

Question Number	Scheme	Marks
1.	<p>(a) Label members 1 \rightarrow 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>(b) e.g.: More convenient, efficient, faster etc. Any 1</p>	<p>B1</p> <p>B1</p> <p>B1 (3)</p> <p>B1 (1)</p> <p>(4 marks)</p>
2.	<p>(a) $\bar{P} \sim N\left(110, \frac{8^2}{16}\right)$ ie: $\bar{P} \sim N(110, 2^2)$</p> <p>(b) $P(110 < \bar{P} < 113) = P\left(0 < Z < \frac{113-110}{2}\right)$</p> <p style="padding-left: 40px;">$= P(0 < Z < 1.5)$</p> <p style="padding-left: 40px;">$= 0.4332$</p>	<p>Normal B1</p> <p>110, 2² B1 (2)</p> <p>Standardising M1</p> <p>A1 ft</p> <p>AWRT 0.433 A1 (3)</p> <p>(5 marks)</p>
3.	<p>(a) 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 style="padding-left: 40px;">$= 0.7292$</p> <p>(b) 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 style="padding-left: 40px;">$= P(Z > 0.56)$</p> <p style="padding-left: 40px;">$= 0.2877$</p>	<p>575 B1</p> <p>2702 B1</p> <p>Standardising M1 A1</p> <p>ft</p> <p>AWRT 0.729 A1 (5)</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>

Question Number	Scheme	Marks	
4.	(a) Attendance ranks 2, 1, 8, 5, 3, 6, 7, 4	B1	
	$\sum d^2 = 48$	Attempt to find $\sum d^2$ M1 A1	
	$r_s = 1 - \frac{6 \times 48}{8 \times 63}$	Substitution of their $\sum d^2$ M1	
	$= 0.4286$	awrt 0.429 A1 ft (5)	
	(b) $H_0 : \rho = 0; H_1 : \rho \neq 0.$	both B1	
	With $n=8$, critical value is 0.7381	0.7381 B1	
	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	Correct comparison M1	
		Conclusion A1 ft (4)	
	(c) Share ranks evenly.	B1	
	Use product moment correlation coefficient on ranks.	B1 (2)	
(11 marks)			
5.	(a) $P(X = x) = \frac{1}{6}; x = 1, 2, \dots, 6.$	B1 B1 (2)	
	(b) Discrete uniform distribution	B1 (1)	
	(c) H_0 : Discrete uniform distribution is a suitable model	B1	
	H_1 : Discrete uniform distribution is <u>not</u> a suitable model	B1	
	$\alpha = 0.05 \quad \nu = 5; \quad \text{CR: } \chi^2 > 11.070$	B1 B1	
	$\sum \frac{(O - E)^2}{E} = \frac{1}{50} \{9^2 + 1^2 + 2^2 + 8^2 + 13^2 + 13^2\}$	All E's=50 B1	
	$= \frac{448}{50} = \underline{9.76}$	$\sum \frac{(O - E)^2}{E}$ M1 A1	
	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.	A1 ft (8)	
	(11 marks)		

Question Number	Scheme	Marks
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 Substitute into s.e. M1 Complete correct expression A1 AWRT 0.561 A1 ± 1.96 B1 $(\bar{x}_L - \bar{x}_H) / \text{their s.e.}$ M1 AWRT ± 1.82 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)

Question Number	Scheme				Marks	
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

$$\sum \frac{(O - E)^2}{E} = \frac{(23 - 27.5)^2}{27.5} + \dots + \frac{(18 - 22.5)^2}{22.5}$$

$$= 3.27$$

Use of $\sum \frac{(O - E)^2}{E}$

M1 A1

A1

$$\alpha = 0.10 \Rightarrow \chi^2 > 2.705$$

$$v = 1$$

B1

Since 3.27 is in the critical region there is evidence of association between gender and test result.

$$2.705$$

B1

A1 ft (11)

(11 marks)

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