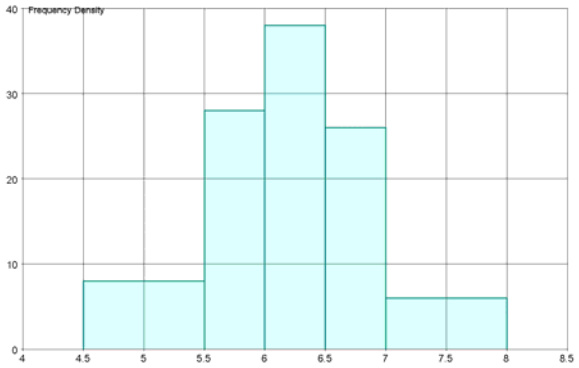
Mark Scheme 4766
January 2006

Q 1 **(i)**	The range = 55 – 15 = 40 The interquartile range = 35 – 26 = 9	B1 CAO B1 CAO	**2**
(ii)	35 + 1.5 x 9 = 48.5 26 – 1.5 x 9 = 12.5 Any value > 48.5 is an outlier (so 55 will be an outlier),	M1 for 48.5 oe M1 for 12.5 oe A1 (FT their IQR in (i))	**3**
(iii)	One valid comment such as eg: Positively skewed Middle 50% of data is closely bunched	E1	**1**
		TOTAL	**6**
2 **(i)**	Impossible because if 3 letters are correct, the fourth must be also.	E1	**1**
(ii)	There is only one way to place letters correctly. There are 4! = 24 ways to arrange 4 letters. OR: $\frac{1}{4}$ x $\frac{1}{3}$ x $\frac{1}{2}$ NOTE: **ANSWER GIVEN**	E1 E1 B1 for $\frac{1}{4}$ x $\frac{1}{3}$ B1 for x $\frac{1}{2}$	**2**
(iii)	E(X) = 1 x $\frac{1}{3}$ + 2 x $\frac{1}{4}$ + 4 x $\frac{1}{24}$ = 1 E(X^2) = 1 x $\frac{1}{3}$ + 4 x $\frac{1}{4}$ + 16 x $\frac{1}{24}$ = 2 So Var(X) = $2 - 1^2$ = 1	M1 For $\sum xp$ (at least 2 non-zero terms correct) A1 CAO M1 for $\sum x^2 p$ (at least 2 non-zero terms correct) M1*dep* for – their E(X)² A1 FT their E(X) provided Var(X) > 0	**5**
		TOTAL	**8**

3 **(i)**	$X \sim B(10,0.2)$ $P(X < 4) = P(X \leq 3) = 0.8791$ OR attempt to sum $P(X = 0,1,2,3)$ using $X \sim B(10,0.2)$ can score M1, A1	M1 for $X \leq 3$ A1	**2**
(ii)	Let p = the probability that a bowl is imperfect $H_0 : p = 0.2 \qquad H_1 : p < 0.2$ $X \sim B(20,0.2)$ $P(X \leq 3) = 0.2061$ $0.2061 > 5\%$ Cannot reject H_0 and so insufficient evidence to claim a reduction. OR using critical region method: CR is {0} B1, 2 not in CR M1, A1 as above	B1 Definition of p B1, B1 B1 for 0.2061 seen M1 for this comparison A1 *dep* for comment <u>in context</u>	**3** **3**
		TOTAL	**8**
4 **(i)**	The company could increase the mean weight. The company could decrease the standard deviation.	B1 CAO B1	**2**
(ii)	Sample mean = 11409/25 = 456.36 $S_{xx} = 5206937 - \frac{11409^2}{25} = 325.76$ Sample s.d = $\sqrt{\frac{325.76}{24}}$ =3.68	B1 M1 for S_{xx} A1	**3**
		TOTAL	**5**
5 **(i)**	$P(A \cap B) = 0.4$	B1 CAO	**1**
(ii)	$P(C \cup D) = 0.6$	B1 CAO	**1**
(iii)	Events B and C are mutually exclusive.	B1 CAO	**1**
(iv)	$P(B) = 0.6$, $P(D) = 0.4$ and $P(B \cap D) = 0.2$ $0.6 \times 0.4 \neq 0.2$ (so B and D not independent)	B1 for $P(B \cap D) = 0.2$ soi E1	**2**
		TOTAL	**5**
6 **(i)**	Number of selections = $\binom{12}{7} = 792$	M1 for $\binom{12}{7}$ A1 CAO	**2**
(ii)	Number of arrangements = 7! = 5040	M1 for 7!, A1 CAO	**2**
		TOTAL	**4**

<table>
<tr><td>7
(i)</td><td>Mean score = (2x8 + 3x7 + 4x6 + 5 + 4)/11 =

6.36</td><td>M1 for $\sum fx/11$
A1 CAO</td><td>2</td></tr>
<tr><td>(ii)</td><td> 

Mean GCSE Score</td><td>G1 Linear sensible scales

G1 fds of 8, 28, 38, 26, 6 or 4k, 14k, 19k, 13k, 3k for sensible values of k either on script or on graph.

