1(i)	$^2/_3$+prod of 2 P's or 1– prod of 2 P's $^2/_3 + {}^1/_3 \times {}^3/_4$ or $1 - {}^1/_3 \times {}^1/_4$ $= {}^{11}/_{12}$ or 0.917 (3 sfs)	M1 M1 A1 **3**	or $^1/_3 \times {}^3/_4$ or $^1/_3 \times {}^1/_4$
(ii)	$^1/_3 \times p$ $^2/_3 + {}^1/_3 \times p = {}^5/_6$ oe $p = {}^1/_2$	M1 M1 A1 **3**	or $^1/_3(1-p)$ or $^1/_3(1-p) = 1 - {}^5/_6$ SW: $\frac{1}{2} \times {}^1/_3 = {}^1/_6$ M2A0, unless clear this is a check
Total		**6**	
2(i)	124.5, 4.8	B1B1 **2**	for 4.8 allow "same"
(ii)	mean smaller or generally smaller or means similar or hts similar oe More widely spread or varied oe	B1f B1f **2**	Assume 2nd referred to unless clear 1st or less consistent or gter dispersion or further from mean, gter variance Not "range" greater Allow opposite if ft (i)
(iii)	("124.5" + 2 x 123)/3 = 123.5	M1 A1 **2**	or (50 x "124.5" + 100 x 123)/150 cao
Total		**6**	
3(i)	$^3/_5 \times {}^2/_4 \times {}^1/_3$ or $^2/_5 \times {}^3/_4 \times {}^1/_3$ x 2 or + $^3/_5 \times {}^2/_4 \times {}^1/_3 + {}^2/_5 \times {}^3/_4 \times {}^1/_3$ $= {}^1/_5$ AG	M1 M1 M1 A1 **4**	or $^1/_{10}$ from tree add 2 equal products of 3 probs all correct Must see correct working NB incorrect methods eg $^3/_5 x^2/_4 x^2/_3$
(ii)	Σxp = 4 $\Sigma x^2 p$ (= 17) $- \mu^2$ = 1	M1 A1 M1 M1 A1 **5**	$\geq$ 3 terms added. Allow arith errors. $\geq$ 3 terms added. Allow arith errors Indep if +ve result $\Sigma(x-\mu)^2 p$ M2; 3 terms: M1 dep +ve result Σxp & $\Sigma x^2 p$, if ÷ eg 4: M0A0 (- μ^2 poss M1)
Total		**9**	

4(i)(a)	Total area = 60 sqs Recog that total area reps 300 8 x 300/60 = 40	M1 M1 M1 A1 **4**	Attempt total area, eg 15000 or 15 cm^2 eg 1 squ = 5 or 15000 ÷ (300 or 50) or 2000/50 cao
(b)	Splitting classes 1.2x4x5 or 0.8x6x5 oe 48	M1 M1 A1 **3**	 or 0.3x16x5 or 0.4x12x5 or 24 NB other correct eg 2x4x5 + $^4/_5$x2x5 Alt method: estimate: 46-50 SC B1
(ii)(a) (b)	Box & whisker Cum freq diag	B1 **1** B1 **1**	
Total		**9**	
5(i)(a)	$(^3/_5)^4 \times {}^2/_5$ = 0.0518 (3sfs) or $^{162}/_{3125}$ oe	M1 A1 **2**	Allow index 3 or 5
(b)	 $(^3/_5)^4$ $1-(^3/_5)^4$ = 0.870 (3 sfs) or $^{544}/_{625}$ oe	 M1 M1 A1 **3**	$^2/_5 + {}^3/_5x^2/_5 + (^3/_5)^2x^2/_5 + (^3/_5)^3x^2/_5$: M2 (1extra or omit or wrong: M1) Allow $1-(^3/_5)^3$ or $1-(^3/_5)^5$
(ii)(a)	B(5, $^2/_5$) stated 5 x $^2/_5$ x $(^3/_5)^4$ or 0.3370 – 0.0778 = 0.259 (3 sfs) or $^{162}/_{625}$ oe	M1 M1 A1 **3**	or $({}^5C_a$ or $^5C_b)x(^2/_5)^a x(^3/_5)^b$ & $a+b=5$
(b)	"0.259" x $^2/_5$ = 0.104 (3 sfs) or $^{324}/_{3125}$ oe	M1 A1f **2**	eg ft: (a) 0.0518 → 0.0207 (a) 0.922 → 0.369
Total		**10**	
6(i)	$^4C_3 \times {}^7C_4$ = 140	M1M1 A1 **3**	M1 either comb. 140/330: M1M1
(ii)	$^3C_2 \times {}^6C_4$ or $\frac{^3C_2}{^4C_3}$ or $\frac{^6C_4}{^7C_4}$ $\frac{^3C_2 \times {}^6C_4}{\text{"140"}}$ or $^3/_4 \times (1-{}^4/_7)$ = $^9/_{28}$ oe or 0.321 (3 sfs)	M1 M1 A1 **3**	or $^3C_2$(x..)/"140" or (…x)$^6C_4$/"140" or $(^3C_2+{}^6C_4)$/"140" or (3+15)/"140" or $^3/_4$ or $1-{}^4/_7$ seen all correct
(iii)	$^3C_2x\,{}^6C_4$ (or i x ii) or $(^3C_3x)^7C_4$ or 45 or 35 or $^1/_4x^4C_3x^7C_4$ or $^3/_4x\,{}^4C_3x^6C_4$ $^3C_2x^6C_4+(^3C_3x)^7C_4$ or "140" $-{}^3C_2x^6C_3$ = 80	M1 M1 A1ft **3**	1 correct prod or "140"– any prod or $^1/_4x^4C_3x^7C_4 + {}^3/_4x\,{}^4C_3x^6C_4$ ft only "140"
Total		**9**	

