GCE

Further Mathematics B MEI

Y412/01: Statistics A

AS Level

Mark Scheme for June 2025

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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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. **Crossed-Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses
When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award NR (No Response):

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
   - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501
    To determine the level – start at the highest level and work down until you reach the level that matches the answer
    To determine the mark within the level, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	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
BP	Blank Page
Seen	
Highlighting	

Other abbreviations in mark scheme	Meaning
dep*	Mark dependent on a previous mark, indicated by *. The * may be omitted if only one previous M mark
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working
AG	Answer given
awrt	Anything which rounds to
BC	By Calculator
DR	This question included the instruction: In this question you must show detailed reasoning.

Subject Specific Marking Instructions

a. Annotations must be used during your marking. For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.

For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

Award NR (No Response)
- if there is nothing written at all in the answer space and no attempt elsewhere in the script
- OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
- OR if there is a mark (e.g. a dash, a question mark, a picture) which isn't an attempt at the question.

Note: Award 0 marks only for an attempt that earns no credit (including copying out the question).

If a candidate uses the answer space for one question to answer another, for example using the space for 8(b) to answer 8(a), then give benefit of doubt unless it is ambiguous for which part it is intended.

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 always 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, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.

If you are in any doubt whatsoever 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, e.g. 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 method mark may usually be implied by a correct answer unless the question includes the DR statement, the command words “Determine” or “Show that”, or some other indication that the method must be given explicitly.

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.

Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. 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, what is acceptable will be detailed in the mark scheme. If this is not the case please, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.

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. Unless units are specifically requested, there is no penalty for wrong or missing units as long as the answer is numerically correct and expressed either in SI or in the units of the question. (e.g. lengths will be assumed to be in metres unless in a particular question all the lengths are in km, when this would be assumed to be the unspecified unit.)
We are usually quite flexible about the accuracy to which the final answer is expressed; over-specification is usually only penalised where the scheme explicitly says so.
- When a value is given in the paper only accept an answer correct to at least as many significant figures as the given value.
- When a value is not given in the paper accept any answer that agrees with the correct value to 2 s.f. unless a different level of accuracy has been asked for in the question, or the mark scheme specifies an acceptable range.
  NB for Specification A the rubric specifies 3 s.f. as standard, so this statement reads "3 s.f".

Follow through should be used so that only one mark in any question is lost for each distinct accuracy error.

Candidates using a value of 9.80, 9.81 or 10 for g should usually be penalised for any final accuracy marks which do not agree to the value found with 9.8 which is given in the rubric.

g. Rules for replaced work and multiple attempts:
- If one attempt is clearly indicated as the one to mark, or only one is left uncrossed out, then mark that attempt and ignore the others.
- If more than one attempt is left not crossed out, then mark the last attempt unless it only repeats part of the first attempt or is substantially less complete.
- if a candidate crosses out all of their attempts, the assessor should attempt to mark the crossed out answer(s) as above and award marks appropriately.

h. For a genuine misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A or B mark in the question. Marks designated as cao may be awarded as long as there are no other errors.
If a candidate corrects the misread in a later part, do not continue to follow through. Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

i. If a calculator is used, some answers may be obtained with little or no working visible. Allow full marks for correct answers, provided that there is nothing in the wording of the question specifying that analytical methods are required such as the bold "In this question you must show detailed reasoning", or the command words "Show" or "Determine". Where an answer is wrong but there is some evidence of method, allow appropriate method marks. Wrong answers with no supporting method score zero. If in doubt, consult your Team Leader.

