GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
(MBS2)

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Key to Mark Scheme

M ..... mark is for ..... method
m ..... mark is dependent on one or more M marks and is for ..... method
A ..... mark is dependent on M or m marks and is for ..... accuracy
B ..... mark is independent of M or m marks and is for ..... method and accuracy
E ..... mark is for ..... explanation
√ **or ft or F** ..... follow through from previous incorrect result
CAO ..... correct answer only
AWFW ..... anything which falls within
AWRT ..... anything which rounds to
AG ..... answer given
SC ..... special case
OE ..... or equivalent
A2,1 ..... 2 or 1 (or 0) accuracy marks
-*x* EE ..... deduct *x* marks for each error
NMS ..... no method shown
PI ..... possibly implied
SCA ..... substantially correct approach
c ..... candidate
SF ..... significant figure(s)
DP ..... decimal place(s)

Abbreviations used in Marking

MC – *x* ..... deducted *x* marks for mis-copy
MR – *x* ..... deducted *x* marks for mis-read
ISW ..... ignored subsequent working
BOD ..... given benefit of doubt
WR ..... work replaced by candidate
FB ..... formulae booklet

Application of Mark Scheme

No method shown:
Correct answer without working ..... mark as in scheme
Incorrect answer without working ..... zero marks unless specified otherwise

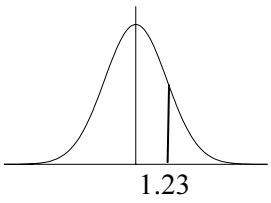
More than one method/choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

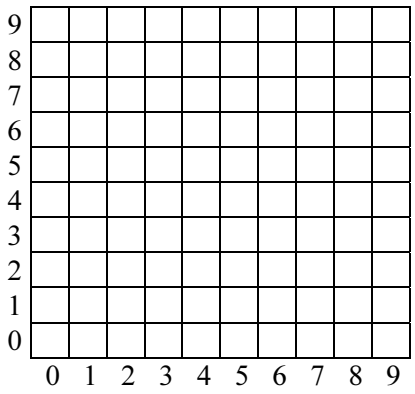
Crossed out work — do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method — award method and accuracy marks as appropriate

Mathematics and Statistics B Statistics 2 MBS2 January 2005

Question Number and Part	Solution	Marks	Total	Comments
1(a)	$P(X > 5) = 1 - P(X \leq 5)$ $= 1 - 0.7851$ $= 0.2149$ ≈ 0.215 1.00000 -0.89065 0.10935	M1 A1	2	0.214 ~ 0.215
(b)	$\lambda = 5 \times 4 = 20$	B1		$\lambda = 20$
		M1		use of continuity correction
	$z = \frac{25.5 - 20}{\sqrt{20}} = 1.23$	M1		their λ and $\sqrt{\lambda}$
	 1.23	m1		completely correct
	$P(X > 25) = 0.109$	A1	5	(0.109 , 0.110)
(c)	Daily	B1√		
	Higher probability of bonus payment	B1√	2	
	Total		**9**	
2(a)	$p = \frac{44}{400} = 0.11$	B1		$p = 0.11$
		B1		1.6449
	CI: $0.11 \pm 1.6449\sqrt{\frac{0.11 \times 0.89}{400}}$	M1		attempted use of Normal
		M1		$\sqrt{\frac{0.11 \times 0.89}{400}}$
	0.11 ± 0.02573			
	(0.08427 , 0.13573)	m1		completely correct
	(0.0843 , 0.136)	A1	6	
(b)	More than 85% success $\Rightarrow$ At most 15% fail	B1		
	0.15 > upper confidence limit Company's claim justified	B1	2	
(c)(i)	Increase in the level of confidence widens the confidence interval obtained – a higher degree of assurance of including the population mean within the interval but less useful for decision making purposes.	B1 E1		(i) wider (ii) narrower (cannot say) Both correct
(ii)	Increasing the number of trials narrows the confidence interval – greater precision is obtained	E1	3	Allow if n is increased, p will change. Hence width of CI will change.
	Total		**11**	

MBS2 (cont)

Question Number and Part	Solution	Marks	Total	Comments
3(a)	A Simple random	B1		Accept random
	B Stratified random	B1		Accept stratified
	C Systematic	B1	3	
(b)	For A:			
	Adv. No bias where quadrats are placed	B1		
	Disad. Some areas may be underrepresented	B1		
	For B:			
	Adv. All areas are represented taking into account conditions across site may differ.	B1		
	Disad. There is no purpose in taking stratified random sample if there is no difference between each stratum. Very time consuming c.f. systematic.	B1		
	For C:			
	Adv. Easy and B comment	B1		
	Disad. May be underlying pattern of plant diversity that has 10m periodicity.	B1	6	
(c)	Require 1 sample in each 10m square.			
	Divide 10m square into a grid and number 0 – 9. 	E1		
	Take 100, 2 digit random numbers.	E1		
	Use as coordinates e.g. 32 → (3 , 2)	E1	3	Wrong to say repeats are ignored.
	Total		**12**	

MBS2 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)(i)	$p = \frac{1620+758+704+1262}{4} = 1086$ $q = \frac{758+704+1262+1747}{4}$	M1 A1		
	$= 1117.75$	A1	3	1117.7 ~ 1117.8
(ii)	$r = \frac{1086+1117.75}{2} = 1101.875$	M1 A1	2	1101.8 ~ 1101.9
(b)	$y = 15.276x + 990.673$ $y = 15.28x + 990.7$	B3	3	M1, M1, A1 if eqns used $(\bar{x}, \bar{y}) = (8.5, 1120.52)$ M1 M1 990.7 A1
(c)				
	x | Actual - Trend |	M1		Trend values
	2 | 1048 – 1021.225 | = 26.775			
	6 | 1091 – 1082.328 | = 8.670	M1		Actual – trend
	10 | 1262 – 1143.432 | = 118.565			
	14 | 1336 – 1204.536 | = 131.460			
	Seasonal effect $\frac{26.78+8.67+118.57+131.46}{4}$	M1		Differences / 4
	$= 71.34 \approx 71.3$	A1	4	71.3 ~ 71.4
(d)	$x = 18$ $y = 1265.64$	M1		Use of $x = 18$
	visits = 1265.64 + 71.3	M1		Applying seasonal
	$= 1336.94$	A1		1336.5 ~ 1337.5
	i.e. 1,337,000	A1√	4	
(e)	Forecast has overestimated by 14,000	B1√		
	Reasonable ≈ 1% error	B1√	2	
	Total		**18**	

MBS2 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)	£479.90	B1	1	
(b)	75% of workers in a particular occupation earn less than upper quartile value.	E1	1	Or 25% earn more …..
(c)	Health & Social Welfare Associate Professionals	B1	1	
(d)	Box and whisker – see graph below	B1 M1 A1 A1	4	Labelling axis Method of construction
(e)	Males have higher average gross weekly earnings. Variability of earnings is greater in males. Both distributions are positively skewed. Higher percentage of males have high earnings. Lowest earnings ≈ same. Etc.	B1 B1 B1	3	Any 3
	Total		**10**	
	TOTAL		**60**	

Question 5 (d) **Box and Whisker Plot**