

**EDEXCEL STATISTICS S1 (6683)
PROVISIONAL MARK SCHEME NOVEMBER 2003**

Question Number	Scheme	Marks																										
1.	<p>(a)</p> <p>The graph shows a positive linear correlation between Performance Score and Salary. The x-axis is labeled 'Performance Score' and ranges from 0 to 50 with major grid lines every 10 units and minor grid lines every 2 units. The y-axis is labeled 'Salary (£00's)' and ranges from 0 to 400 with major grid lines every 50 units and minor grid lines every 10 units. There are 12 data points marked with 'x' and one point marked with a solid dot at (25, 240). A line of best fit is drawn through the points, starting at the origin (0,0) and passing through approximately (40, 400).</p> <table border="1"> <caption>Data points from the scatter plot</caption> <thead> <tr> <th>Performance Score</th> <th>Salary (£00's)</th> </tr> </thead> <tbody> <tr><td>15</td><td>125</td></tr> <tr><td>16</td><td>210</td></tr> <tr><td>19</td><td>185</td></tr> <tr><td>20</td><td>170</td></tr> <tr><td>22</td><td>190</td></tr> <tr><td>23</td><td>240</td></tr> <tr><td>24</td><td>225</td></tr> <tr><td>25</td><td>220</td></tr> <tr><td>26</td><td>230</td></tr> <tr><td>29</td><td>310</td></tr> <tr><td>38</td><td>380</td></tr> <tr><td>39</td><td>400</td></tr> </tbody> </table>	Performance Score	Salary (£00's)	15	125	16	210	19	185	20	170	22	190	23	240	24	225	25	220	26	230	29	310	38	380	39	400	<p>Scales and labels B1 Points B3 (-1e.e.) (4)</p>
Performance Score	Salary (£00's)																											
15	125																											
16	210																											
19	185																											
20	170																											
22	190																											
23	240																											
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25	220																											
26	230																											
29	310																											
38	380																											
39	400																											

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	<p>(b) $S_{xy} = 69798 - \frac{256 \times 2465}{10} = \underline{6694}$ 256, 2465</p> <p style="padding-left: 150px;">S_{xy} or S_{xx}</p> <p>$S_{xx} = 7266 - \frac{256^2}{10} = \underline{712.4}$ 6694</p> <p style="padding-left: 150px;">712.4</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>A1 (4)</p>
	<p>(c) $b = \frac{6694}{712.4} = \underline{9.3964\dots}$</p> <p>(i) $a = \frac{2465}{10} - \frac{6694}{712.4} \times \frac{256}{10} = \underline{5.95199\dots}$</p> <p>$\therefore \underline{y = 5.95 + 9.40x}$ 3.s.f.</p>	<p>M1 A1</p> <p>B1</p> <p>B1 \checkmark</p>
	<p>(ii) Line on graph</p>	<p>B1 (5)</p>
	<p>(d) Salary increases by £940 for every 1 point performance increase</p>	<p>B1 (1)</p>
	<p>(e) $x = 35 \Rightarrow y = 334.95$</p> <p>Salary is £33,495</p>	<p>B1</p> <p>B1 \checkmark (2)</p>
		<p style="text-align: right;"><u>16</u></p>