j. If in any case the scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	AO	Guidance	
1	(a)		Cheaper Easier Takes less time Takes less effort More practical More convenient Easier for analysis Census might be impossible (population too large or changing too quickly)	**B1** **B1** **[2]**	**1.2** **1.2**	Any two different reasons **B0** for 'The sample would be representative/reliable/unbiased' **B0** for speculative statements – e.g. 'people might lie', 'people might not respond'	Ignore non-contradictory statements. May have two reasons within one statement. If reason given as disadvantage then it must be clearly related to a census.
	(b)		The larger the sample, the more likely it is to be **representative** of the population (and so the more confident we can be about the results).	**B1** **[1]**	**1.2**		**B0** for comments mentioning only outliers/anomalies/bias/data analysis. **B0** for 'more reliable/accurate'

Question			Answer	Marks	AO	Guidance	
2	(a)		$\frac{2}{5}$ or 0.4	B1 [1]	1.1		
	(b)		$\sum_{y=1}^{n} \frac{y}{595} = 1$ or $1 + 2 + ... + n = 595$ $\frac{1}{2}n(n+1) = 595$ $\Rightarrow n^2 + n - 1190 = 0$ $\Rightarrow n = 34$ or $n = -35$	M1 A1	3.1a 1.1	For $\Sigma p = 1$ or the sum of 1st n integers = 595 oe. Forming quadratic equation and solving correctly. If $n = -35$ not stated, condone $(n + 35)(n - 34) = 0$ or $n = (1 \pm 69)/2$ followed by $n > 0 \therefore n = 34$.	Or for $1 + 2 + \ldots + 34 = 595$
			(But $n > 0$) so $n = 34$	A1 [3]	2.3	Correct value for n from a clearly presented method	If **M0** then **SCB1** for correct answer
	(c)		$\left(P(Y < n) = 1 - \frac{34}{595} = \frac{561}{595} =\right) \frac{33}{35}$ o.e.	B1FT [1]	1.1	FT $1 - n/595$ for positive integer n from **(b)** provided probability >0	Awrt 0.94
	(d)		$P(X + Y \leq 2) = \frac{1}{6} \times \frac{2}{595} + \frac{1}{3} \times \frac{1}{595} + \frac{1}{6} \times \frac{1}{595}$ $= \frac{1}{714}$	M1 A1 [2]	3.1a 1.1	Or clear explanation that (X, Y) is **either** (0, 2) **or** (1, 1) **or** (0, 1) and no other possibilities. Condone 0.0014	For listing all 3 possibilities with no extras. Condone inclusion of (0, 0), (1, 0) and/or (2, 0). If **M0** then **SCB1** for correct answer with no working.

Question			Answer	Marks	AO	Guidance	
3	(a)		0.21	**B1** **[1]**	**1.1**	$P(Q = 2) = 0.7 \times 0.3$	
	(b)		$P(Q > 5) = (1 - 0.3)^5$ or 0.7^5 or 0.16807	**M1**	**1.1**	Using $P(Q > x) = q^x$ correctly	Or attempt to find P(1) + ... + P(5). Allow **M1** for $1 - (1 - p)^5$
			$P(Q \leq 5) = 1 - 0.7^5 = 0.83193$	**A1** **[2]**	**1.1**	**awrt** 0.83	If **M0** then **SCB1** for correct answer
	(c)		$P(Q + R + S = 5)$ $= P(Q = 1) \times P(R = 4) \times P(S = 0)$	**M1**	**3.1a**	Understanding that there is only one way this can occur and that the probabilities can be multiplied (because of independence).	**M1M1** can be implied by correct answer or calculation
			$= \frac{1}{5} \times 0.3 \times 0.9^{10}$	**M1**	**1.1**	Two of these probabilities correct in a single term calculation	$0.9^{10} = 0.348678\ldots$
			= 0.0209	**A1** **[3]**	**1.1**	0.02092070641...	**awrt** 0.021
	(d)		$E(Q) = 1/0.3$ (= 10/3)	**B1**	**1.1**	Correct use of rule for Geo(0.3)	
			$E(S) = 10 \times 0.1$ (= 1)	**B1**	**1.1**	Correct use of rule for B(10, 0.1)	
			$E(T) = E(R) - E(Q) + 2E(S)$ (= 6 – 10/3 + 2×1)	**M1**	**1.1**	Correct use of expectation algebra for $E(T)$ in terms of other E( )s.	Condone incorrect values provided that it is clear that the expectation algebra is correct.
			$= \frac{14}{3}$	**A1** **[4]**	**1.1**	**awrt** 4.7	If **M0** then **SCB1** for correct answer

