

**NOVEMBER 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</p> $512 \pm 2.576 \times \sqrt{\frac{37.4}{120}}$ $49.8 < \mu < 52.6$	<p>M1 B1 A1 3</p>	$\bar{x} \pm z \frac{s}{\sqrt{n}}$ <p>Calculation of correct form Using <math>z = 2.576</math> Or equivalent statement</p>
<p>2 (i) <math>0.015n = 2.55</math> <math>n = 170</math> (ii) mean = <math>210 \times 0.015 (=3.15)</math></p> $P(0) + P(1) + P(2) = e^{-3.15} \left( 1 + 3.15 + \frac{3.15^2}{2} \right)$ $= 0.390 \text{ or } 0.391$ <p>SR use of Binomial scores B1 for final correct answer 0.389</p>	<p>M1 A1 2 B1 M1 A1 3</p>	<p>For equation linking <math>n, p</math> and mean For correct answer For new mean For evaluating Poisson <math>P(0) + P(1) + P(2) + [P(3)]</math> For correct answer</p>
<p>3 (i) <math>z = \frac{64.3 - 65}{4.9/\sqrt{n}} = -1.807</math> <math>n = 160</math> (ii) <math>H_0: \mu = 65</math> <math>H_1: \mu &lt; 65</math> Critical Value <math>\pm 1.645</math> Significant growth decrease</p>	<p>M1 M1 A1 3 B1 B1 M1 A1 4</p>	<p>For standardising equation = <math>\pm 1.807</math> with <math>n</math> or <math>\sqrt{n}</math> Solving for <math>n</math> For correct answer CWO. For <math>H_0</math> and <math>H_1</math> For <math>\pm 1.645</math> (or fit <math>\pm 1.96</math> for two tail test) Comparing given statistic with their CV Correct conclusion</p>
<p>4 (i) <math>H_0: \lambda = 4.8</math> <math>H_1: \lambda &lt; 4.8</math> Under <math>H_0</math> <math>P(0) = e^{-4.8} (=0.00823)</math> <math>P(1) = 0.0395</math> <math>P(2) = 0.0948</math> Critical region is <math>X = 0</math> or <math>1</math> Not enough evidence to say road sign has decreased accidents SR If M0, M0 allow M1 for stating / showing <math>P(0) + P(1) &lt; 10\%</math> (ii) <math>P(\text{Type I error}) = P(0) + P(1) = 0.0477</math></p>	<p>B1 M1 M1 A1 5 M1 A1 2</p>	<p>For both <math>H_0</math> and <math>H_1</math> For evaluating <math>P(0)</math> and <math>P(1)</math> and <math>P(2)</math> For stating/showing that <math>P(0) + P(1) + P(2) &gt; 10\%</math> For critical region. Correct conclusion For identifying correct outcome For correct answer</p>
<p>5 (i) new mean = 5.6 <math>P(X+Y &gt; 3) = 1 - \{P(0) + P(1) + P(2) + P(3)\}</math> <math display="block">= 1 - e^{-5.6} \left( 1 + 5.6 + \frac{5.6^2}{2!} + \frac{5.6^3}{3!} \right)</math> <math display="block">= 0.809</math> (ii) <math>\bar{X} \sim N\left(2.5, \frac{2.5}{80}\right)</math> or equiv. method using totals <math>N(200, 200)</math> <math display="block">P(X &lt; 2.4) = \Phi\left(\frac{2.4 - 2.5}{\sqrt{(2.5/80)}}\right) \text{ or } \Phi\left(\frac{192 - 200}{\sqrt{200}}\right)</math> <math display="block">= \Phi(-0.566)</math> <math display="block">= 1 - 0.7143 = 0.286</math></p>	<p>B1 M1 A1 A1 4 M1 A1 M1 A1 4</p>	<p>For new mean For evaluating <math>1 -</math> some Poisson probabilities For correct expression For correct answer For using normal distribution with mean <math>2.5 / 200</math> For correct variance For standardising and using normal tables For correct answer</p>

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<p>6 (i) <math>k \int_{20}^{28} \frac{1}{x^2} dx = 1</math></p> <p><math>k \left[ \frac{-1}{x} \right]_{20}^{28} = 1</math></p> <p><math>k \left[ \frac{1}{20} - \frac{1}{28} \right] = 1 \Rightarrow k = 70</math></p> <p>(ii) <math>E(X) = k \int_{20}^{28} \frac{1}{x} dx = k[\ln x]</math>  <math>= 23.6, 23.5, 70 \ln 1.4, 70 \ln (7/5)</math></p> <p>(iii) <math>P(X &lt; E(X)) = \int_{20}^{23.55} \frac{70}{x^2} dx</math>  <math>= 0.528</math> (accept 0.534 from 23.6)  ( 0.521 23.5)</p> <p>(iv) Greater  Prob in (iii) is <math>&gt; 0.5</math></p>	<p>M1</p> <p>A1</p> <p>A1 3</p> <p>M1</p> <p>A1</p> <p>A1 3</p> <p>M1</p> <p>A1 2</p> <p>B1ft</p> <p>B1ft 2</p>	<p>For equating to 1 and attempt to integrate</p> <p>Correct integration</p> <p>For given answer correctly obtained (no decimals seen).</p> <p>For attempt to evaluate <math>\int_{20}^{28} \frac{70}{x} dx</math></p> <p>For correct integration</p> <p>For correct answer</p> <p>For attempt to evaluate <math>\int_{20}^{23.55} \frac{70}{x^2} dx</math> between their limits (<math>&lt; 28</math>)</p> <p>For correct answer</p> <p>For correct statement</p> <p>For correct reason. Follow through from (iii) or calculating med. = 23.3</p>
<p>7 (i) <math>W \sim N(17.6, 0.133(2))</math></p> <p><math>\Phi\left(\frac{18-17.6}{\sqrt{0.1332}}\right) (= 0.8633)</math></p> <p><math>\Phi\left(\frac{17-17.6}{\sqrt{0.1332}}\right) = 1 - 0.9499 (= 0.0501)</math></p> <p><math>0.8633 - 0.0501 = 0.813</math></p> <p>(ii) Wt diff <math>D \sim N(0, 0.0072)</math></p> <p><math>P(D &gt; 0.05) = 1 - \Phi\left(\frac{0.05}{\sqrt{0.0072}}\right) = 1 - \Phi(0.589)</math></p> <p><math>= 0.278</math></p> <p><math>P(D &lt; 0.05) = 0.278</math></p> <p><math>0.278 + 0.278 = 0.556</math></p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1 5</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>For standardising and using tables</p> <p>For standardising and using tables</p> <p>For correct answer</p> <p>For correct mean and variance</p> <p>For standardising and using tables</p> <p>For 0.278 (could be implied)</p> <p>For finding the other probability</p> <p>For correct answer</p>