

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

awrt = “anything which rounds to...”

Question Number	Scheme	Marks																																	
<p>4. (a)</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 5%;">A</th> <th style="width: 5%;">B</th> <th style="width: 5%;">C</th> <th style="width: 5%;">D</th> <th style="width: 5%;">E</th> <th style="width: 5%;">F</th> <th style="width: 5%;">G</th> <th style="width: 5%;">H</th> <th style="width: 5%;">I</th> <th style="width: 5%;">J</th> </tr> </thead> <tbody> <tr> <td>Performance</td> <td>10</td> <td>5</td> <td>8</td> <td>3</td> <td>9</td> <td>6</td> <td>1</td> <td>4</td> <td>7</td> <td>2</td> </tr> <tr> <td>Dedication</td> <td>7</td> <td>6</td> <td>3</td> <td>5</td> <td>9</td> <td>10</td> <td>4</td> <td>2</td> <td>8</td> <td>1</td> </tr> </tbody> </table> <p>$\Sigma d^2 = 70$</p> <p>$r_s = 1 - \frac{6 \times 70}{10 \times 99} = 0.576$</p> <p>(b) $H_0: \rho = 0; H_1: \rho \neq 0$</p> <p>$n = 10 \Rightarrow$ critical value = 0.5636</p> <p>0.576 is in the critical region</p> <p>Evidence of correlation between performance and dedication.</p> <p>(c) Likely to be an element of judgement in grading. Dedication unlikely to be normally distributed.</p>		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	<p>M1</p> <p>M1 A1</p> <p>M1 A1 (5)</p> <p>B1 B1</p> <p>B1</p> <p>M1</p> <p>A1ft (5)</p> <p>B1 (1)</p> <p>(11 marks)</p>
	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																									
<p>5.</p>	<p>Expected Frequency Male: 50.98 27.85 39.17 Female: 57.02 31.15 48.83</p> <p>H_0: no association between gender and facility</p> <p>H_1: Association between gender and facility</p> <p>$\Sigma \frac{(O - E)^2}{E} = \frac{(50.98 - 40)^2}{50.98} + \frac{(57.02 - 68)^2}{57.02} + \dots + \frac{(43.83 - 31)^2}{43.83}$</p> <p style="text-align: center;">= 12.7</p> <p>$\alpha = 0.05, \nu = 2 \Rightarrow$ CR: $\chi^2 > 5.991$</p> <p>Evidence of association between gender and facility</p>	<p>M1 A1 A1</p> <p>B1</p> <p>B1</p> <p>M1 A1</p> <p>A1</p> <p><u>B1 B1</u></p> <p>A1ft (11)</p> <p>(11 marks)</p>																																	

ft = follow through mark

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