7(i)	Binomial $n = 10, p = 0.9$ Each seed equally likely germ or P(germ) same for all seeds oe Seeds independent oe	B1 B1 B1 B1 **4**	 Both requ'd. Ignore $q = 0.1$ or seeds grown in same conditions Context nec'y for each B1
(ii)	0.0702 (3 sfs)	 B2 **2**	0.07 or 0.2639: B1 Σ or 1-Σ: 1 term extra or omit or wrong: M1
(iii)	1 – "0.0702" $0.9298^{20} + {}^{20}C_1 \times 0.0702 \times 0.9298^{19}$ = 0.585 (3 sfs)	 M1 M1M1 A1 **4**	 Or 0.9298 or 0.93(0) seen M1 each term cao eg ft (ii) 0.2639 → (iii) 0.0178 from correct wking: M3A0 $0.0702^{20}+{}^{20}C_1 \times 0.9298 \times 0.0702^{19}$ ($=2.25\times10^{-21}$): SC M1M1 NB ft (ii) for all M mks. But if 0.1, 0.9 used, must be clear using (ii) rounded
Total		**10**	

8(i)(a)	Ranks 1 2 3 4 5 6 7 8 9 9 8 7 6 5 4 3 2 1 3 2 1 5 4 7 8 6 9 7 8 9 5 6 3 2 4 1	M1 A1	Attempt ranks, same dir'n Correct ranks
	Σd^2 (= 16)	M1dep	Dep ranks attempted
	$r_s = 1 - \frac{6 \times \text{their } 16}{9 \times (9^2-1)}$ = 0.867 (3 sfs) or $^{13}/_{15}$ oe	M1dep A1 **5**	Correct formula with $n = 9$, dep M1M1
(b)	Countries with larger pops tend to have larger capital pops. oe	B1ft **1**	or ft (a) Must interp & refer to context. Not "Gd corr'n country & cap pops" Not "Gd agree't country & cap pops" Not "Gd rel'nship country & cap pops" Not "proportional"
(ii)	$\frac{1533.76 - (337.5 \times 28.3)/9}{\sqrt{((18959.11-337.5^2/9)(161.65-28.3^2/9))}}$ = 0.698 (3 sfs)	M1 A1 **2**	(= 472.51//(6302.86x72.66)) Or correct subst in 2 "S" formulae, any version No wking: 0.7 M0A0; 0.70: M1A0
~~(iii)~~	~~Increase~~	~~B1~~ **1**	or nearer to 1
~~(iv)(a)~~	~~x on y~~ Est country pop from cap or x from y oe	B1ind B1ind **2**	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 B1dep **2**	or reliable because r (or r_s) high: B1 or unreliable because r (or r_s) not hi: B1 "accurate": B0
Total		**13**	

Total 72 marks