G1 (dep on reasonable attempt at fd) Appropriate label for vertical scale eg ‘Frequency density’, ‘frequency per ½ unit’, ‘students per mean GCSE score’. (allow Key)</td><td>3</td></tr>
<tr><td>(iii)</td><td><table>
<tr><th>Mid point, x</th><th>f</th><th>fx</th><th>fx²</th></tr>
<tr><td>5</td><td>8</td><td>40</td><td>200</td></tr>
<tr><td>5.75</td><td>14</td><td>80.5</td><td>462.875</td></tr>
<tr><td>6.25</td><td>19</td><td>118.75</td><td>742.1875</td></tr>
<tr><td>6.75</td><td>13</td><td>87.75</td><td>592.3125</td></tr>
<tr><td>7.5</td><td>6</td><td>45</td><td>337.5</td></tr>
<tr><td></td><td>60</td><td>372</td><td>2334.875</td></tr>
</table>
Sample mean = 372/60 = 6.2

$S_{xx} = 2334.875 - \frac{372^2}{60} = 28.475$
Sample s.d = $\sqrt{\frac{28.475}{59}} = 0.695$</td><td>B1 mid points

B1FT $\sum fx$ and $\sum fx^2$

B1 CAO

M1 for their S_{xx}

A1 CAO</td><td>5</td></tr>
<tr><td>(iv)</td><td>Prediction of score = 13 x 7.4 – 46 = 50.2
So predicted AS grade would be B</td><td>M1 For 13 x 7.4 – 46
A1 dep on 50.2 (or 50) seen</td><td>2</td></tr>
<tr><td>(v)</td><td>Prediction of score = 13 x 5.5 – 46 = 25.5

So predicted grade would be D/E
(allow D or E)
Because score roughly halfway from 20 to 30,
OR (for D) closer to D than E
OR (for E) past E but not up to D boundary</td><td>M1 For 13 x 5.5 – 46

A1 dep on 25.5 (or 26 or 25) seen
E1 For explanation of conversion – logical statement/argument that supports their choice.</td><td>3</td></tr>
<tr><td>(vi)</td><td>Mean = 13 x 6.2 – 46 = 34.6
Standard deviation = 13 x 0.695 = 9.035</td><td>B1 FT their 6.2
M1 for 13 x their 0.695
A1 FT</td><td>3</td></tr>
<tr><td></td><td></td><td>TOTAL</td><td>18</td></tr>
</table>

8 **(i)**	P(all jam) $= \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10}$ $= \frac{1}{22} = 0.04545$	M1 5 x 4 x 3 or $\binom{5}{3}$ in numerator M1 12 x 11 x 10 or $\binom{12}{3}$ in denominator A1 CAO	**3**
(ii)	P(all same) $= \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10} + \frac{4}{12} \times \frac{3}{11} \times \frac{2}{10} + \frac{3}{12} \times \frac{2}{11} \times \frac{1}{10}$ $= \frac{1}{22} + \frac{1}{55} + \frac{1}{220} = \frac{3}{44} = 0.06818$	M1 Sum of 3 reasonable triples or combinations M1 Triples or combinations correct A1 CAO	**3**
(iii)	P(all different) $= 6 \times \frac{5}{12} \times \frac{4}{11} \times \frac{3}{10}$ $= \frac{3}{11} = 0.2727$	M1 5,4,3 M1 $6 \times$ three fractions or $\binom{12}{3}$ denom. A1 CAO	**3**
(iv)	P(all jam given all same) = $\frac{\frac{1}{22}}{\frac{3}{44}} = \frac{2}{3}$	M1 Their (i) in numerator M1 Their (ii) in denominator A1 CAO	**3**
(v)	P(all jam exactly twice) $= \binom{5}{2} \times \left(\frac{1}{22}\right)^2 \times \left(\frac{21}{22}\right)^3 = 0.01797$	M1 for $\binom{5}{2}$ x … M1 for their $p^2\ q^3$ A1 CAO	**3**
(vi)	P(all jam at least once) $= 1 - \left(\frac{21}{22}\right)^5 = 0.2075$	M1 for their q^5 M1 indep for 1 – 5th power A1 CAO	**3**
		TOTAL	**18**