CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

GCE Advanced Level
GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7
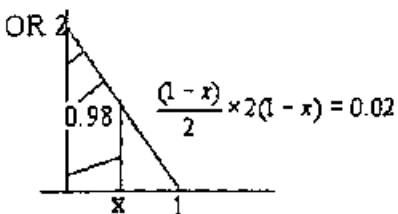
MATHEMATICS
(Probability and Statistics 2)

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

Page 1	Mark Scheme	Syllabus	Paper
	A & AS Level Examinations – June 2002	9709, 8719	7

1	$\bar{x} \pm 2.326 \times \dfrac{2.4}{\sqrt{90}}$	B1		For z value of 2.33
		M1		For expression of correct form involving $\sqrt{90}$ in denom
	$2.326 \times \dfrac{2.4}{\sqrt{90}} \times 2$ Width	M1		For subtracting lower from upper, or multiplying half-width by 2
	$= 1.18$	A1	4	For correct answer

2	EITHER			
	$0.275 \pm 1.96 \times \sqrt{\dfrac{0.275 \times 0.725}{120}}$	M2		Calculation of correct form $p \pm z\sqrt{\dfrac{pq}{n}}$ (SR M1 if only one side of interval seen)
	$0.195 < p < 0.355$	B1		Use of $p = 0.275$
		A1	4	For correct answer
	OR			
	$33 \pm 1.96\sqrt{120 \times 0.275 \times 0.725}$	M1		Calculation of correct form $np \pm z\sqrt{npq}$ (accept just one side of interval)
	$\dfrac{23.413}{120} < p < \dfrac{42.586}{120}$	M1		Division by 120 (BOTH sides)
	$0.195 < p < 0.355$	B1		Use of 0.275
		A1	4	Correct answer

3	3 sugar ~ N(1500, 1200)	B1		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)	M1		For adding their variances and means(+ purse) for coffee and sugar
		A1		For correct mean and variance for their total weight ie with or without the purse
	$P(W < 2900) = \Phi\left(\dfrac{2900 - 2850}{\sqrt{1920}}\right)$	M1		For standardising and use of tables (consistent inclusion/exclusion of purse)
	Or $P(W<2550) = \Phi\left(\dfrac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$	A1	6	For correct answer

4	(i) $\bar{x} = 14.2$, $s^2 = \dfrac{1}{149}\left(37746 - \dfrac{2130^2}{150}\right) = 50.3(4)$	B1 B1	2	For correct mean For correct variance
	(ii) $H_0 : \mu = 12$ and $H_1 : \mu \neq 12$	B1		Both hypotheses correct
	Test statistic $z = \dfrac{14.2 - 12}{\sqrt{\dfrac{50.34}{150}}} = 3.798$	M1 A1		For standardising attempt with se of form $\dfrac{s}{\sqrt{n}}$ For 3.80
		M1		Or comparing $\Phi(3.798)$ with 0.95 (or equiv. for one tail test) Signs consistent.
	Compare with 1.645 or 1.282 for one-tail t Reject exam boards claim	A1	5	Correct conclusion ft on their z and H_1

5	(i) P(9 or 10H) = $(0.5)^9 \times (0.5) \times {}_{10}C_9 + (0.5)^{10}$ ($= 0.01074$)	M1		For P(9 or 10H)
	P(9T or 10T) = 0.01074	M1		For P(9 or 10T)
		M1		For identifying outcome for Type I error
	P(type 1 error) = 0. 0215 **AG**	A1	4	For obtaining given answer legitimately
	(ii) P(9 or 10H) = $(0.7)^9 \times (0.3) \times {}_{10}C_9 + (0.7)^{10}$ ($=0.1493$)	M1		For evaluating P(9 or 10H) with P(H) = 0.7
	P(9 or 10T) = $(0.3)^9 \times (0.7) \times {}_{10}C_9 + (0.3)^{10}$ = 0.000143	M1		For evaluating P(9 or 10T) with P(T) = 0.3
		M1		For identifying outcome for Type II error
	P(type II error) = 1 - 0.1493 - 0.000143 = 0.851	A1	4	For correct answer (SR 0.851 no working B2)

6 (i) mean = 6 $P(X = 5) = 0.161$	M1 A1	2	For mean 6 and evaluating a Poisson prob For correct answer
(ii) $\mu = 2$ $P(0) = e^{-2}\ (= 0.135)$ $1 - P(0) = 0.865$	B1 M1 A1	3	For $\mu = 2$ used in a Poisson prob. For $1 - P(0)$, any mean For correct answer
(iii) $\mu = 24$, $\sigma^2 = 24$ $z = \dfrac{19.5 - 24}{\sqrt{24}}$ $= -0.9186$ $1 - \Phi(0.9186) = 0.179$	B1 B1 M1 A1 A1	5	For $\mu = 24$ For their var=their mean For standardising with or without cc For correct continuity correction For correct answer (SR Using Poisson with no approximation $(0.180(26))$ scores M1 A1 only)
7 (i) $E(X) = \displaystyle\int_0^1 2x(1 - x)\ dx$ $= \displaystyle\int_0^1 2x - 2x^2\ dx$ $= \left[x^2 - \dfrac{2x^3}{3}\right] = 0.333$	M1 A1 A1	 3	For sensible attempt to integrate $xf(x)$ For correct integrand (any form) For correct answer
(ii) $Var(X) = \displaystyle\int_0^1 2x^2 - 2x^3 dx\ - (0.333)^2$ $= \left[\dfrac{2x^3}{3} - \dfrac{2x^4}{4}\right] - (0.333)^2$ $= 0.0556$	M1* M1*dep A1	 3	For sensible attempt to integrate $x^2f(x)$ For their integral– (their mean)^2 For correct answer
(iii) $\displaystyle\int_0^x 2(1 - x)\ dx\ = 0.98$ $\left[2x - x^2\right] = 0.98$ $x^2 - 2x + 0.98 = 0$ $x = 0.859$ 859 tonnes OR 2 0.98 $\dfrac{(1 - x)}{2} \times 2(1 - x) = 0.02$ x 1	M1 A1 M1 A1 B1 ft M1 A1 M1 A1 B1	 5	For identifying both sides of equation For correct equation in any form For solving for x (must be sensible attempt) For correct answer For applying concept of continuous rv. For identifying x from a relevant diagram For correct equation For solving for x For correct answer For applying concept of continuous rv.