for "mean" FT only candidate's test statistic if cv = 1.645 See additional notes regarding alternative methods
				[8]	
3	(v)		With a 10% significance level rather than a 5% significance level, Advantage: One is less likely to accept the null hypothesis when it is false. Disadvantage: One is more likely to reject the null hypothesis when it is true.	E1 E1 **[2]**	Accept equivalent wording. See additional notes Note – Unless stated otherwise, assume the first comment relates to an advantage and the second comment relates to a disadvantage.

Question	Answer	Marks	Guidance
4 (i)	H_0: no association between age and working days lost H_1: some association between age and working days lost	B1	For hypotheses, at least one of which is in context. Allow hypotheses in terms of independence, in context. Do not allow "relationship" or "correlation" for "association"
	EXPECTED: 0 to 4 / 5 to 9 / 10 or more Under 35: 24.47 / 28.39 / 9.14 35 to 50: 26.84 / 31.14 / 10.02 Over 50: 23.68 / 27.47 / 8.84	B1	For at least one row/column of expected values correct (to 1 d.p.) Seen or implied by contributions
	CONTRIB'N: 0 to 4 / 5 to 9 / 10 or more Under 35: 1.7404 / 0.0680 / 2.8880 35 to 50: 0.0499 / 0.0239 / 0.4076 Over 50: 2.4931 / 0.0101 / 5.7945	B1	All correct (to 2 d.p.). Accept fraction equivalents. Seen or implied by contributions
		M1	For valid attempt at $(O-E)^2/E$ Seen or implied by at least one correct contribution to 2 d.p.. Allow 5.80 for last cell. Condone values in a list.
		A1	For all correct to 2 d.p. or better. Allow 5.80 for last cell. Condone values in a list. NB: These two marks cannot be implied by a correct final value of X^2
	$X^2 = 13.48$	B1	For answers rounding to 13.48. Do not penalize over-specification here.
	Refer to χ^2_4	B1	For 4 degrees of freedom.
	Critical value at 1% level = 13.28	B1	No further marks from here if incorrect.
	13.48 > 13.28 so result is significant	B1*	For significant oe FT their test statistic
	There is evidence to **suggest** that there is <u>some association between age and working days lost</u>	E1dep*	For **non-assertive** conclusion in <u>context</u> Allow conclusion in terms of independence FT their test statistic NB if H_0 H_1 reversed, or 'correlation' mentioned, do not award final E1
		[10]	

Question			Answer	Marks	Guidance
4	(ii)		The large contribution/contribution of 2.4931 implies that there are fewer employees than expected who lose 0 to 4 working days. The small contribution/contribution of 0.0101 implies that there are about as many as expected who lose 5 to 9 working days. The large contribution/contribution of 5.7945 implies that there are more employees than expected who lose more than 10 working days.	E1 E1 E1 **[3]**	For correct interpretation with reference to contribution for 0 to 4 working days For correct interpretation with reference to contribution for 5 to 9 working days For correct interpretation with reference to contribution for more than 10 working days SC1 if all interpretations are correct but with no reference to contributions. i.e. max 1 out of 3
4	(iii)		Critical value at 1% level = 9.21 7.08 < 9.21 so the result is not significant oe There is insufficient evidence to **suggest** that there is an association between age and working days lost.	B1* B1dep* E1dep* **[3]**	CAO for cv For correct conclusion For **non-assertive** conclusion in context
4	(iv)		Conclusion in (iii) is valid if only categorizing working days lost into '0 to 4' and '5 or more'. However, if '5 or more' is subdivided into '5 to 9' and '10 or more', this additional subdivision gives the data more precision and allows the relationship in part (i) to be revealed.	E1 E1 **[2]**	As written, or for explaining that **combining/subdividing groups** leads to a **different** result. For **subdivision** allows relationship to be revealed or gives more precision/sensitivity/detail. Allow subdivision gives "a more reliable test" but not "a more accurate test" For both to be awarded, wording must be **clear**.

Additional Notes on Sensible Comparisons

In Q1 Part (ii)	1.752 > 0.5636	is not sensible as $r_s > 1$
	-0.758 < 0.5636	is a correct statement but not a sensible comparison for the purposes of a hypothesis test as the values have different signs.
	0.758 < 0.5636	is incorrect and earns M0A0
In Q3 part (iv)	Neither 2.469 > 0.05 nor 0.0067 < 1.645 are considered sensible as each compares a z-value with a probability.	
	Similar to Q2 part (ii), 2.469 > -1.645 is not considered to be a sensible comparison due to the different signs of the values being compared.	

Additional Notes on Conclusions to Hypothesis Tests

The following are examples of conclusions which are considered too assertive.

There is sufficient evidence to reject H_0 and conclude that…
"there is a positive association between…" or
"there seems to be evidence that there is a positive association between…" or
"the mean wing length is greater …."
"there doesn't appear to be positive correlation between…"

Also note that final conclusions **must refer to H_1 in context** for the final mark to be given.
e.g. In Q1 (iv), a conclusion stating that "the evidence suggests that there is no correlation …." gets A0 as this refers to H_0.

Additional Notes on Alternative Methods in Q3 (iv)

Critical value method	cv = 130.5 + 1.645 × √11.84 ÷ √20	gets M1* B1 (for 1.645)
	= 131.8	gets A1 cao (replacing the A1 for 2.469)
	132.4 > 131.8	gets M1dep* if a conclusion is made. The final A1A1 available as before if 1.645 used.

Condone use of σ = 11.84 if also used in part (i), part (ii) or part (iii), which would give

cv = 130.5 + 1.645 × 11.84 ÷ √20	gets M1* B1 (for 1.645)
= 134.86	gets A0
132.4 < 134.86	gets M1dep* if a conclusion is made. The final A1A1 available as before if 1.645 used.

Probability Method	P(sample mean > 2.469) = 0.0067	gets M1*A1 B1 (the B1 for 0.0067, from tables, replaces the B1 for 1.645. Allow 0.00677 and 0.0068)
	0.0067 < 0.05	gets M1dep* if a conclusion is made. The final A1A1 available as before provided that B1 for 0.0067 awarded NOTE Condone B1 for 0.9933 (allow 0.99323 and 0.9932) if compared with 0.95 at which point the final M1dep*A1A1 are available. B0M0A0A0 if 0.9933 obtained from P(sample mean > -2.469).

Condone use of $\sigma = 11.84$ if also used in part (i), part (ii) or part (iii), which would give

P(sample mean > 0.7177) = 0.2365,	for M1*A0B1
0.2365 > 0.05	gets M1dep* if a conclusion is made. The final A1A1 available as before provided that B1 for 0.2365 awarded NOTE Condone B1 for 0.7635 if compared with 0.95 at which point the final M1dep*A1A1 are available B0M0A0A0 if 0.7635 obtained from P(sample mean > -0.7177).

Additional Notes on Q3 part(v)

Advantage	One is more likely to reject H_0 when H_0 is false (H_1 is true) One is more likely to accept H_1 when H_1 is true (H_0 is false) One is less likely to accept H_0 when H_0 is false (H_1 is true) One is less likely to reject H_1 when H_1 is true (H_0 is false) Allow less likely to have a Type II error (wrongly accept H_0)
Disadvantage	One is more likely to reject H_0 when H_0 is true (H_1 is false) One is more likely to accept H_1 when H_1 is false (H_0 is true) One is less likely to accept H_0 when H_0 is true (H_1 is false) One is less likely to reject H_1 when H_1 is false (H_0 is true) Allow more likely to have a Type I error (wrongly reject H_0)

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