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

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*)	$H_o : \rho = 0;\ H_1 : \rho \neq 0.$ both	B1
		With *n*=8, critical value is 0.7381 0.7381	B1
		Since 0.429 is not in the critical region $(\rho < -0.7381 \text{ or } \rho > 0.7381)$ then there is no evidence to reject H_o 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*)	$P(X = x) = \frac{1}{6};\ x = 1, 2, \ldots, 6.$	B1 B1 (2)
	(*b*)	Discrete uniform distribution	B1 (1)
	(*c*)	H_o : Discrete uniform distribution is a suitable model	B1
		H_1 : Discrete uniform distribution is <u>not</u> a suitable model	B1
		$\alpha = 0.05 \quad \nu = 5;$ 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)	$H_o : \mu_L = \mu_H; H_1 : \mu_L \neq \mu_H$		B1 B1
		s.e. $= \sqrt{\frac{8.13^2}{400} + \frac{6.69^2}{300}}$	Substitute into s.e.	M1
			Complete correct expression	A1
		$= 0.5607$	AWRT 0.561	A1
		$\alpha = 0.05 \Rightarrow$ C.R: $z < -1.96$ or $z > 1.96$	± 1.96	B1
		Test statistic: $z = \frac{6.40 - 7.42}{0.5607} = \underline{-1.819}$	$(\bar{x}_L - \bar{x}_H)$/ their s.e.	M1
			AWRT ± 1.82	A1
		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.		A1 ft (9)
	(b)	C. L. Theorem enables use of $\bar{L} \sim$ Normal and $\bar{H} \sim$ 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 $\frac{R_T \times C_T}{100}$ Male 27.5 22.5 50 27.5 Female 27.5 22.5 50 22.5 Total 55 45 100	M1 A1 A1
	H_o : No association between gender and test result	B1
	H_1 : Association between gender and test result	B1
	$\sum \frac{(O-E)^2}{E} = \frac{(23-27.5)^2}{27.5} + \ldots \frac{(18-22.5)^2}{22.5}$ Use of $\sum \frac{(O-E)^2}{E}$	M1 A1
	$= 3.27$	A1
	$\alpha = 0.10 \Rightarrow \chi^2 > 2.705$ $\quad v = 1$	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*)	$\bar{x} = \hat{\mu} = \frac{85.2}{12} = \underline{7.10}$		M1A1	
		$s^2 = \frac{1}{11}\left\{906.18 - \frac{(85.2)^2}{12}\right\}$	Substitution in correct formula	M1	
			Complete correct expression	A1 ft	
		$= 27.3873$	AWRT 27.4	A1	(5)
	(*b*)	Confidence interval is given by	$\bar{x} \pm z_{\frac{\alpha}{2}} \cdot \frac{s}{\sqrt{n}}$	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)