GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/07, 8719/07

MATHEMATICS AND HIGHER MATHEMATICS Paper 7 (Probability and Statistics 2)



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1 (i) H_0 : $\mu = 15$ or $p = 0.25$ H_1 : $\mu > 15$ or $p > 0.25$ (ii) Test statistic $z = \pm \frac{21.5 - 15}{\sqrt{60 \times 0.25 \times 0.75}} = 1.938$ OR test statistic $z = \pm \frac{22/60^{-0.5}/60^{-15/60}}{\sqrt{0.25 \times 0.75}} = 1.938$ CV $z = 1.645$ In CR Claim justified 2 (i) Mean = 3.5 + 2.9 + 3.1 = 9.5 Var = 0.3² + 0.25² + 0.35² (=0.275) St dev = 0.524 A1 For H ₀ and H ₁ correct For Alternative	-tailed, to 5% one-tail
(ii) Test statistic $z = \pm \frac{21.5 - 15}{\sqrt{60 \times 0.25 \times 0.75}} = 1.938$ OR test statistic $z = \pm \frac{2^2/60 - 0.5/60 - 15/60}{\sqrt{\frac{0.25 \times 0.75}{60}}} = 1.938$ CV $z = 1.645$ In CR Claim justified A1ft CI Mean = $3.5 + 2.9 + 3.1 = 9.5$ Var = $0.3^2 + 0.25^2 + 0.35^2$ (=0.275) St dev = 0.524 M1 For attempt at standardising with or vacc, must have $\sqrt{}$ something with 60 is denom For 1.94 (1.938) For comparing with 1.645 or 1.96 if 2 signs consistent, or comparing areas For correct answer(ft only for correct test) 9.5 as final answer For summing three squared deviation For correct answer For correct answer For standardising, no cc	-tailed, to 5% one-tail
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(ii) $z = \frac{9-9.3}{ their \text{ var} } = -1.907$ M1 For standardising, no cc	
their var	
Well vai	
-	
1	enom -
or z = 36-38 = -1.907	
$\sqrt{(4 \times their var)}$ no 'mixed' methods.	
T (4 00 T) 0 0 T (4 0 T)	
$\Phi(1.907) = 0.9717 = 0.972$ A1 3 For correct answer	
3 (i) $E(2X-3Y) = 2E(X) - 3E(Y) = 16 - 18$ M1 For multiplying by 2 and 3 resp and s	uht
	ubt
= - 2 A1 2 For correct answer	
(ii) $Var(2X-3Y) = 4Var(X) + 9Var(Y)$ B1 For use of $Var(Y) = 6$	
= 19.2 + 54 M1 For squaring 3 and 2	
	,
M1 For adding variances (and nothing el	se)
= 73.2 A1 4 For correct final answer	
4 (i) $\bar{x} = 375.3$ B1 For correct mean (3.s.f)	
$\sigma^2_{n-1} = 8.29$ M1 For legit method involving <i>n</i> -1, can be	: implied
A1 3 For correct answer	
(ii) p = 0.19 or equity B1 For correct p	
(ii) $p = 0.19$ or equiv. B1 For correct p	
D 10 - 0 01	المادة
$0.19 \pm 2.055 \times \sqrt{\frac{0.19 \times 0.81}{200}}$ M1 For correct form $p \pm z \times \sqrt{\frac{pq}{n}}$ either/bo	in sides
200	
B_1 For $z = 2.054$ or 2.055	
0.400 0.047	
0.133 < <i>p</i> < 0.247 A1 4 For correct answer	

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5 (i) $\frac{c-54}{3.1/\sqrt{10}} = -1.282$	B1 M1	For + or – 1.282 seen For equality/inequality with their z (\pm) (must have used tables), no $\sqrt{10}$ needed (c can be
$c = 54 - 1.282 \times \frac{3.1}{\sqrt{10}} = 52.74$	A1	numerical) For correct expression (c can be numerical, but signs must be consistent)
	A1 4	For correct GIVEN answer. No errors seen.
(ii) $P(\bar{x} > 52.74) = 1 - \Phi\left(\frac{52.74 - 51.5}{3.1/\sqrt{10}}\right)$	B1	For identifying the outcome for a type II error For standardising , no $\sqrt{10}$ needed
$= 1 - \Phi(1.265) = 1 - 0.8971$	A1	For ± 1.265 (accept 1.26-1.27)
= 0.103 or 0.102	A1 4	For correct answer
6 (i) P(5) = $e^{-6} \times \frac{6^5}{5!} = 0.161$	M1	For an attempted Poisson P(5) calculation,
3!	A1 2	any mean For correct answer
	A1 2	FOI COITECT GIISMEI
(ii) $P(X \ge 2) = 1 - \{P(0) + P(1)\}$ = 1 - $e^{-1.6}(1+1.6)$	B1 M1	For μ = 1.6, evaluated in a Poisson prob For 1 – P(0) – P(1) or 1 – P(0) – P(1) – P(2)
= 0.475	A1 3	For correct answer
(iii)	M1	For multiplying P(1) by P(4) any (consistent)
P(1 then 4 5) = $\frac{\left(e^{-3} \times 3\right) \times \left(e^{-3} \times \frac{3^4}{4!}\right)}{e^{-6} \times \frac{6^5}{4!}}$	M1	mean For dividing by P(5) any mean
5!	A1 3	For correct answer
= 0.156 or 5/32		
7 (i) $c \int_{0}^{3} t(25 - t^{2}) dt = 1$	M1	For equating to 1 and a sensible attempt to integrate
$c\left[\frac{25t^2}{2} - \frac{t^4}{4}\right]_0^5 = 1$	A1	For correct integration and correct limits
$c\left[\frac{625}{2} - \frac{625}{4}\right] = 1 \implies c = \frac{4}{625}$	A1 3	For given answer correctly obtained
(ii) $\int_{2}^{4} ct(25 - t^{2}) dt = \left[\frac{25ct^{2}}{2} - \frac{ct^{4}}{4} \right]_{2}^{4} = c[136] - c[46]$	M1*	For attempting to integrate f(t) between 2 and 4 (or attempt 2 and 4)
	M1*dep	For subtracting their value when t = 2 from
$=\frac{72}{125} (0.576)$	A1 3	their value when t = 4 For correct answer
(iii) $\int_{C}^{5} ct^{2}(25-t^{2})dt = \left[\frac{4}{4} \times \frac{25t^{3}}{4} - \frac{4}{4} \times \frac{t^{5}}{4}\right]^{5}$	M1*	For attempting to integrate $tf(t)$, no limits
(iii) $\int_{0}^{5} ct^{2} (25 - t^{2}) dt = \left[\frac{4}{625} \times \frac{25t^{3}}{3} - \frac{4}{625} \times \frac{t^{5}}{5} \right]_{0}^{5}$	A1	needed For correct integrand can have <i>c</i> (or their <i>c</i>)
$=\frac{8}{3}$	M1*dep	For subtracting their value when t=0 from
	A1 4	their value when t=5 For correct answer
l .		1