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*)	$H_0 : \mu_A = \mu_B$ $H_1: \mu_A \neq \mu_B$	B1 B1
		standard error $= \sqrt{\dfrac{9.1^2}{100} + \dfrac{8.4^2}{120}} = 1.19$ (awrt)	M1 A1
		$\alpha = 0.01 \Rightarrow$ CR: $z < -2.5758$ or $z > 2.5758$	B1 need both
		$z = \dfrac{70.6 - 67.2}{1.19} = 2.86$ (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*)	$\overline{M} \sim N (80, \dfrac{2.6^2}{10})$ or N (80, 0.676)	B1 B1 **(2)**
	(*b*)	$P(\overline{M} < 78.5) = P(z < \dfrac{78.5 - 80}{2.6 / \sqrt{10}})$	M1
		$= P(z < -1.82)$	A1
		$= 0.0344$	A1 **(3)**
	(*c*)	Let W = weight of all 10 people	
		$W = M_1 + \ldots + M_6 + F_1 + \ldots + F_4$	
		$E(W) = (6 \times 80) + (4 \times 59) = 716$	B1
		$\text{Var}(W) = (6 \times 2.6^2) + (4 \times 1.9^2) = 55$	B1
		$P(W > 730) = P(z > \dfrac{730 - 716}{\sqrt{55}})$	M1 A1
		$= P(z > 1.89)$	
		$= 0.0294$	A1 **(5)**
			(10 marks)

awrt = "anything which rounds to…"

Question Number	Scheme	Marks
4. (a)	 $\quad\quad\quad\quad A \quad B \quad C \quad D \quad E \quad F \quad G \quad H \quad I \quad J$ Performance $\;10 \quad 5 \quad 8 \quad 3 \quad 9 \quad 6 \quad 1 \quad 4 \quad 7 \quad 2$ Dedication $\;\;\;7 \quad 6 \quad 3 \quad 5 \quad 9 \quad 10 \quad 4 \quad 2 \quad 8 \quad 1$	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
	$\Sigma \dfrac{(O-E)^2}{E} = \dfrac{(50.98-40)^2}{50.98} + \dfrac{(57.02-68)^2}{57.02} + \ldots + \dfrac{(43.83-31)^2}{43.83}$	M1 A1
	$\quad\quad = 12.7$	A1
	$\alpha = 0.05, \; \underline{\nu = 2} \Rightarrow$ CR: $\chi^2 > \underline{5.991}$	B1 B1
	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
		$\sum \dfrac{(O - E)^2}{E} = 5.69$ (awrt)	M1 A1
		$\alpha = 0.05$, $\underline{v = 6} \Rightarrow$ 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 $\sum \dfrac{(O - E)^2}{E}$ being different, the degrees of freedom would have been reduced by 1 ($v = 5$).	B1 **(1)**
			(12 marks)
7.	(*a*)	Cooling by subtracting 500 for each observation gives	
		Mean $= 500 + \dfrac{22}{10} = 502.2$	M1 A1
		Variance $= \frac{1}{9} \{ 288 - \dfrac{22^2}{10} \} = 26.622$	M1 A1 A1 **(5)**
	(*b*)	Limits are $502.2 \pm 1.6449 \times 5.0$	M1
		$\qquad$ (493.98, 510.42) $\qquad\qquad$ [accept (494, 510)]	A1 **(2)**
	(*c*)	95 % confidence limits are	
		$\qquad 502.2 \pm 1.96 \times \dfrac{5.0}{\sqrt{10}}$	M1 A1ft B1 (for 1.96)
		$\qquad$ (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
		$z = \dfrac{503.9 - 500}{5.0 / \sqrt{15}} = 1.47$	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)