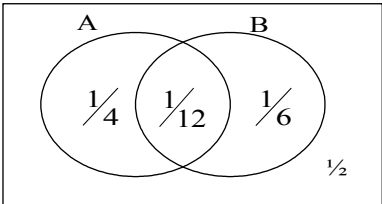
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Question Number	Scheme	Marks															
2.	<p>(a) $P(\text{scores 30 points}) = P(\text{hit, hit, hit,}) = 0.6^3 = 0.216$ 0.6^3</p> <p style="text-align: right;">0.216</p>	<p>M1</p> <p>A1 (2)</p>															
	<p>(b)</p> <table border="1" style="display: inline-table; margin-right: 20px;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">10</td> <td style="padding: 5px;">20</td> <td style="padding: 5px;">30</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;">0.4</td> <td style="padding: 5px;">0.6×0.4</td> <td style="padding: 5px;">$0.6^2 \times 0.4$</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">$P(X=x)$</td> <td style="padding: 5px;">0.4</td> <td style="padding: 5px;">0.24</td> <td style="padding: 5px;">0.144</td> <td style="padding: 5px;">(0.216)</td> </tr> </table> <p style="font-size: small; margin-left: 20px;">$x = 0, 10, 20, 30$ One correct $P(X=x)$ 0.4; 0.24; 0.144</p>	x	0	10	20	30		0.4	0.6×0.4	$0.6^2 \times 0.4$		$P(X=x)$	0.4	0.24	0.144	(0.216)	<p>B1</p> <p>M1</p> <p>A1; A1; A1</p> <p style="text-align: right;">(5)</p>
	x	0	10	20	30												
		0.4	0.6×0.4	$0.6^2 \times 0.4$													
	$P(X=x)$	0.4	0.24	0.144	(0.216)												
	<p>(c) $E(X) = (0 \times 0.4) + \dots + (30 \times 0.216) = \underline{11.76}$ $\sum xP(X=x)$</p> <p style="text-align: right;">11.8</p>	<p>M1</p> <p>A1</p>															
	<p>$E(X^2) = (10^2 \times 0.24) + \dots + (30^2 \times 0.216) = \underline{276}$</p>	<p>B1</p>															
	<p>Std Dev = $\sqrt{276 - 11.76^2} = 11.7346\dots$ $\sqrt{E(X^2) - (E(X))^2}$</p> <p style="text-align: right;">11.7</p>	<p>M1</p> <p>A1 (5)</p>															
	<p>(d) P (Linda scores more in round 2 than in round 1)</p> <p style="margin-left: 40px;">$= P(X_1 = 0 \ \& \ X_2 = 10, 20, 30) \ X_2 > X_1$</p> <p style="margin-left: 80px;">$+ P(X_1 = 0 \ \& \ X_2 = 10, 20, 30)$</p> <p style="margin-left: 120px;">All possible</p> <p style="margin-left: 80px;">$+ P(X_1 = 20 \ \& \ X_2 = 30)$</p> <p style="margin-left: 40px;">$= 0.4 \times (0.24 + 0.144 + 0.216)$</p> <p style="margin-left: 80px;">$+ (0.24(0.144 + 0.216))$</p> <p style="margin-left: 80px;">$+ (0.144 \times 0.126)$</p> <p style="margin-left: 40px;"><u>$= 0.357504$</u></p> <p style="text-align: right;">0.358</p>	<p>M1</p> <p>A1</p> <p>A1 \checkmark</p> <p>A1 \checkmark</p> <p>A1 \checkmark</p> <p>A1 \checkmark</p> <p>A1 (6)</p> <p style="text-align: right;">18</p>															

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3.	<p>(a)(i) Let X represent amount of sauce in a jar. $\therefore X \sim N(505, 10^2)$</p>	
	$\therefore P(X < 500) = P\left(Z < \frac{500 - 505}{10}\right)$	Standardising with 505, 10 M1
	$= P(Z < -0.5)$	-0.5 A1
	$= 1 - 0.6915$	
	$= \underline{0.3085}$	0.3085 A1
	<p>(ii) Expected number = 30×0.3085</p>	$30 \times (i)$ M1
	$= \underline{9.225}$	9.23 A1
	<p>(b) $P(X < 500) = 0.01$</p>	B1
	$\therefore \frac{500 - \mu}{10} = -2.3263$	Standardising M1 -2.3263 B1
	$\therefore \underline{\mu = 523.263}$	523 A1 (4)
		9

**EDEXCEL STATISTICS S1 (6683)
PROVISIONAL MARK SCHEME NOVEMBER 2003**

Question Number	Scheme	Marks
4.	(a) A list of all possible outcomes of an experiment	B1 (1)
	(b) A set of outcomes of an experiment	B1 (1)
	(c) $P(A \cap B) = P(A)P(B) = \frac{1}{3} \times \frac{1}{4} = \underline{\frac{1}{12}}$	B1 (1)
	(d) $P(A B) = P(A) = \frac{1}{3}$	Application of indep. M1 1/3 A1 (2)
	(e) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= \frac{1}{3} + \frac{1}{4} - \frac{1}{12}$ $= \underline{\frac{1}{2}}$	Application of $P(A \cup B)$ M1 $\frac{1}{2}$ A1 (2) <u>7</u>
	<p>Aliter</p>  <p>A Venn diagram with two overlapping circles, A and B, inside a rectangular frame. Circle A is on the left and contains the fraction 1/4. Circle B is on the right and contains the fraction 1/6. The overlapping region between A and B contains the fraction 1/12. Below circle B, outside the frame, is the fraction 1/2. The labels A and B are placed above their respective circles.</p>	

