CAMBRIDGE
INTERNATIONAL EXAMINATIONS

JUNE 2002

GCE Advanced Level
GCE Advanced Subsidiary Level

MARK SCHEME

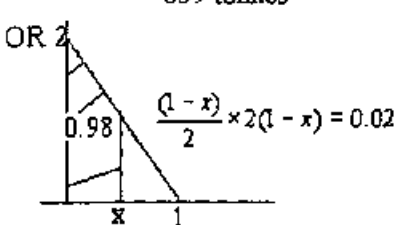## MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7

MATHEMATICS
(Probability and Statistics 2)

1 $\bar{x} \pm 2.326 \times \dfrac{2.4}{\sqrt{90}}$ $2.326 \times \dfrac{2.4}{\sqrt{90}} \times 2$ Width $= 1.18$	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 $0.275 \pm 1.96 \times \sqrt{\dfrac{0.275 \times 0.725}{120}}$ $0.195 < p < 0.355$ OR $33 \pm 1.96\sqrt{120 \times 0.275 \times 0.725}$ $\dfrac{23.413}{120} < p < \dfrac{42.586}{120}$ $0.195 < p < 0.355$	M2 B1 A1 4 M1 M1 B1 A1 4	Calculation of correct form $p \pm z\sqrt{\dfrac{pq}{n}}$ (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 $\sim N(1500, 1200)$
 5 coffee $\sim N(1000, 720)$
 Total weight $\sim N(2850, 1920)$
 or $\sim N(2500, 1920)$
 	
 $P(W < 2900) = \Phi\left(\dfrac{2900 - 2850}{\sqrt{1920}}\right)$
 Or $P(W < 2550) = \Phi\left(\dfrac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$
	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) $\bar{x} = 14.2$, $s^2 = \dfrac{1}{149}\left(37746 - \dfrac{2130^2}{150}\right) = 50.3(4)$ (ii) $H_0 : \mu = 12$ and $H_1 : \mu \neq 12$ Test statistic $z = \dfrac{14.2 - 12}{\sqrt{\dfrac{50.34}{150}}} = 3.798$ Compare with 1.645 or 1.282 for one-tail t Reject exam boards claim	B1 B1 2 B1 M1 A1 M1 A1 5	For correct mean For correct variance Both hypotheses correct For standardising attempt with se of form $\dfrac{s}{\sqrt{n}}$ For 3.80 Or comparing $\Phi(3.798)$ with 0.95 (or equiv. for one tail test) Signs consistent. Correct conclusion ft on their z and H_1		
5 (i) $P(9 \text{ or } 10H) = (0.5)^9 \times (0.5) \times {}_{10}C_9 + (0.5)^{10}$ $(= 0.01074)$ $P(9T \text{ or } 10T) = 0.01074$ $P(\text{type 1 error}) = 0.0215 \text{ AG}$ (ii) $P(9 \text{ or } 10H) = (0.7)^9 \times (0.3) \times {}_{10}C_9 + (0.7)^{10}$ $(= 0.1493)$ $P(9 \text{ or } 10T) = (0.3)^9 \times (0.7) \times {}_{10}C_9 + (0.3)^{10}$ $= 0.000143$ $P(\text{type II error}) = 1 - 0.1493 - 0.000143$ $= 0.851$	M1 M1 M1 A1 4 M1 M1 M1 A1 4	For $P(9 \text{ or } 10H)$ For $P(9 \text{ or } 10T)$ For identifying outcome for Type I error For obtaining given answer legitimately For evaluating $P(9 \text{ or } 10H)$ with $P(H) = 0.7$ For evaluating $P(9 \text{ or } 10T)$ 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) $\mu = 24,\ \sigma^2 = 24$ $z = \dfrac{19.5-24}{\sqrt{24}} = -0.9186$ $1 - \Phi(0.9186) = 0.179$	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) $E(X) = \int_{0}^{1} 2x(1-x)\ dx$ $= \int_{0}^{1} 2x - 2x^2\ dx$ $= \left[x^2 - \dfrac{2x^3}{3} \right] = 0.333$	M1 A1 A1	 3	For sensible attempt to integrate $xf(x)$ For correct integrand (any form) For correct answer
(ii) $Var(X) = \dfrac{\int_{0}^{1} 2x^2 - 2x^3 dx}{} - (0.333)^2$ $= \left[\dfrac{2x^3}{3} - \dfrac{2x^4}{4} \right] - (0.333)^2$ $= 0.0556$	M1* M1*dep A1	 3	For sensible attempt to integrate $x^2 f(x)$ 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 $\dfrac{(1-x)}{2} \times 2(1-x) = 0.02$	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.