

JUNE 2002

**GCE Advanced Level
GCE Advanced Subsidiary Level**

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /7, 8719 /7

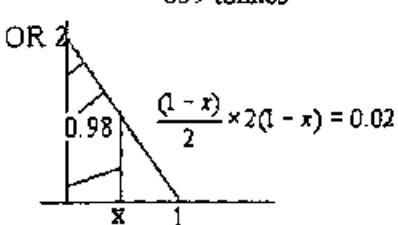
**MATHEMATICS
(Probability and Statistics 2)**



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<p>1 $\bar{x} \pm 2.326 \times \frac{2.4}{\sqrt{90}}$</p> <p>Width $2.326 \times \frac{2.4}{\sqrt{90}} \times 2$</p> <p>= 1.18</p>	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1 4</p>	<p>For z value of 2.33</p> <p>For expression of correct form involving $\sqrt{90}$ in denom</p> <p>For subtracting lower from upper, or multiplying half-width by 2</p> <p>For correct answer</p>
<p>2 EITHER</p> <p>$0.275 \pm 1.96 \times \sqrt{\frac{0.275 \times 0.725}{120}}$</p> <p>$0.195 < p < 0.355$</p> <p>OR</p> <p>$33 \pm 1.96 \sqrt{120 \times 0.275 \times 0.725}$</p> <p>$\frac{23.413}{120} < p < \frac{42.586}{120}$</p> <p>$0.195 < p < 0.355$</p>	<p>M2</p> <p>B1</p> <p>A1 4</p> <p>M1</p> <p>M1</p> <p>B1</p> <p>A1 4</p>	<p>Calculation of correct form $p \pm z \sqrt{\frac{pq}{n}}$ (SR M1 if only one side of interval seen)</p> <p>Use of $p = 0.275$</p> <p>For correct answer</p> <p>Calculation of correct form $np \pm z \sqrt{npq}$ (accept just one side of interval)</p> <p>Division by 120 (BOTH sides)</p> <p>Use of 0.275</p> <p>Correct answer</p>
<p>3 3 sugar ~ N(1500, 1200)</p> <p>5 coffee ~ N(1000, 720)</p> <p>Total weight ~ N(2850, 1920)</p> <p>or ~ N(2500, 1920)</p> <p>$P(W < 2900) = \Phi\left(\frac{2900 - 2850}{\sqrt{1920}}\right)$</p> <p>Or $P(W < 2550) = \Phi\left(\frac{2550 - 2500}{\sqrt{1920}}\right) = 0.873$</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 6</p>	<p>For (normal dist with) correct means for both</p> <p>For (normal dist with) correct variance for both</p> <p>For adding their variances and means(+ purse) for coffee and sugar</p> <p>For correct mean and variance for their total weight ie with or without the purse</p> <p>For standardising and use of tables (consistent inclusion/exclusion of purse)</p> <p>For correct answer</p>
<p>4 (i) $\bar{x} = 14.2, s^2 = \frac{1}{149} \left(37746 - \frac{2130^2}{150} \right) = 50.3(4)$</p> <p>(ii) $H_0: \mu = 12$ and $H_1: \mu \neq 12$</p> <p>Test statistic $z = \frac{14.2 - 12}{\sqrt{\frac{50.34}{150}}} = 3.798$</p> <p>Compare with 1.645 or 1.282 for one-tail t</p> <p>Reject exam boards claim</p>	<p>B1</p> <p>B1 2</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1 5</p>	<p>For correct mean</p> <p>For correct variance</p> <p>Both hypotheses correct</p> <p>For standardising attempt with se of form $\frac{s}{\sqrt{n}}$</p> <p>For 3.80</p> <p>Or comparing $\Phi(3.798)$ with 0.95 (or equiv. for one tail test) Signs consistent.</p> <p>Correct conclusion fit on their z and H_1</p>
<p>5 (i) $P(9 \text{ or } 10H) = (0.5)^9 \times (0.5) \times {}_{10}C_9 + (0.5)^{10}$ (= 0.01074)</p> <p>$P(9T \text{ or } 10T) = 0.01074$</p> <p>$P(\text{type I error}) = 0.0215$ AG</p> <p>(ii) $P(9 \text{ or } 10H) = (0.7)^9 \times (0.3) \times {}_{10}C_9 + (0.7)^{10}$ (= 0.1493)</p> <p>$P(9 \text{ or } 10T) = (0.3)^9 \times (0.7) \times {}_{10}C_9 + (0.3)^{10}$ = 0.000143</p> <p>$P(\text{type II error}) = 1 - 0.1493 - 0.000143$ = 0.851</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1 4</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1 4</p>	<p>For P(9 or 10H)</p> <p>For P(9 or 10T)</p> <p>For identifying outcome for Type I error</p> <p>For obtaining given answer legitimately</p> <p>For evaluating P(9 or 10H) with P(H) = 0.7</p> <p>For evaluating P(9 or 10T) with P(T) = 0.3</p> <p>For identifying outcome for Type II error</p> <p>For correct answer (SR 0.851 no working B2)</p>

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<p>6 (i) mean = 6 $P(X = 5) = 0.161$</p> <p>(ii) $\mu = 2$ $P(0) = e^{-2} (= 0.135)$ $1 - P(0) = 0.865$</p> <p>(iii) $\mu = 24, \sigma^2 = 24$ $z = \frac{19.5 - 24}{\sqrt{24}} = -0.9186$ $1 - \Phi(0.9186) = 0.179$</p>	<p>M1 A1 2</p> <p>B1 M1 A1 3</p> <p>B1 B1 M1 A1 A1 5</p>	<p>For mean 6 and evaluating a Poisson prob For correct answer</p> <p>For $\mu = 2$ used in a Poisson prob. For $1 - P(0)$, any mean For correct answer</p> <p>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)</p>
<p>7 (i) $E(X) = \int_0^1 2x(1-x) dx$</p> $= \int_0^1 2x - 2x^2 dx$ $= \left[x^2 - \frac{2x^3}{3} \right]_0^1 = 0.333$ <p>(ii) $\text{Var}(X) = \int_0^1 2x^2 - 2x^3 dx - (0.333)^2$</p> $= \left[\frac{2x^3}{3} - \frac{2x^4}{4} \right]_0^1 - (0.333)^2$ $= 0.0556$ <p>(iii) $\int_0^x 2(1-x) dx = 0.98$</p> $\left[2x - x^2 \right]_0^x = 0.98$ $x^2 - 2x + 0.98 = 0$ $x = 0.859$ <p>859 tonnes</p> <p>OR</p>  <p>$\frac{(1-x)}{2} \times 2(1-x) = 0.02$</p>	<p>M1</p> <p>A1</p> <p>A1 3</p> <p>M1*</p> <p>M1*dep</p> <p>A1 3</p> <p>M1</p> <p>A1 M1 A1 B1 ft</p> <p>M1 A1 M1 A1 B1 5</p>	<p>For sensible attempt to integrate $xf(x)$</p> <p>For correct integrand (any form)</p> <p>For correct answer</p> <p>For sensible attempt to integrate $x^2f(x)$</p> <p>For their integral - (their mean)²</p> <p>For correct answer</p> <p>For identifying both sides of equation</p> <p>For correct equation in any form For solving for x (must be sensible attempt) For correct answer For applying concept of continuous rv.</p> <p>For identifying x from a relevant diagram For correct equation For solving for x For correct answer For applying concept of continuous rv.</p>