Question			Answer	Marks	AO	Guidance	
4	(a)		It does seem suitable since the data is random on random and the underlying distribution appears to be bivariate normal (because the distribution of points is roughly elliptical)	**B1** **B1** **[2]**	**2.2a** **3.5a**	Both variables are random B1 Must be the distribution of the parent population, not the sample data.	Allow (The elliptical spread of points indicates that) the data may come **from** (a population with) a bivariate normal distribution. Do not allow 'the data/underlying data has a bivariate normal distribution'.
	(b)		$S_{xy} = 24981.486 - \frac{2409.4 \times 350.87}{34}$ $S_{yy} = 3681.851 - \frac{350.87^2}{34}$ $b = \frac{S_{xy}}{S_{yy}} = \frac{117.1866...}{60.97579...}$ $x = 1.92185y + 51.0317$ or $x - 70.865 = 1.92185(y - 10.320)$ $x = 70.3$ (3 sf) or 70 (2 sf)	**M1** **M1** **A1** **A1** **[4]**	**3.1a** **1.1** **1.1** **1.1**	For correct substitution of values into given formula for either. (**M1** can be implied by S_{xy} = 117.1866..., S_{yy} = 60.97579... or b = 1.92185…) Correct calculation for b (using their values). (can be implied by b = 1.92185...) Allow $x = 1.9y + 51$ Must be 2 or 3 sf. **A0** for 70.0 Condone 70.2 from valid form of correct line eg $x = 1.92y + 51.0$	Ignore attempts to find S_{xx} **M0** for S_{xy}/S_{xx}. If both calculated then correct one must be chosen for **M1**. **A0** if wrong line. **SCB1** for 69.8 or 70 but not 70.0 from wrong regression line which could follow first **M1**. ($y = 0.293806x - 10.5007$)

Question		Answer	Marks	AO	Guidance	
5	(a)	Jam 4 since it has a ranking of 1 and 2 and no other jam does better than 1 and 3.	**B1** **[1]**	**2.2b**	Jam 4 identified and attempt to compare its ranks with ranks of other jam(s)	e.g. The sum of Jam 4's ranks is the lowest/highest/best **B0** for just 'Jam 4 as it is ranked 1 & 2 by the judges'.
	(b)	$1-\frac{6\sum d^2}{8(8^2-1)}=\frac{6}{7}$ or $\sum d^2=12$	**M1**	**3.1b**		
		$\sum_{\text{not lost}} d^2 = 0^2+2^2+1^2+1^2+2^2+1^2=11$	**M1**	**1.1**	Reasonable attempt to calculate Σd^2 for the 6 extant pairs.	$0 + 4 + 1 + 1 + 4 + 1 = 11$
		Only options for rest of data are $(8-7)^2 + (6-8)^2$ (= 5) or $(8-8)^2 + (6-7)^2$ (= 1) (which should equal 12 – 11 = 1).				
		So it must be that Jam 2 was awarded 8 and Jam 6 was awarded 7 (by Judge B).	**A1**	**3.2a**	Rank & Jam specified explicitly	No incorrect working seen
		Alternative method Missing ranks from Judge B are 7 and 8.				
		$\sum d^2 = 12$ or $\sum d^2 = 16$	**M1**		Use missing ranks, either way round, to calculate $\sum d^2$	Must use 7 and 8 as missing ranks
		$r_s=\frac{6}{7}$ or $r_s=\frac{17}{21}$	**M1**		Substitute $n = 8$ and their $\sum d^2$ into Spearman's Rank formula	
		So it must be that Jam 2 was awarded 8 and Jam 6 was awarded 7 (by Judge B).	**A1**		Rank & Jam specified explicitly	No incorrect working seen
			[3]			

