

**JUNE 2002** 

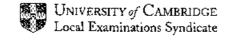
## GCE Advanced Level GCE Advanced Subsidiary Level

## **MARK SCHEME**

**MAXIMUM MARK: 50** 

SYLLABUS/COMPONENT: 9709 /7, 8719 /7

MATHEMATICS (Probability and Statistics 2)





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7 512226 2.4	Bl		For z value of 2.33
1 $\bar{x} \pm 2.326 \times \frac{2.4}{\sqrt{90}}$	Ml		For expression of correct form involving $\sqrt{90}$ in denom
$2.326 \times \frac{2.4}{\sqrt{90}} \times 2$ Width	Ml		For subtracting lower from upper, or multiplying half-width by 2
= 1.18	Ai	4	For correct answer
2 EITHER	<del>                                     </del>		F
	M2		Calculation of correct form $p \pm z \sqrt{\frac{pq}{n}}$
$0.275 \pm 1.96 \times \sqrt{\frac{0.275 \times 0.725}{120}}$	1		Calculation of correct form V n (SR M1 if only one side of interval seen)
$0.195$	Bl		Use of $p = 0.275$
·	AI	4	For correct answer
OR 33± 1.96√ 120x0.275x0.725 23.413 < p < 42.586	Mi		Calculation of correct form np±z√npq (accept just one side of interval)
120 120	MI		Division by 120 (BOTH sides)
0.195 < p < 0.355	Bl		Use of 0.275
-	Ai	4	Correct answer
3 sugar ~ N(1500, 1200)	Bi		For (normal dist with) correct means for both
5 coffee ~ N(1000,720)	B1		For (normal dist with) correct variance for both
Total weight ~ N(2850, 1920) or ~ N(2500, 1920)	MI		For adding their variances and means(+ purse)for coffee and sugar
01~14(2300, 1920)	Al		For correct mean and variance for their total weight
(2900 - 2850)	'		ie with or without the purse
$P(W \le 2900) = \Phi\left(\frac{2900 - 2850}{\sqrt{1920}}\right)$	Mi		For standardising and use of tables (consistent
$P(W < 2900) = \Phi\left(\frac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$ $OrP(W < 2550) = \Phi\left(\frac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$	Al	6	inclusion/exclusion of purse) For correct answer
	81		For correct mean
4 (i) $\bar{x} = 14.2$ , $s^2 = \frac{1}{149} \left( 37746 - \frac{2130^2}{150} \right) = 50.3(4)$	B1	2	For correct variance
(ii) $H_0: \mu = 12$ and $H_1: \mu \neq 12$	В1		Both hypotheses correct
Test statistic $z = 14.2 - 12 = 3.798$			5
<u>/50.34</u>	Ml		For standardising attempt with se of form $\sqrt{n}$
$\sqrt{\frac{50.57}{150}}$	Al		For 3.80
A 120	мі		Or comparing $\Phi(3.798)$ with 0.95 (or equiv. for one
Compare with 1.645 or 1.282 for one-tail t	AI	5	tail test) Signs consistent.  Correct conclusion ft on their z and H <sub>1</sub>
Reject exam boards claim  F (2) 2(0 ex 1010 ex (0 $5)^{9}$ (0 5) y (0 + (0 $5)^{10}$	1		For P(9 or 10H)
5 (i) P(9 or 10H) = $(0.5)^9 x (0.5) x_{10} C_9 + (0.5)^{10}$ (= 0.01074)	MI M1		For P(9 or 10T)
P(9T  or  10T) = 0.01074	MI		For identifying outcome for Type I error
P(type 1 error) = 0. 0215 AG	Al	4	For obtaining given answer legitimately
(ii)P(9 or 10H)= $(0.7)^9 \times (0.3) \times_{10} C_9 + (0.7)^{10}$	MI		For evaluating P(9 or 10H) with P(H) $\approx 0.7$
(a)P(9 or 10H)= $(0.7) \times (0.3) \times {}_{10}C_{9} + (0.7)$ (=0.1493)			For evaluating $P(9 \text{ or } 10T)$ with $P(T) = 0.3$
P(9 or 10T) = $(0.3)^9 \times (0.7) \times_{10} C_9 + (0.3)^{10}$	MI		
= 0.000143	MI		For identifying outcome for Type II error
P(type II error) = 1 - 0.1493 - 0.000143	AI	4	For correct answer (SR 0.851 no working B2)
= 0.851			

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6 (i) mean = 6	Ml		For mean 6 and evaluating a Poisson prob
P(X=5)=0.161	A1	2	For correct answer
(ii) μ=2	Bı		For $\mu$ =2 used in a Poisson prob.
$P(0) = e^{-2} (= 0.135)$	Ml		For 1 - P(0), any mean
1 - P(0) = 0.865	Al	3	For correct answer
	B!		   For μ=24
(iii) $\mu = 24$ , $\sigma^2 = 24$	Bl		For their var=their mean
19.5-24	M1		For standardising with or without cc
$z = \frac{19.5 - 24}{\sqrt{24}} = -0.9186$	Al		For correct continuity correction
	Al	5	For correct answer
$1 - \Phi(0.9186) = 0.179$			(SR Using Poisson with no approximation
			(0.180(26)) scores M1 A1 only)
7 (i) $E(X) = \int_{0}^{1} 2x(1-x) dx$	Ml		For sensible attempt to integrate $xf(x)$
$\int_{0}^{1} 2x - 2x^2 dx$	Al		For correct integrand (any form)
$-\left[x^{2}-\frac{2x^{3}}{3}\right]_{-0.333}$	Al	3	For correct answer
(ii) $Var(X) = \begin{bmatrix} \int_{0}^{1} 2x^{2} - 2x^{3} dx \\ -(0.333)^{2} \end{bmatrix}$ $= \begin{bmatrix} \frac{2x^{3}}{3} - \frac{2x^{4}}{4} \end{bmatrix}_{-(0.333)^{2}}$	M1*		For sensible attempt to integrate $x^2f(x)$
$= \left[ \frac{2x^3}{3} - \frac{2x^4}{4} \right]_{-(0.333)^2}$	M1*d	ер	For their integral— (their mean) <sup>2</sup>
= 0.0556	<b>A</b> 1	3	For correct answer
$\int_{0}^{x} 2(1-x) dx$ (iii) 0 = 0.98	Ml		For identifying both sides of equation
$\left[2x-x^2\right]_{0.98}$	Al		For correct equation in any form
			For solving for x (must be sensible attempt)
$x^2 - 2x + 0.98 = 0$			For correct answer
x = 0.859 859 tonnes			For applying concept of continuous rv.
OR 24			For identifying x from a relevant diagram
$\lambda$			For correct equation
$0.98 \qquad \frac{(1-x)}{2} \times 2(1-x) = 0.02$			For solving for x
$0.98$ $\frac{2}{2} \times 2(1-x) = 0.02$	ΑI		For correct answer
		5	For applying concept of continuous rv.
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