ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme
January 2004

GCE

Mathematics & Statistics B

Unit MBS2

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

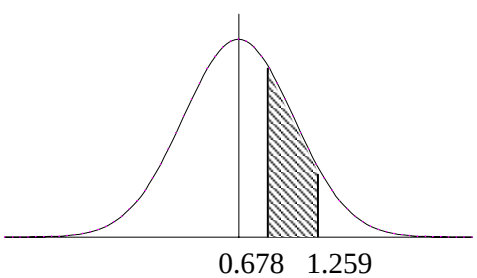
Application of mark scheme

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.

Question Number and part	Solution	Marks	Total	Comments
1(a)	$c = \frac{47.2 + 33.8 + 40.4 + 41.9 + 36.1}{5}$	M1		
	= 39.9	A1		awrt 39.9
	$d = \frac{36.1 + 35.4 + 29.8 + 36.0 + 39.0}{5}$			
	= 35.3	A1	3	awrt 35.3
(b)	$n = 7$	B1	1	
	Total		**4**	
2(a)	Random variation about a downward linear trend	B1 B1	2	Random variation Downward linear
(b)	Seasonal variation about an upward linear trend	B1 B1	2	Seasonal variation Upward linear
(c)	Short term variation about an upward non-linear trend	B1 B1	2	Short term variation Upward non-linear
(d)	Random variation but no trend	B1 B1	2	Random variation No trend
	Total		**8**	
3(a)(i)	300×52			
	= 15600	B1	1	
(ii)	$\sqrt{\frac{2 \times 200 \times 15600}{6}}$	M1		$\sqrt{\frac{2 \times 200 \times a(i)}{6}}$
	= 1019.8	A1√		
	= 1020 (int)	A1	3	
(b)(i)	$1.645 \times 40 \times \sqrt{3}$	B1		1.645, 1.6449, 1.64
	= 113.97	M1		
	i.e. 114	A1	3	
(ii)	$3 \times 300 + 114$	M1		3×300
	= 900 + 114	M1		900 + b(i)
	= 1014	A1√	3	
(c)	$114 \times £6$	M1		b(i) × 6
	= £684	A1√	2	
(d)	The best policy is to order 1020 fans whenever stock declines to 1014 fans. On average, orders should arrive when there are 114 fans remaining.	B1√ B1√ B1√	3	a(ii) b(ii) b(i)
	Total		**15**	

Question Number and part	Solution	Marks	Total	Comments
4(a)	Poisson	B1	1	
(b)	C.I. for 12 weeks			
	$16 \pm 2.326\sqrt{16}$	B1		Mean 16 s.d. $\sqrt{16}$
	for 1 week	B1		2.326
	$\frac{16}{12} \pm \frac{2.326\sqrt{16}}{12}$	M1 M1		using normal Poisson parameters
	Alternative:			
	C.I. for 1 week			
	$\frac{16}{12} \pm \frac{2.326\sqrt{\frac{16}{12}}}{\sqrt{12}}$			Mean $\frac{16}{12}$ s.d. $\sqrt{\frac{16}{12}}$
	$= \frac{4}{3} \pm 2.326 \times \frac{1}{3}$			
	$= 1.3333 \pm 0.7753$	m1		Completely correct
	$= 0.558 \sim 2.109$			(0.55, 0.56)
	$= 0.558 \sim 2.11$	A1	6	(2.10, 2.11)
(c)	Have used the Normal approx. to the Poisson.	E1		
	Poisson requires a constant mean; the observed value of $\frac{16}{12}$ is unlikely to be exactly equal to the mean, so the value $\sqrt{\frac{16}{12}}$ used for the standard deviation is only an approximation.	E1	2	
	Total		**9**	

Question Number and part	Solution	Marks	Total	Comments
5(a)(i)	B (500, 0.001)	B1	1	
(ii)	$n = 500$ $p = 0.001$			
	$np = 0.5$ hence use Po(0.5)	B1		
	$P(X \geq 2) = 1 - P(X \leq 1)$	M1		
	$= 1 - 0.9098$			
	$= 0.0902$	A1	3	
(b)	$\lambda = 30$ / day $\quad P(250 < X < 260)$			
	$\lambda = 240$ / eight days	B1		
	$\frac{250.5 - 240}{\sqrt{240}} = 0.678$	M1		Use of $z = \frac{x - \mu}{\sigma}$
	$\frac{259.5 - 240}{\sqrt{240}} = 1.259$	M1		Use of continuity correction
		A1		At least one correct continuity correction
		A1		Both z correct
				Needs first M1
	0.678 1.259			
	$0.89599 - 0.75111 = 0.14488$	m1		
	$= 0.145$ (3 sig fig)	A1√	7	(0.144,0.148)
	Total		**11**	

Question Number and part	Solution	Marks	Total	Comments
6(a)(i)	Systematic	B1	1	
(ii)	80	B1	1	
(iii)	Easier to obtain because only need to select one random number.	E1	1	
(b)(i)		M1		
		A1		3 correct
		A1	3	All correct (no marks for totals)
(ii)	No because sample cannot consist of all males	E1	1	oe
(c)				Many possible answers
	Randomly select two Halls of Residence.	B1		Cluster
	This will give sample of size 200.	B1		
				Describe random sampling
	Number Halls 00-19	B1		
	Select a 2 digit random number	B1		
	Ignore repeats and	B1		
	> 19	B1	6	
	Total		**13**	
	TOTAL		**60**	

	Y1	Y2	Y3	Y4	Tot
F	18	13	12	12	55
M	14	12	10	9	45
Tot	32	25	22	21	100