Question		Answer	Marks	AO	Guidance	
5	(c)	H_0: There is no association between the rankings of the judges.	**B1**	3.3	or "The judges do not tend to be in agreement" **B0** for correlation	If H_0: $\rho_s = 0$ is used then ρ_s must be fully defined (could be below).
		H_1: There is **positive** association between the rankings of the judges	**B1**	1.1	or "The judges tend to be in agreement". No need to mention the population but for **B1B1** at least one of the hypotheses must be in context and include 'rankings' e.g. H_0: no association between judges H_1: positive association between judges would get **B1B0**	If H_1: $\rho_s > 0$ is used then ρ_s must be fully defined (could be above).
		(n = 8, 1%, one-tailed so) CV = 0.8333	**B1**	3.4		
		0.8571 > 0.8333 so the result is significant (ie we can reject H_0).	**M1**	1.1	Correct comparison between the given TS and their CV leading to consistent conclusion.	
		So there is sufficient evidence (at the 1% significance level) to **suggest** that there is **positive association** between (the rankings of) the two judges.	**A1** **[5]**	2.2b	Correct contextual and non-assertive conclusion from correct CV. Do not ISW. Must be H_0: no association	

Question			Answer	Marks	AO	Guidance	
6	(a)	(i)	Binomial Distribution is suitable because: • Fixed number of words. • Each word either misprinted or not. • Whether one word is misprinted does not affect the probability of another word being misprinted (independent). • The probability of a word being misprinted is constant.	**B1** **B1** **[2]**	**1.2** **2.4**	**B1** for any **two** of the conditions stated. **B1B1** for correct comments with any three stated with at least one in context.	If **B0B0** then **SCB1** for B(100 000, 0.00011) Not the 'events' are independent Not the probabilities of words being misprinted are independent.
6	(a)	(ii)	A Poisson distribution is suitable because n is large and p is small.	**B1** **[1]**	**1.2**	or $np = 11$ which is very close to $npq = 10.99879$	n is large and there is a low probability gets **B0**
6	(a)	(iii)	11	**B1** **[1]**	**1.1**		
	(b)		$X \sim \text{Po}(11) \Rightarrow \text{P}(X = 9) = 0.109$	**B1** **[1]**	**1.1**	**BC** 0.1085255093...	**awrt** 0.11
	(c)		$\text{Var}(P) = \text{Var}(20X) = 400\text{E}(X)$ [= 4400] And $\text{E}(P) = \text{E}(20X) = 20\text{E}(X)$ [= 220] **Var(P) ≠ E(P)** so $P = 20X$ can't be Poisson	**M1** **A1** **[2]**	**1.1** **3.2a**	Deducing the correct mean **and** variance of P either as expressions or values using their 11. Clear demonstration that the mean and variance of $P = 20X$ must be different and so P cannot be Po.	$X \sim \text{Po}(11) \Rightarrow \text{E}(X) = 11$ & $\text{Var}(X) = 11$ Condone use of binomial distribution for **M1** only. Max **M1A0**
	(d)		The total number of misprinted words in both books, $Y \sim \text{Po}(16.5)$. P(payment between £300 & £500, exclusive) = $\text{P}(16 \leq Y \leq 24)$ $(= \text{P}(Y \leq 24) - \text{P}(Y \leq 15))$ (= 0.96955... – 0.41801...) = 0.552	**B1** **M1** **A1** **[3]**	**3.1b** **1.1** **1.1**	Po(16.5) or $\lambda = 16.5$ stated Translating from money to numbers of misprints to get $16 \leq Y \leq 24$ o.e. 0.9695547821..., 0.4180196071	 Could be P(16) + P(17) +... + P(24). **awrt** 0.55 If **M0** then **SCB1** for correct answer

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO</th><th>Guidance</th><th></th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>Advantage: with only 3 categories the data can be easily converted into a (manageable) contingency table.

