ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme
January 2004

GCE

Mathematics & Statistics B

Unit MBS6

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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 mark 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		Perhaps implied
c		Candidate

Abbreviations used in marking

MC – *x*	deducted *x* marks for miscopy
MR – *x*	deducted *x* marks for misread
ISW	ignored subsequent working
BOD	gave benefit of doubt
WR	work replaced by candidate

Application of mark scheme

Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

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Question Number and Part	Solution	Marks	Total	Comments
1(a)	H_0 Population median purchases = 11 H_1 Population median purchases > 11 1 tail test 10% level	B1		
	signs - - + - + + + + + - + . + + - + - + - - +	M1		For signs
	test stat = 8 -/ 12 +	A1		For test stat
	Bin (20, 0.5) model	M1		For use of Bin model
	$P(\leq 8 -) = 0.2517 > 0.10$	M1		For comparison ts and 10% or cr $\leq 6 (\geq 14)$
	Accept H_0 No significant evidence to suggest median has increased	A1	6	No probs allow M1M0A0
(b)	Distribution of purchases is skew or Wilcoxon requires symmetric distribution	B1	1	
	Total		**7**	
2(a)	$0.65 \times 0.46 = 0.299$	M1A1	2	
(b)	$0.65 + 0.52 - 0.30 = 0.87$	M1 A1	2	For 0.65 + 0.52
(c)	$1 - (0.52 + 0.38 - 0.25) = 0.35$	M1 M1 A1	3	For 0.52 + 0.38 – 0.25 For sensible effort at 1 –
(d)	$\frac{0.65 \times 0.46}{0.38} = 0.787$	M1 M1 A1	3	For numerator ft part (a), (not 0.65×0.38) For denominator
	Total		**10**	

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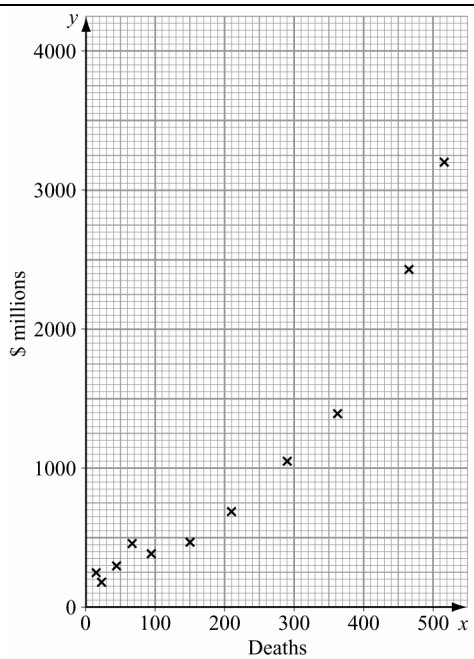
Question Number and Part	Solution	Marks	Total	Comments
3 (a)		B1 M1A1	3	Axes/scales Plot OK (allow 1 small slip)
(b)	ranks *x* 2, 6, 11, 9, 10, 1, 8, 4, 5, 7, 3 *y* 2, 7, 10, 9, 11, 1, 6, 4, 5, 8, 3 r_s (from calculator) = 0.964 **sc** 0.96/0.963 allow B1 M1 A0	M1 A1 B3	5	For ranks - can be reversed Can ft for small slip in ranks **Alternatively:** Differences, *d* 0, 1, 1, 0, 1, 0, 2, 0, 0, 1, 0 $\sum d^2 = 8$ B1 $r_s = 1 - \frac{6\times 8}{11\times 120} = 0.964$ M1, A1
(c)	H_0 $\rho_s = 0$ H_1 $\rho_s > 0$ 1 tail 1% test stat r_s = 0.964 critical value = 0.700 tests stat > 0.700 so significant evidence exists to reject H_0 and conclude that a positive association exists. This suggests that floods in which there is a higher death toll, also result in a greater cost in property damage.	B1 B1 M1 A1	4	For cv (.7545 B0 M1) (.6851 B0 M0) Comparison ts/cv Explanation in context
3(d)	There is clear evidence of a non linear relationship	B1	1	
	Total		**13**	

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Question Number and Part	Solution	Marks	Total	Comments
4(a)	test 1 mean = 66.4 st dev = 14.7 (accept 14.0) test 2 mean = 66.2 st dev = 19.9 (accept 19.0)	B1 B1B1	3	For both means For each st dev Must be consistent Or M1A1 if method shown
(b)	H_0 Population median scores same for both tests H_1 Population median scores differ 2 tail test 5 % level differences A B C D E F G H I J K L 4 -9 3 -5 25 10 -4 -8 -3 –1 -2 -7 ranks 5½ 10 3½ 7 12 11 5½ 9 3½ 1 2 8 $T_+ = 5½+ 3½+ 12+ 11 = 32$ $T_- = 10+ 7 +5½ +9 + 3½ +1 +2 +8 =46$ test stat $T = 32$ critical value = 14 test stat > 14 so Accept H_0 There is no significant evidence of a difference in median scores for the two tests	B1 M1 m1 A1 m1 A1 B1 M1 A1	9	Or refer to population mean For differences For ranks (1 = lowest) For totals Correct test stat For cv For comparison ts/cv
(c)	PMCC $r = 0.891$ (3 sf) (from calculator) **sc** 0.89 allow M1 M1 A0	B3	3	or r = $\dfrac{555956 - \dfrac{797 \times 794}{12}}{48.63 \times 65.98}$ = 0.891 (3 sf) M1, M1, A1
(d)	PMCC indicates results show positive association – consistent results No sig difference in medians Means for tests 1 & 2 about the same but the higher st dev for test 2 indicates that this test may be more effective at discriminating between good/bad applicants	B1 E1	2	For general similarity in test outcomes – must mention all results ft slight error – must mention all For mentioning st dev and discrimination
(e)	Separate groups took the 2 tests, there may be differences between the abilities of the people in the groups which would affect the results. Different types of questions used in random order Tests done at the same time	B1 B1	2	Concept of pairing removing effect of differences With any other sensible comment – cost/time/number of people
	Total		**19**	

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Question Number and Part	Solution	Marks	Total	Comments
5(a)	minimum T = 1+2+3+4+5 = 15	M1A1		Allow $15-5\times\frac{6}{2}$
	maximum T = 6+7+8+9+10 = 40	M1A1	4	$40-5\times\frac{6}{2}$
(b)(i)	test stat $U = 29 - \frac{6\times 7}{2} = 8$ (lower tail)	M1A1		Accept U = 34 (upper tail)
	lower tail cv = 7	B1		For consistent cv
	U > 7	M1		For comparison correct U/cv
	Accept H_0 There is insufficient evidence to suggest a difference between the suppliers.	A1	5	
(ii)	To conclude that the materials do not differ (identical pops) when, in fact, there is a difference (pops are not identical)	B1 E1	2	Correct idea of Type II In context
	Total		**11**	
	TOTAL		**60**	

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