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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MS2A Statistics 2A

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	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	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	OE	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
–*x* EE	deduct *x* marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

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

MS2A/W

Q	Solution	Mark	Total	Comments
1(a)(i)	$\mathrm{P}(Y=2)=\dfrac{e^{-1.9}\times(1.9)^2}{2!}$	M1		
	$=0.270$	A1	2	AWRT
(ii)	$(0.270)^5=0.00143$	M1A1 √	2	On their (a)(i) AWRT
(b)(i)	$X\sim \mathrm{P}_o(9.5)$	B1	1	Poisson **and** 9.5
(ii)	$\mathrm{P}(X\geq 10)=1-\mathrm{P}(X\leq 9)$ $=1-0.5218$ $=0.4782$	M1 A1	2	
(iii)	$\therefore\quad p=10\times(0.4782)^3(0.5218)^2$ $=0.298$	M1 A1	2	On their b (ii) AWRT 0.3
	Total		**9**	
2	H_0: The venue/location has no effect on the result of the match.	B1		
	O_i | E_i | $\dfrac{(O_i-E_i)^2}{E_i}$ 15 | 10.8 | 1.6333 6 | 9.72 | 1.4237 6 | 6.48 | 0.0356 5 | 9.2 | 1.9174 12 | 8.28 | 1.6713 6 | 5.52 | 0.0417 $\sum O_i=50$ | $\sum E_i=50$ | $\chi^2=6.723$	M1A1 M1A1 A1		calculation of E attempted. Use of $\dfrac{(O_i-E_i)^2}{E_i}$ AWFW 6.6 to 6.8
	$\chi^2_{5\%}(2)=5.991$	B1 B1√		For $\nu=2$ For 5.991 (on their ν)
	$5.991 < 6.72\quad\therefore$ Reject H_0	A1√		
	Evidence suggests that the results are affected by the venue/location	E1√	10	
	Total		**10**	

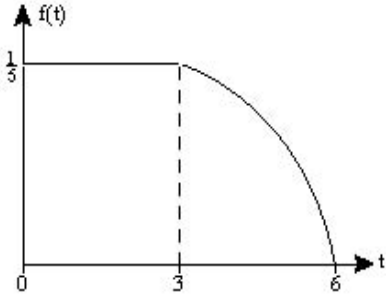
MS2A/W (cont)

Q	Solution	Mark	Total	Comments
3(a)	$\mathrm{E}(R)=\left(1\times\frac{1}{4}\right)+\left(2\times\frac{1}{2}\right)+\left(4\times\frac{1}{4}\right)$ $=2.25$	M1A1		$2\frac{1}{4}$
	$\mathrm{E}(R^2)=\left(1\times\frac{1}{4}\right)+\left(4\times\frac{1}{2}\right)+\left(16\times\frac{1}{4}\right)$ $=6.25$			$6\frac{1}{4}$
	$\therefore \mathrm{Var}(R)=6.25-(2.25)^2$ $=1.1875$	M1 A1√	4	$1\frac{3}{16}$ on their E (R)
(b)(i)				

x	1	$\frac{1}{4}$	$\frac{1}{16}$
$P(X=x)$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

	B1		
$\mathrm{E}(X)=\left(1\times\frac{1}{4}\right)+\left(\frac{1}{4}\times\frac{1}{2}\right)+\left(\frac{1}{16}\times\frac{1}{4}\right)$	M1		
$=\frac{1}{4}+\frac{1}{8}+\frac{1}{64}$ $=\frac{16+8+1}{64}$			
$=\frac{25}{64}$	A1	3	AG
(ii) $\mathrm{A}=\left(R+\frac{8}{R}\right)\times\frac{8}{R}=8+\frac{64}{R^2}$	M1		Attempt at area = $l \times b$
$\mathrm{E}(\mathrm{A})=8+\mathrm{E}\left(\frac{64}{R^2}\right)=8+64\times\mathrm{E}\left(\frac{1}{R^2}\right)$	M1		
$=8+64\times\mathrm{E}(X)=8+64\times\frac{25}{64}$ $=33$			CAO
	Total	**10**	
4(a) $\sum x=15.8$ $\sum x^2=25.0592$ $\bar{x}=\frac{15.8}{10}=1.58$	B1		$\bar{X}\sim N\left(\mu,\frac{\sigma^2}{10}\right)$
$s^2=\frac{25.0592}{9}-\frac{10}{9}(1.58)^2$ $=0.01057\dot{}$	B2	3	$(s=0.1028)$ AWRT 0.011
(b) 90% CI for μ $1.58\pm\frac{s}{\sqrt{10}}\times 1.833$	M1A1ft		1.58 ± 0.0596
$(1.52,1.64)$	t B1 B1√ A1√	5	for ν for t for interval
	Total	**8**	

MS2A/W (cont)

Q	Solution	Marks	Total	Comments
5(a)		B3	3	B1 2 axes with scales B1 Horizontal line at 0.2 from 0 to 3 B1 Curve from 3 to 6
(b)	$\mathrm{P}(T=3)=0$	B1	1	
(c)	$\mathrm{P}(T\geq 3)=1-\mathrm{P}(T<3)$ $=1-\frac{3}{5}$ $=\frac{2}{5}$	M1 A1	 2	$\int_3^6 \frac{1}{45}t(6-t)\,\mathrm{d}t=\frac{2}{5}$
(d)	$\int_0^m \frac{1}{5}\mathrm{d}t=0.5$ $\therefore \left(\frac{t}{5}\right)_0^m=0.5$ $\frac{m}{5}-0=0.5$ $m=0.5\times 5$ $m=2.5$	M1 A1	 2	$\mathrm{P}(T\leq 3)=0.6$ $\therefore 0\leq$ median <3 $\frac{1}{5}m=0.5$ $m=5\times 0.5$ $m=2.5$ AG
(e)	$\mathrm{E}(T)=\int_0^3 \frac{1}{5}t\ \mathrm{d}t+\int_3^6 \frac{1}{45}t^2(6-t)\ \mathrm{d}t$ $=\left[\frac{1}{10}t^2\right]_0^3+\left[\frac{2}{45}t^3-\frac{1}{180}t^4\right]_3^6$ $=\frac{9}{10}+1.65$ $=2.55$ $\therefore \mathrm{P}(\text{median}<T<\text{mean})$ $=\mathrm{P}(2.5<T<2.55)$ $=0.05\times\frac{1}{5}$ $=0.01$	M1 A1A1 A1 M1 A1	 6	
	Total		**14**	

MS2A/W (cont)

Q	Solution	Marks	Total	Comments
6(a)	$H_0 : \mu = 35$ $H_1 : \mu \neq 35$	B1		
	$2-$tail test , 1% sig. level			
	under H_0, $\bar{X} \sim N\left(\mu, \frac{\sigma^2}{n}\right)$			
	$\bar{X} \sim N\left(35, \frac{144}{100}\right)$	B1		
	$z = \frac{37.9 - 35}{1.2}$	M1		$z = \frac{37.9-35}{\text{their } \sigma/\sqrt{n}}$
	$z = 2.42$	A1√		On their $\sigma/\sqrt{n}$
	$z_{crit} = \pm 2.5758$	B1		
	Do not reject H_0	A1√		On their z
	evidence to support the claim that the mean age is 35 years.	E1√	7	
(b)	Accept H_0 when H_0 is false Accepting the mean to be 35 years when it isn't	B2	2	Allow B1 if not in context
	Total		**9**	
	Total		**60**	