

**Mark Scheme 4732  
January 2006**

|              |   |                            |          |  |
|--------------|---|----------------------------|----------|--|
| 1(i)         | $\frac{2}{3} + \text{prod of 2 P's}$ or $1 - \text{prod of 2 P's}$<br>$\frac{2}{3} + \frac{1}{3} \times \frac{3}{4}$ or $1 - \frac{1}{3} \times \frac{1}{4}$<br>$= \frac{11}{12}$ or 0.917 (3 sfs)  | M1<br>M1<br>A1             | 3        | or $\frac{1}{3} \times \frac{3}{4}$ or $\frac{1}{3} \times \frac{1}{4}$  |
| (ii)         | $\frac{1}{3} \times p$<br>$\frac{2}{3} + \frac{1}{3} \times p = \frac{5}{6}$ oe<br>$p = \frac{1}{2}$  | M1<br>M1<br>A1             | 3        | or $\frac{1}{3}(1-p)$<br>or $\frac{1}{3}(1-p) = 1 - \frac{5}{6}$<br>SW: $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ M2A0, unless clear this is a check  |
| <b>Total</b> |   |                            | <b>6</b> |  |
| 2(i)         | 124.5, 4.8  | B1B1                       | 2        | for 4.8 allow "same"   |
| (ii)         | mean smaller or generally smaller<br>or means similar or hts similar oe<br>More widely spread or varied oe  | B1f<br>B1f                 | 2        | Assume 2 <sup>nd</sup> referred to unless clear 1 <sup>st</sup><br>or less consistent or gter dispersion<br>or further from mean, gter variance<br>Not "range" greater<br>Allow opposite if ft (i)                                       |
| (iii)        | ("124.5" + 2 x 123)/3<br>= 123.5  | M1<br>A1                   | 2        | or (50 x "124.5" + 100 x 123)/150<br>cao   |
| <b>Total</b> |   |                            | <b>6</b> |  |
| 3(i)         | $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3}$ or $\frac{2}{5} \times \frac{3}{4} \times \frac{1}{3}$<br>x 2 or +<br>$\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} + \frac{2}{5} \times \frac{3}{4} \times \frac{1}{3}$<br>= $\frac{1}{5}$ AG | M1<br>M1<br>M1<br>A1       | 4        | or $\frac{1}{10}$ <u>from tree</u><br>add 2 equal products of 3 probs<br>all correct<br>Must see correct working<br>NB incorrect methods eg $\frac{3}{5} \times \frac{2}{4} \times \frac{2}{3}$  |
| (ii)         | $\sum xp$<br>= 4<br>$\sum x^2 p (= 17)$<br>- $\mu^2$<br>= 1   | M1<br>A1<br>M1<br>M1<br>A1 | 5        | $\geq 3$ terms added. Allow arith errors.<br>$\geq 3$ terms added. Allow arith errors<br>Indep if +ve result<br>$\sum (x-\mu)^2 p$ M2; 3 terms: M1 dep +ve result<br>$\sum xp$ & $\sum x^2 p$ , if $\div$ eg 4: M0A0 (- $\mu^2$ poss M1) |
| <b>Total</b> |   |                            | <b>9</b> |  |

