

Question Number	Scheme	Marks
<p>1. (a)</p>	<p>Label members 1 → 240</p> <p>Use random numbers to select first from 1 – 8</p> <p>Select every 8th member (e.g. 6,14, 22, ...)</p>	<p>B1</p> <p>B1</p> <p>B1 (3)</p>
<p>(b)</p>	<p>e.g.: More convenient, efficient, faster etc. Any 1</p>	<p>B1 (1)</p> <p>(4 marks)</p>
<p>2. (a)</p>	<p>$\bar{P} \sim N\left(110, \frac{8^2}{16}\right)$ ie: $\bar{P} \sim N(110, 2^2)$</p>	<p>Normal B1</p> <p>110, 2² B1 (2)</p>
<p>(b)</p>	<p>$P(110 < \bar{P} < 113) = P\left(0 < Z < \frac{113-110}{2}\right)$</p> <p>= P (0 < Z < 1.5)</p> <p>= 0.4332</p>	<p>Standardising M1</p> <p>A1 ft</p> <p>AWRT 0.433 A1 (3)</p> <p>(5 marks)</p>
<p>3. (a)</p>	<p>Let T represent total time</p> <p>$\therefore E(T) = 225 + 165 + 185 = 575$</p> <p>$\text{Var}(T) = 38^2 + 23^2 + 27^2 = 2702$</p> <p>$\therefore P(533 < T < 655) = P(-0.81 < Z < 1.54)$</p> <p>= 0.7292</p>	<p>575 B1</p> <p>2702 B1</p> <p>M1 A1</p> <p>ft</p> <p>AWRT 0.729 A1 (5)</p>
<p>(b)</p>	<p>Let D represent the difference in times for tasks B and C (i.e. $B - C$)</p> <p>$\therefore E(D) = 165 - 185 = -20$</p> <p>$\text{Var}(D) = 23^2 + 27^2 = 1258$</p> <p>$\therefore P(D > 0) = P\left(Z > \frac{0 - (-20)}{\sqrt{1258}}\right)$</p> <p>= P(Z > 0.56)</p> <p>= 0.2877</p>	<p>B1</p> <p>B1</p> <p>Standardising M1 A1</p> <p>-20, $\sqrt{1258}$ ft</p> <p>AWRT 0.288 A1 (5)</p> <p>(10 marks)</p>

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4.	<p>(a) Attendance ranks 2, 1, 8, 5, 3, 6, 7, 4</p> $\sum d^2 = 48$ $r_s = 1 - \frac{6 \times 48}{8 \times 63}$ $= 0.4286$ <p>(b) $H_0 : \rho = 0; H_1 : \rho \neq 0.$</p> <p>With $n=8$, critical value is 0.7381</p> <p>Since 0.429 is not in the critical region ($\rho < -0.7381$ or $\rho > 0.7381$) then there is no evidence to reject H_0 and it can be concluded that at the 5% level there is no evidence of correlation between league position and attendance</p> <p>(c) Share ranks evenly.</p> <p>Use product moment correlation coefficient on ranks.</p>	<p>B1</p> <p>Attempt to find $\sum d^2$ M1 A1</p> <p>Substitution of their $\sum d^2$ M1</p> <p>awrt 0.429 A1 ft (5)</p> <p>both B1</p> <p>0.7381 B1</p> <p>Correct comparison M1</p> <p>Conclusion A1 ft (4)</p> <p>B1</p> <p>B1 (2)</p> <p>(11 marks)</p>
5.	<p>(a) $P(X = x) = \frac{1}{6}; x = 1, 2, \dots, 6.$</p> <p>(b) Discrete uniform distribution</p> <p>(c) H_0: Discrete uniform distribution is a suitable model</p> <p>H_1: Discrete uniform distribution is <u>not</u> a suitable model</p> <p>$\alpha = 0.05 \quad \nu = 5; \quad \text{CR: } \chi^2 > 11.070$</p> $\sum \frac{(O - E)^2}{E} = \frac{1}{50} \{9^2 + 1^2 + 2^2 + 8^2 + 13^2 + 13^2\}$ $= \frac{448}{50} = \underline{9.76}$ <p>Since 9.76 is not in the critical region there is no evidence to reject H_0 and thus the data is compatible with the assumption.</p>	<p>B1 B1 (2)</p> <p>B1 (1)</p> <p>B1</p> <p>B1</p> <p>B1 B1</p> <p>All E's=50 B1</p> <p>$\sum \frac{(O - E)^2}{E}$ M1 A1</p> <p>A1 ft (8)</p> <p>(11 marks)</p>

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6. (a)	$H_0 : \mu_L = \mu_H; H_1 : \mu_L \neq \mu_H$ $\text{s.e.} = \sqrt{\frac{8.13^2}{400} + \frac{6.69^2}{300}}$ $= 0.5607$ $\alpha = 0.05 \Rightarrow \text{C.R: } z < -1.96 \text{ or } z > 1.96$ $\text{Test statistic: } z = \frac{6.40 - 7.42}{0.5607} = \underline{-1.819}$ <p>Since -1.819 is not in the critical region then there is no evidence to reject H_0 and thus it can be concluded that there is no difference in mean expenditure on tobacco.</p>	B1 B1 M1 A1 A1 B1 M1 A1 A1 ft (9)
(b)	C. L. Theorem enables use of $\bar{L} \sim \text{Normal}$ and $\bar{H} \sim \text{Normal}$.	\bar{L} or \bar{H} B1 Normal B1 (2)
(11 marks)		

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7.	Observed Frequencies					
		Pass	Fail	Total		
	Male	23	27	50		
	Female	32	18	50		
	Total	55	45	100		
	Expected Frequencies					
		Pass	Fail	Total		Use of $\frac{R_r \times C_c}{100}$
	Male	27.5	22.5	50		27.5
	Female	27.5	22.5	50		22.5
	Total	55	45	100		
	H_0 : No association between gender and test result					B1
	H_1 : Association between gender and test result					B1
	$\sum \frac{(O - E)^2}{E} = \frac{(23 - 27.5)^2}{27.5} + \dots + \frac{(18 - 22.5)^2}{22.5}$					Use of $\sum \frac{(O - E)^2}{E}$
	= 3.27					M1 A1
$\alpha = 0.10 \Rightarrow \chi^2 > 2.705$				A1		
$\alpha = 0.10 \Rightarrow \chi^2 > 2.705$				v = 1		
Since 3.27 is in the critical region there is evidence of association between gender and test result.				B1		
				2.705		
				B1		
				A1 ft		
				(11)		
				(11 marks)		

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<p>8. (a)</p> <p>(b)</p> <p>(c)</p>	$\bar{x} = \hat{\mu} = \frac{85.2}{12} = 7.10$ $s^2 = \frac{1}{11} \left\{ 906.18 - \frac{(85.2)^2}{12} \right\}$ $= 27.3873$ <p>Confidence interval is given by</p> $7.10 \pm 1.6449 \times \frac{5.1}{\sqrt{12}}$ <p>ie:- (4.6783, 9.5216)</p> <p>The value 4 is not in the interval; Thus the claim is not substantiated.</p>	<p>M1A1</p> <p>Substitution in correct formula M1</p> <p>Complete correct expression A1 ft</p> <p>AWRT 27.4 A1 (5)</p> <p>$\bar{x} \pm z_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$ M1</p> <p>Correct expression with their values A1 ft</p> <p>1.6449 B1</p> <p>AWRT (4.68, 9.52) A1 A1 (5)</p> <p>B1</p> <p>B1 (2)</p> <p>(12 marks)</p>