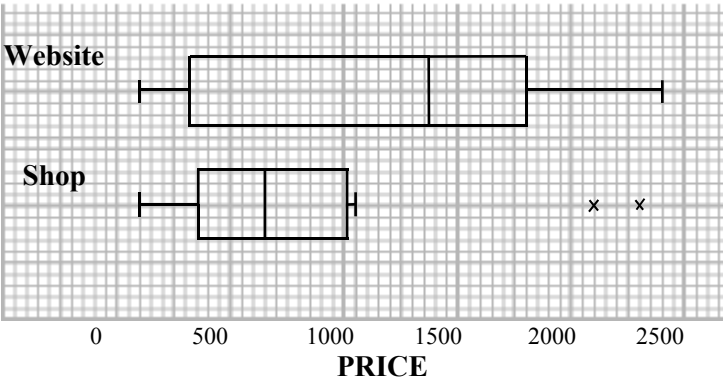
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5.	<p>(a) $E(X) = \sum x \times P(X = x) = \frac{1}{n} + \frac{2}{n} + \dots + \frac{n}{n}$ Use of $E(X)$</p> $= \frac{1}{n} \{1 + 2 \dots + n\}$	M1
	$= \frac{1}{n} \cdot \frac{1}{2} n(n+1) = \frac{n+1}{2}$ <p>Use of $\frac{1}{2}n(n+1)$</p>	M1
	$\therefore \frac{n+1}{2} = 5 \Rightarrow \underline{n = 9^*}$ <p>c.s.o</p>	A1 (3)
	<p>(b) $P(X < T) = \frac{1}{9} \times 6 = \frac{2}{3}$</p>	M1 A1 (2)
	<p>(c) $\text{Var}(X) = E(X^2) - \{E(X)\}^2$</p> $= \frac{1^2}{9} + \frac{2^2}{9} + \dots + \frac{9^2}{9} - 5^2$ <p>Use of $\text{Var}(X)$</p>	M1
	$= \frac{1}{9} \times \frac{1}{6} \times 9 \times 10 \times 19 - 5^2$ <p>Use of $\sum n^3$</p>	M1
	$= \frac{20}{3}$ <p>Correct</p>	A1
	<p>OR</p> $\text{Var}(X) = \frac{n^2 - 1}{12} = \frac{80}{12} = \frac{20}{3}$	A1 (4)
		M2 A1 A1
	9	

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6.	<p>(a) $\sum x = 12075; \sum x^2 = 15\,499\,685$</p> <p>$\therefore \bar{x} = \frac{12075}{15} = \underline{805}$</p> <p>$sd = \sqrt{\frac{15499685}{15} - 805^2} = 620.71491$</p>	B1
	621	A1 (3)
	(NB Using $n-1$ gives 642.50125...)	
	<p>(b) 99, 169, 299, 350, 475, 485, 550, 650, 689, 830, 999, 1015, 1050, 2100, 2315</p>	Attempt to order M1
	$\therefore Q_2 = \underline{650}$	650 A1
	<p>$\therefore IQR = Q_3 - Q_1 = 1015 - 350 = \underline{665}$</p>	Attempt at $Q_3 - Q_1$ M1
		665 A1 (4)
	<p>(c) $Q_3 + 1.5(Q_3 - Q_1) = 1015 + 1.5 \times 665 = 2012.5$</p>	Use of given outlier formula M1
	$\therefore 2100$ and 2315 are outliers	A1
	<p>$Q_1 - 1.5(Q_3 - Q_1) = 350 - 1.5 \times 665 < 0$</p> <p>$\therefore$ No outliers</p>	A1 (3)

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	<p>(d)</p>  <p>(e) Median website > median shop</p> <p>Website negative skew; shop approx symmetrical Ignoring outliers</p> <p>Ranges approximately equal Shop $Q_3 < \text{Website } Q_3 \Rightarrow$ shop sales low value</p> <p>Website sales more variable in value</p>	<p>Boxplot M1</p> <p>Scales & Labels A1</p> <p>Website A1</p> <p>Shop A1</p> <p>(4)</p> <p>Any two sensible comments B1 B1</p> <p>(2)</p> <p><u>16</u></p>	