|              |  |                      |           |  |
|--------------|--|----------------------|-----------|--|
| 4(i)(a)      | Total area = 60 sqs<br>Recog that total area reps 300<br>$8 \times 300/60$<br>= 40   | M1<br>M1<br>M1<br>A1 | 4         | Attempt total area, eg 15000 or 15 cm <sup>2</sup><br>eg 1 squ = 5 or 15000 ÷ (300 or 50)<br>or 2000/50<br>cao   |
| (b)          | Splitting classes<br>$1.2 \times 4 \times 5$ or $0.8 \times 6 \times 5$ oe<br><br>48   | M1<br>M1<br><br>A1   | 3         | or $0.3 \times 16 \times 5$ or $0.4 \times 12 \times 5$ or 24<br><br>NB other correct eg $2 \times 4 \times 5 + \frac{4}{5} \times 2 \times 5$<br>Alt method: estimate: 46-50 SC B1                                    |
| (ii)(a)      | Box & whisker  | B1                   | 1         |  |
| (b)          | Cum freq diag  | B1                   | 1         |  |
| <b>Total</b> |  |                      | <b>9</b>  |  |
| 5(i)(a)      | $(\frac{3}{5})^4 \times \frac{2}{5}$<br>= 0.0518 (3sfs) or $\frac{162}{3125}$ oe   | M1<br>A1             | 2         | Allow index 3 or 5   |
| (b)          | $(\frac{3}{5})^4$<br>$1 - (\frac{3}{5})^4$<br>= 0.870 (3 sfs) or $\frac{544}{625}$ oe  | M1<br>M1<br>A1       | 3         | $\frac{2}{5} + \frac{3}{5} \times \frac{2}{5} + (\frac{3}{5})^2 \times \frac{2}{5} + (\frac{3}{5})^3 \times \frac{2}{5}$ : M2<br>(1extra or omit or wrong: M1)<br>Allow $1 - (\frac{3}{5})^3$ or $1 - (\frac{3}{5})^5$ |
| (ii)(a)      | $B(5, \frac{2}{5})$ stated<br>$5 \times \frac{2}{5} \times (\frac{3}{5})^4$ or 0.3370 – 0.0778<br>= 0.259 (3 sfs) or $\frac{162}{625}$ oe  | M1<br>M1<br>A1       | 3         | or $({}^5C_a \text{ or } {}^5C_b) \times (\frac{2}{5})^a \times (\frac{3}{5})^b$ & $a + b = 5$   |
| (b)          | “0.259” $\times \frac{2}{5}$<br>= 0.104 (3 sfs) or $\frac{324}{3125}$ oe   | M1<br>A1f            | 2         | eg ft: (a) 0.0518 → 0.0207<br>(a) 0.922 → 0.369  |
| <b>Total</b> |  |                      | <b>10</b> |  |
| 6(i)         | ${}^4C_3 \times {}^7C_4$<br>= 140  | M1M1<br>A1           | 3         | M1 either comb. 140/330: M1M1  |
| (ii)         | ${}^3C_2 \times {}^6C_4$ or $\frac{{}^3C_2}{{}^4C_3}$ or $\frac{{}^6C_4}{{}^7C_4}$<br><br>$\frac{{}^3C_2 \times {}^6C_4}{\text{“140”}}$ or $\frac{3}{4} \times (1 - \frac{4}{7})$<br>= $\frac{9}{28}$ oe or 0.321 (3 sfs)  | M1<br>M1<br>A1       | 3         | or ${}^3C_2(x..)/\text{“140”}$ or $(\dots)^6C_4/\text{“140”}$<br>or $({}^3C_2 + {}^6C_4)/\text{“140”}$ or $(3+15)/\text{“140”}$<br>or $\frac{3}{4}$ or $1 - \frac{4}{7}$ seen<br>all correct                           |
| (iii)        | ${}^3C_2 \times {}^6C_4$ (or i x ii) or $({}^3C_3 \times {}^7C_4)$ or 45 or 35<br>or $\frac{1}{4} \times {}^4C_3 \times {}^7C_4$ or $\frac{3}{4} \times {}^4C_3 \times {}^6C_4$<br><br>${}^3C_2 \times {}^6C_4 + ({}^3C_3 \times {}^7C_4)$ or “140” – ${}^3C_2 \times {}^6C_3$<br>= 80 | M1<br>M1<br>A1ft     | 3         | 1 correct prod or “140” – any prod<br>or $\frac{1}{4} \times {}^4C_3 \times {}^7C_4 + \frac{3}{4} \times {}^4C_3 \times {}^6C_4$<br>ft only “140”  |
| <b>Total</b> |  |                      | <b>9</b>  |  |

