CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

GCE Advanced Level
GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7

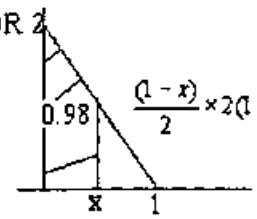
MATHEMATICS
(Probability and Statistics 2)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1	$\bar{x} \pm 2.326 \times \frac{2.4}{\sqrt{90}}$ Width $2.326 \times \frac{2.4}{\sqrt{90}} \times 2$ = 1.18	B1 M1 M1 A1	4	For z value of 2.33 For expression of correct form involving $\sqrt{90}$ in denom For subtracting lower from upper, or multiplying half-width by 2 For correct answer
2	EITHER $0.275 \pm 1.96 \times \sqrt{\frac{0.275 \times 0.725}{120}}$ $0.195 < p < 0.355$ OR $33 \pm 1.96\sqrt{120 \times 0.275 \times 0.725}$ $\frac{23.413}{120} < p < \frac{42.586}{120}$ $0.195 < p < 0.355$	M2 B1 A1 M1 M1 B1 A1	4 4	Calculation of correct form $p \pm z\sqrt{\frac{pq}{n}}$ (SR M1 if only one side of interval seen) Use of $p = 0.275$ For correct answer Calculation of correct form $np \pm z\sqrt{npq}$ (accept just one side of interval) Division by 120 (BOTH sides) Use of 0.275 Correct answer

3	3 sugar ~ N(1500, 1200)
	5 coffee ~ N(1000,720)
	Total weight ~ N(2850, 1920)
	or ~ N(2500, 1920)
	$P(W < 2900) = \Phi\left(\frac{2900 - 2850}{\sqrt{1920}}\right)$
	$\text{Or}P(W<2550) = \Phi\left(\frac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$
		B1
		B1
		M1
		A1
		M1
		A1
			6	For (normal dist with) correct means for both
				For (normal dist with) correct variance for both
				For adding their variances and means(+ purse)for coffee and sugar
				For correct mean and variance for their total weight ie with or without the purse
				For standardising and use of tables (consistent inclusion/exclusion of purse)
				For correct answer

4	(i) $\bar{x} = 14.2, s^2 = \frac{1}{149}\left(37746 - \frac{2130^2}{150}\right) = 50.3(4)$ (ii) $H_0 : \mu = 12$ and $H_1 : \mu \neq 12$ Test statistic $z = \frac{14.2 - 12}{\sqrt{\frac{50.34}{150}}} = 3.798$ Compare with 1.645 or 1.282 for one-tail t Reject exam boards claim	B1 B1 B1 M1 A1 M1 A1	2 5	For correct mean For correct variance Both hypotheses correct For standardising attempt with se of form $\frac{s}{\sqrt{n}}$ For 3.80 Or comparing $\Phi(3.798)$ with 0.95 (or equiv. for one tail test) Signs consistent. Correct conclusion fit 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) P(9T or 10T) = 0.01074 P(type I error) = 0. 0215 **AG** (ii)P(9 or 10H)= $(0.7)^9 \times (0.3) \times {}_{10}C_9 + (0.7)^{10}$ (=0.1493) P(9 or 10T) = $(0.3)^9 \times (0.7) \times {}_{10}C_9 + (0.3)^{10}$ = 0.000143 P(type II error) = 1 - 0.1493 -0.000143 = 0.851	M1 M1 M1 A1 M1 M1 M1 A1	4 4	For P(9 or 10H) For P(9 or 10T) For identifying outcome for Type I error For obtaining given answer legitimately For evaluating P(9 or 10H) with P(H) = 0.7 For evaluating P(9 or 10T) with P(T) = 0.3 For identifying outcome for Type II error 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) $\mu = 24$, $\sigma^2 = 24$ $z = \frac{19.5-24}{\sqrt{24}} = -0.9186$ $1 - \Phi(0.9186) = 0.179$	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) $E(X) = \int_0^1 2x(1-x)\,dx$ $= \int_0^1 2x - 2x^2\,dx$ $= \left[x^2 - \frac{2x^3}{3}\right] = 0.333$	M1 A1 A1 3	For sensible attempt to integrate $xf(x)$ For correct integrand (any form) For correct answer
(ii) $\mathrm{Var}(X) = \int_0^1 2x^2 - 2x^3\,dx - (0.333)^2$ $= \left[\frac{2x^3}{3} - \frac{2x^4}{4}\right] - (0.333)^2$ $= 0.0556$	M1* M1*dep A1 3	For sensible attempt to integrate $x^2f(x)$ For their integral– (their mean)^2 For correct answer
(iii) $\int_0^x 2(1-x)\,dx = 0.98$ $\left[2x - x^2\right] = 0.98$ $x^2 - 2x + 0.98 = 0$ $x = 0.859$ 859 tonnes	M1 A1 M1 A1 B1 ft	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.
OR 2  	M1 A1 M1 A1 B1 5	For identifying x from a relevant diagram For correct equation For solving for x For correct answer For applying concept of continuous rv.