

4734

Mark Scheme

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<p>1(i)</p>	<p>Total has Poisson distribution with mean $\lambda = 0.21 \times 5 + 0.24 \times 5 = 2.25$</p> <p>$P(\geq 2) = 1 - e^{-\lambda}(1+\lambda)$ $= 0.657$</p>	<p>M1 A1 M1 A1 4</p>	<p>With $\times 5$</p> <p>λ or $1+\lambda$ in brackets (their λ) Or interpolation from tables</p>
<p>(ii)</p>	<p>EITHER: Each length is a random sample OR: Flaws occur independently on the reels</p>	<p>B1 1 [5]</p>	<p>In context Accept randomly</p>
<p>2</p>	<p>$H_0: \mu = (\text{or } \geq) 170, H_1: \mu < 170$ $\bar{x} = 167.5$ $s^2 = 5.9$</p> <p>EITHER: $(\alpha) (167.5 - 170) / \sqrt{(5.9/6)}$ $= -2.52(1)$ Compare with -2.015</p> <p>OR: $(\beta) 170 - t \sqrt{(5.9/6)}$ $= 168.0$ Compare 167.5 with CV and reject H_0 There is sufficient evidence at the 5% significance level that the machine dispenses less than 170 ml on average.</p>	<p>B1 B1 B1 M1 A1 M1 M1 A1 M1 A1 [7]</p>	<p>For both hypotheses; accept words SR 2-tail test: B0B1B1M1A1M1A0 Max 5/7</p> <p>Standardise 167.5; + or - for M; /6 seen Explicitly Allow 2.571</p> <p>Finding critical value or region. With $t = 2.015$ or 2.571 Explicitly. Allow correct use of t M0 if z used SR: B1 if no explicit comparison but conclusion "correct"</p>
<p>3(i)</p>	<p>H_0: There is no association between the area in which a shopper lives and the day they shop (H_1: All alternatives) E-Values 27.3 14.7 37.7 20.3 $\chi^2 = (4.3-0.5)^2(27.3^{-1}+37.7^{-1}+14.7^{-1}+20.3^{-1})$ $= 2.606$ Compare with 2.706 Do not reject H_0. There is insufficient evidence of an association.</p> <p>SR: If H_0 association, lose 1st B1 and last M1A1</p>	<p>B1 M1 A1 M1 ft A1 A1 M1 A1 8</p>	<p>SR difference in proportions B1 define and evaluate p_1 and p_2 with H_0 B1 for $p=0.42$ M1A1 for $z = \pm 1.827$ or 1.835 (no pe) M1A0 Max 5/8</p> <p>At least one E value correct (M1) All correct (A1) At least one χ^2, no or wrong cc, (M1FtE) All correct (A1); 2.606 or 2.61 (A1) Or use calculator ($p = 0.106$) SR: B1 if no explicit comparison, as Q2 SR: If H_0 association, lose 1st B1 and last M1A1</p>
<p>(ii)</p>	<p>Conclusion the same since critical value > 2.706 (and test statistic unchanged)</p>	<p>B1 1 [9]</p>	<p>OR from $z = \pm 2.17$, SR</p>