|              |  |                                      |   |
|--------------|--|--------------------------------------|---|
| 7(i)         | Binomial<br>$n = 10, p = 0.9$<br><br>Each seed equally likely germ<br>or P(germ) same for all seeds oe<br>Seeds independent oe | B1<br>B1<br><br>B1<br>B1<br><b>4</b> | Both requ'd. Ignore $q = 0.1$<br><br>or seeds grown in same conditions<br><br>Context nec'y for each B1   |
| (ii)         | 0.0702 (3 sfs)   | B2<br><b>2</b>                       | 0.07 or 0.2639: B1<br>$\Sigma$ or $1-\Sigma$ : 1 term extra or omit or wrong:<br>M1   |
| (iii)        | $1 - "0.0702"$<br>$0.9298^{20} + {}^{20}C_1 \times 0.0702 \times 0.9298^{19}$<br><br>$= 0.585$ (3 sfs)                         | M1<br>M1M1<br><br>A1 <b>4</b>        | Or 0.9298 or 0.93(0) seen<br>M1 each term<br><br>cao<br>eg ft (ii) 0.2639 $\rightarrow$ (iii) 0.0178 from<br>correct wking: M3A0<br><br>$0.0702^{20} + {}^{20}C_1 \times 0.9298 \times 0.0702^{19}$<br>( $= 2.25 \times 10^{-21}$ ): SC M1M1<br>NB ft (ii) for all M mks. But if 0.1, 0.9<br>used, must be clear using (ii) rounded |
| <b>Total</b> |  | <b>10</b>                            |   |

|              |   |                |  |
|--------------|---|----------------|--|
| 8(i)(a)      | Ranks 1 2 3 4 5 6 7 8 9   9 8 7 6 5 4 3 2 1<br>3 2 1 5 4 7 8 6 9   7 8 9 5 6 3 2 4 1                              | M1<br>A1       | Attempt ranks, same dir'n<br>Correct ranks   |
|              | $\Sigma d^2 (= 16)$   | M1dep          | Dep ranks attempted  |
|              | $r_s = 1 - \frac{6 \times \text{their } 16}{9 \times (9^2 - 1)}$<br>$= 0.867$ (3 sfs) or $^{13}/_{15}$ oe         | M1dep<br>A1    | Correct formula with $n = 9$ , dep M1M1  |
| (b)          | Countries with larger pops tend to have larger capital pops. oe   | B1ft           | 1<br>or ft (a)<br>Must <u>interp</u> & refer to context.<br>Not "Gd corr'n country & cap pops"<br>Not "Gd agree't country & cap pops"<br>Not "Gd rel'nship country & cap pops"<br>Not "proportional" |
| (ii)         | $\frac{1533.76 - (337.5 \times 28.3)/9}{\sqrt{((18959.11 - 337.5^2/9)(161.65 - 28.3^2/9))}}$<br>$= 0.698$ (3 sfs) | M1<br>A1       | (= $472.51/\sqrt{(6302.86 \times 72.66)}$ )<br>Or correct subst in 2 "S" formulae, any version   |
| (iii)        | Increase  | B1             | 1<br>No wking: 0.7 M0A0; 0.70: M1A0  |
| (iv)(a)      | Est country pop from cap or $x$ from $y$ oe   | B1ind<br>B1ind | 2<br>or nearer to 1<br>$y$ indep or known or given or $x$ unknown or $x$ dep on $y$ oe   |
| (b)          | any indication-different context, eg "Africa", "remote areas" unreliable  | B1<br>B1dep    | 2<br>or reliable because $r$ (or $r_s$ ) high: B1<br>or unreliable because $r$ (or $r_s$ ) not hi: B1<br>"accurate": B0  |
| <b>Total</b> |   |                | <b>13</b>  |

Total 72 marks