

JUNE 2002

**GCE Advanced Level
GCE Advanced Subsidiary Level**

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7

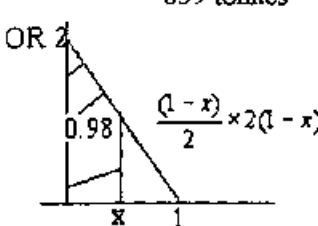
**MATHEMATICS
(Probability and Statistics 2)**



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1	$\bar{x} \pm 2.326 \times \frac{2.4}{\sqrt{90}}$ $\text{Width} = 2.326 \times \frac{2.4}{\sqrt{90}} \times 2$ $= 1.18$	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 4 M1 M1 B1 A1 4	$p \pm z \sqrt{\frac{pq}{n}}$ Calculation of correct form (SR M1 if only one side of interval seen) Use of $p = 0.275$ For correct answer $np \pm z \sqrt{npq}$ Calculation of correct form (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) $P(W < 2900) = \Phi\left(\frac{2900 - 2850}{\sqrt{1920}}\right)$ $\text{Or } P(W < 2550) = \Phi\left(\frac{2550 - 2850}{\sqrt{1920}}\right) = 0.873$	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 2 B1 M1 A1 M1 A1 5	For correct mean For correct variance Both hypotheses correct $\frac{s}{\sqrt{n}}$ For standardising attempt with se of form 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) $P(9 \text{ or } 10H) = (0.5)^9 \times (0.5) \times {}_{10}C_9 + (0.5)^{10}$ $= 0.01074$ $P(9T \text{ or } 10T) = 0.01074$ $P(\text{type I error}) = 0.0215$ 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 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)

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6 (i) mean = 6 $P(X = 5) = 0.161$ (ii) $\mu = 2$ $P(0) = e^{-2} (= 0.135)$ $1 - P(0) = 0.865$ (iii) $\mu = 24, \sigma^2 = 24$ $z = \frac{19.5 - 24}{\sqrt{24}} = -0.9186$ $1 - \Phi(0.9186) = 0.179$	M1 A1 2 B1 M1 A1 3 B1 B1 M1 A1 A1 5	For mean 6 and evaluating a Poisson prob For correct answer For $\mu = 2$ used in a Poisson prob. For $1 - P(0)$, any mean For correct answer 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) $E(X) = \int_0^1 2x(1-x) dx$ $= \int_0^1 2x - 2x^2 dx$ $= \left[x^2 - \frac{2x^3}{3} \right]_0^1 = 0.333$ (ii) $\text{Var}(X) = \int_0^1 2x^2 - 2x^3 dx - (0.333)^2$ $= \left[\frac{2x^3}{3} - \frac{2x^4}{4} \right]_0^1 - (0.333)^2$ $= 0.0556$ (iii) $\int_0^x 2(1-x) dx = 0.98$ $\left[2x - x^2 \right]_0^x = 0.98$ $x^2 - 2x + 0.98 = 0$ $x = 0.859$ 859 tonnes OR  $\frac{(1-x)}{2} \times 2(1-x) = 0.02$	M1 A1 A1 3 M1* M1*dep A1 3 M1 A1 M1 A1 B1 ft M1 A1 M1 A1 B1 5	For sensible attempt to integrate $xf(x)$ For correct integrand (any form) For correct answer For sensible attempt to integrate $x^2f(x)$ For their integral – (their mean)² For correct answer 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.