Question Number		Scheme	Marks
1.	(*a*)	Stratified	B1 **(1)**
	(*b*)	Label De-luxe rooms 1 – 20	B1
		Using *random numbers* in range 1 – 20 select *2 rooms*	B1 B1
		Repeat for Premier using 1 – 40 and select 4 rooms Repeat for Standard using 1 – 100 and select 10 rooms	B1 **(4)**
			(5 marks)
2.	(*a*)	$H_0 : \mu_A = \mu_B$ $\quad$ $H_1 : \mu_A \neq \mu_B$	B1 B1
		standard error = $\sqrt{\frac{9.1^2}{100}+\frac{8.4^2}{120}} = 1.19$ (awrt)	M1 A1
		$\alpha = 0.01 \Rightarrow$ CR: $z < -2.5758$ or $z > 2.5758$	B1 need both
		$z = \frac{70.6-67.2}{1.19} = 2.86$ (awrt)	M1 A1
		Since 2.86 is in the critical range, H_0 is rejected. There is evidence of a difference in mean playing time.	A1ft **(8)**
	(*b*)	Central Limit Theorem applies to enable normal distribution to be used.	B1 **(1)**
			(9 marks)
3.	(*a*)	$\overline{M} \sim \text{N}(80, \frac{2.6^2}{10})$ or N (80, 0.676)	B1 B1 **(2)**
	(*b*)	$P(\overline{M} < 78.5) = P(z < \frac{78.5-80}{2.6/\sqrt{10}})$	M1
		$= P(z < -1.82)$	A1
		$= 0.0344$	A1 **(3)**
	(*c*)	Let W = weight of all 10 people	
		$W = M_1 + \dots + M_6 + F_1 + \dots + F_4$	
		$E(W) = (6 \times 80) + (4 \times 59) = 716$	B1
		$Var(W) = (6 \times 2.6^2) + (4 \times 1.9^2) = 55$	B1
		$P(W > 730) = P(z > \frac{730-716}{\sqrt{55}})$	M1 A1
		$= P(z > 1.89)$	
		$= 0.0294$	A1 **(5)**
			(10 marks)

awrt = "anything which rounds to…"

Question Number	Scheme	Marks
4. (*a*)		A	B	C	D	E	F	G	H	I	J | Performance 10 5 8 3 9 6 1 4 7 2 Dedication 7 6 3 5 9 10 4 2 8 1	M1
	$\Sigma d^2 = 70$	M1 A1
	$r_s = 1 - \dfrac{6 \times 70}{10 \times 99} = 0.576$	M1 A1 **(5)**
(*b*)	$H_0: \rho = 0$; $H_1: \rho \neq 0$	B1 B1
	$n = 10 \Rightarrow$ critical value = 0.5636	B1
	0.576 is in the critical region	M1
	Evidence of correlation between performance and dedication.	A1ft **(5)**
(*c*)	Likely to be an element of judgement in grading. Dedication unlikely to be normally distributed.	B1 **(1)**
		(11 marks)
5.	Expected Frequency Male: 50.98 27.85 39.17 Female: 57.02 31.15 48.83	M1 A1 A1
	H_0: no association between gender and facility	B1
	H_1: Association between gender and facility	B1
	$\sum \dfrac{(O-E)^2}{E} = \dfrac{(50.98-40)^2}{50.98} + \dfrac{(57.02-68)^2}{57.02} + \ldots + \dfrac{(43.83-31)^2}{43.83}$	M1 A1
	$= 12.7$	A1
	$\alpha = 0.05$, $\underline{\nu = 2} \Rightarrow$ CR: $\chi^2 > \underline{5.991}$	<u>B1</u> <u>B1</u>
	Evidence of association between gender and facility	A1ft **(11)**
		(11 marks)

ft = follow through mark

Question Number		Scheme	Marks
6.	(*a*)	$R = 43.76$; $S = 54.68$; $T = 43.76$ using tables	M1 A1; B1 B1
		(OR $R = 43.75$; $S = 54.69$; $T = 43.75$ using calculator)	**(4)**
	(*b*)	H_0: Binomial model with $n = 8$, $p = 0.5$ is suitable H_1: Binomial model with $n = 8$, $p = 0.5$ is not suitable	B1 (both)
		Amalgamation of data	M1
		$\sum \frac{(O-E)^2}{E} = 5.69$ (awrt)	M1 A1
		$\alpha = 0.05$, $\underline{\nu = 6} \Rightarrow$ CR: $\chi^2 > \underline{12.592}$	<u>B1</u> <u>B1</u>
		Since 5.69 is not in the critical region there is no evidence to reject H_0. The binomial model with $n = 8$ and $p = 0.5$ is a suitable model.	A1ft **(7)**
	(*c*)	Apart from the expected values and $\sum \frac{(O-E)^2}{E}$ being different, the degrees of freedom would have been reduced by 1 ($\nu = 5$).	B1 **(1)**
			(12 marks)
7.	(*a*)	Cooling by subtracting 500 for each observation gives	
		Mean $= 500 + \frac{22}{10} = 502.2$	M1 A1
		Variance $= \frac{1}{9}\{288 - \frac{22^2}{10}\} = 26.622$	M1 A1 A1 **(5)**
	(*b*)	Limits are $502.2 \pm 1.6449 \times 5.0$	M1
		(493.98, 510.42) [accept (494, 510)]	A1 **(2)**
	(*c*)	95 % confidence limits are	
		$502.2 \pm 1.96 \times \frac{5.0}{\sqrt{10}}$	M1 A1ft B1 (for 1.96)
		(499, 505)	A1 A1 **(5)**
	(*d*)	H_0: $\mu = 500$ H_1: $\mu > 500$	B1 (both)
		$\alpha = 0.05 \Rightarrow$ CR: $z > 2.3263$	B1
		$z = \frac{503.9 - 500}{5.0/\sqrt{15}} = 1.47$	M1 A1
		1.47 is not in the critical region $\Rightarrow$ no evidence to reject H_0; no evidence to suggest mean is greater than 500g	A1 ft **(5)**
			(17 marks)