<p>4(i)</p>	<p>$s^2 = (1183.65 - 246.6^2/70)/69$ Use $\bar{x} \pm zs/\sqrt{(70)}$ $s/\sqrt{(70)}$ 1.645 (3.10, 3.94)</p>	<p>M1 M1 A1 A1 A1</p>	<p>AEF Allow without ft or with s^2; with 70 Their s A0 if interval not indicated</p>
<p>(ii)</p>	<p>Change 90 to around 90</p>	<p>B1</p>	<p>1 Or equivalent</p>
<p>(iii)</p>	<p>$4(0.9)^3(0.1) + 0.9^4$ $= 0.9477$</p>	<p>M1 A1</p>	<p>2 [8] Use of bino with $p=0.9$ or 0.1 and 4 and Correct terms considered. art 0.948</p>
<p>5(i)</p>	<p>$e^{-2.25} - e^{-4}$ $\times 150$ $= 13.1$ Last: $150 - \text{sum} = 2.7$</p>	<p>M1 A1 A1 A1 ft</p>	<p>4 Or find last entry using $F(x)$ Or 2.7 if found first Or 13.1 any accuracy</p>
<p>(ii)</p>	<p>(H_0: Data fits the model, H_1: Data does not fit) Combine last two cells $\chi^2 = 7.8^2/33.2 + 11.6^2/61.6 + 7.4^2/39.4 + 11.2^2/15.8$ $= 13.3(46)$ Compare with 9.348 (or 11.14), reject H_0 (There is sufficient evidence at the $2\frac{1}{2}\%$ significance level that) the model is not a good fit</p>	<p>B1 M1*Dep A1 A1 M1 A1 ft Dep*</p>	<p>6 [10] At least two correct All correct In range 13.2 to 13.5 SR: If last 2 cells are not combined B0M1A1A1(for 13.5) M1A1 If no explicit comparison B1 if conclusion follows</p>
<p>6(i)</p>	<p>Anxiety scores; have normal distributions; common variance; independent samples $H_0: \mu_E = \mu_C, H_1: \mu_E < \mu_C$ $s^2 = (1923.56 + 1147.58)/29 (= 105.9)$ $(t) = (32.16 - 38.21)/\sqrt{[105.9(18^{-1} + 13^{-1})]}$ $= -1.615$ $t_{crit} = -1.699$ Compare -1.615 with -1.699 and do not reject H_0 There is insufficient evidence at the 5% significance level to show that anxiety is reduced by listening to relaxation tapes</p>	<p>B2 B1 B1 M1 A1 A1 B1 M1 A1 ft</p>	<p>10 Context + 2 valid points B2 Context + 1VP, no context +2VP B1 Not in words Allow 1 error; eg $s^2 = 1923.56/(17 \text{ or } 18)$ All correct + $47.5/(12 \text{ or } 13)$ Or + Or +; accept art ± 1.70 Or +, +. M0 if t not $\pm 1.699, \pm 2.045$ In context, not over-assertive OR Find CV or CR: B2B1B1; C= or $\geq st, t = \pm 1.699$ or ± 2.015 M1A1 $t = \pm 1.699$ B1; G= 6.11(2) A1; $6.112 > 6.05$ and reject H_0 etc M1A1</p>
<p>(ii)</p>	<p>Sample sizes are too small (to appeal to CLT)</p>	<p>B1</p>	<p>1 [11]</p>

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<p>7(i)</p>	<p>Use $\sum F + \sum M \sim N(\mu, \sigma^2)$ $\mu = 1104.9$ $\sigma^2 = 6 \times 9.3^2 + 9 \times 8.5^2$ $= 1169.2$ $P(> 1150) = 1 - \Phi\left(\frac{1150 - 1104.9}{\sqrt{1169.2}}\right)$ $= 0.0937$</p>	<p>M1 A1 M1 A1 M1 A1</p>	<p>Sum of indep normal variables is normal</p> <p>Standardise, correct tail. M0 $\sigma/\sqrt{15}$ Accept .094</p>
<p>(ii)</p>	<p>If unknown M, prob $\frac{1}{2}$, 6F and 9M as before. If unknown W, prob $\frac{1}{2}$, 7W and 8M Having $N(1093.3, 1183.4)$ $P(> 1150) = 1 - \Phi(1.648) = 0.0497$ $P = \frac{1}{2} \times 0.0936 + \frac{1}{2} \times 0.0497$ $= 0.07165$</p>	<p>M1 B1 B1 A1 M1 A1</p>	<p>Considering two cases</p> <p>Mean and variance</p> <p>Use of $\frac{1}{2}$ ART 0.072</p>
<p>8(i)</p>	<p>$X = \frac{1}{4} S^2$</p> $F(s) = \int_1^s \frac{8}{3s^3} ds = \left[-\frac{4}{3s^2} \right]_1^s$ $= \frac{4}{3} (1 - 1/s^2)$ <p>$G(x) = P(X \leq x) = P(S \leq 2\sqrt{x})$ $= F(2\sqrt{x})$</p> $= \frac{4}{3} - \frac{1}{3x}$ $g(x) = \begin{cases} \frac{1}{3x^2} & \frac{1}{4} \leq x \leq 1, \\ 0 & \text{otherwise.} \end{cases}$	<p>B1 M1 A1 M1 A1 ft M1 B1</p>	<p>Ignore range here</p> <p>SR: B1 for $G(x) = F(2\sqrt{x})$ without justification and with correct result ft F</p> <p>For $G'(a)$ For range</p>
<p>(ii)</p>	<p>EITHER: $G(m) = \frac{1}{2}$ $\Rightarrow \frac{4}{3} - \frac{1}{3m} = \frac{1}{2}$ $\Rightarrow m = \frac{2}{5}$</p> <p>OR: $\int_{1/4}^m \frac{1}{3x^2} dx = \frac{1}{2}$ $\Rightarrow \left[-\frac{1}{3x} \right]_{1/4}^m = \frac{1}{2}$ $\Rightarrow m = \frac{2}{5}$</p>	<p>M1 A1 ft A1 M1 A1 A1</p>	<p>ft $G(x)$ in (i)</p> <p>CAO</p> <p>Allow wrong $\frac{1}{4}$</p> <p>Allow wrong $\frac{1}{4}$</p> <p>CAO</p>
		<p>6 [12]</p>	
		<p>7</p>	
		<p>3 [10]</p>	