Disadvantage: information is lost</td><td>B1

B1

[2]</td><td>2.2a

3.5b</td><td>or the data are more portable or easier to interpret or easier to process or easier to compare with other sets of (similarly grouped) data or in a form suitable for a χ^2 test, etc

Allow ‘detail is lost’
Do not allow ‘data is lost’ or ‘accuracy is lost’.
Condone examples that demonstrate that information has been lost.</td><td>Allow ‘With only three categories the expected frequencies should be greater’
Ignore speculation about values the data may take.

Ignore speculation about values the data may take.</td></tr>
<tr><td></td><td>(b)</td><td></td><td>H_0: There is no association between the hospital (treating the complaint) and the length of stay at the hospital.
H_1: There is association between the hospital (treating the complaint) and the length of stay at the hospital.</td><td>B1

B1

[2]</td><td>3.3

3.3</td><td>or “The hospital (treating the complaint) and the length of stay at the hospital are independent”.
or “The hospital (treating the complaint) and the length of stay at the hospital are not independent”.</td><td>

At least one of the hypotheses must be in context.</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><td></td><td>Short</td><td>Medium</td><td>Long</td></tr><tr><td>A</td><td>12.116</td><td>14.348</td><td>17.536</td></tr><tr><td>B</td><td>25.884</td><td>30.652</td><td>37.464</td></tr></table></td><td>M1

A1
[2]</td><td>1.1

1.1</td><td>Any bold value correct.

All correct to 3 d.p.</td><td>Ignore rounding errors/incorrect accuracy for this M mark if intent clear.</td></tr>
</table>

	(d)		<table><tr><td></td><td>Short</td><td>Medium</td><td>Long</td></tr><tr><td>A</td><td>**0.8013** (4)</td><td>**2.2266** (4)</td><td>**0.3668** (7)</td></tr><tr><td>B</td><td>0.3751</td><td>**1.0422**</td><td>0.1717</td></tr></table>	**M1**	**1.1**	Any **bold** value correct to at least 3 decimal places.	Table shows chi-squared contributions to 4 dp using "exact" expected frequencies. If expected frequencies to 3 dp are used, and the chi-squared contribution differs, then different 4th dp is given in brackets.
			Test statistic = 4.98	**A1**	**3.4**	4.983816... **awrt** 4.98	
			Degrees of freedom = 2	**B1**	**2.5**	Can be implied by correct *p*-value	
			Critical value = 4.61	**B1**	**1.1**	4.60517... **awrt** 4.61	Or *p*-value = 0.083 (0.082752... or 0.082763... if 3dp used)
			4.98 > 4.61 so significant or reject H_0	**M1**	**1.1**	Correct comparison between their TS and their CV and indication of meaning (could be "reject H_0" oe)	Or 0.917 > 0.90 or 0.083 < 0.10 (using *p*-value).
			There is sufficient evidence (at the 10% significance level) to **suggest** that there is association between hospital and length of stay at the hospital.	**A1** **[6]**	**2.2b**	Must be both contextual and non-assertive. Must use correct CV and TS Do not ISW if a later statement is assertive.	
	(e)		(With a contribution of 2.23) the medium stay at Hospital A (gives the largest contribution).	**B1FT** **[1]**	**2.2a**	**FT** the cell in their table in **(d)** containing the largest value.	
	(f)		New CV is 5.991 and 4.98 < 5.991	**M1**	**3.5c**	5.991 (**awrt** 5.99) Finding new CV and making correct comparison with their TS	or comparing their *p*-value correctly with 0.05 0.083 > 0.05 or 0.917 < 0.95
			So now the test is **not significant** so **the result would change.** ie the new significance level would have affected the result of the test.	**A1FT** **[2]**	**1.1**	**FT** their TS and result. Must give revised result but no need to give revised conclusion.	

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