Note: "3 sfs" means an answer which is equal to, or rounds to, the given answer. If such an answer is seen and then later rounded, apply ISW.

1	$(0\times0.1) + 1\times0.2 + 2\times0.3 + 3\times0.4$ $= 2(.0)$ $(0^2\times0.1) + 1\times0.2 + 2^2\times0.3 + 3^2\times0.4$ $(= 5)$ $- 2^2$ $= 1$	M1 A1 M1 M1 A1 5	≥ 2 non-zero terms correct eg $\div 4$: M0 ≥ 2 non-zero terms correct $\div 4$: M0 Indep, ft their μ. Dep +ve result $(-2)^2\times0.1+(-1)^2\times0.2+0^2\times0.3+1^2\times0.4$:M2 ≥ 2 non-0 correct: M1 $\div 4$: M0
Total		**5**	
2	UK Fr Ru Po Ca 1 2 3 4 5 or 5 4 3 2 1 4 3 1 5 2 2 3 5 1 4 Σd^2 $(= 24)$ $r_s = 1 - \frac{6 \times \text{“24”}}{5 \times (5^2-1)}$ $= -{}^1/_5$ or -0.2	 M1 A1 M1 M1 A1 5	Consistent attempt rank other judge RCFUP 3 5 2 1 4 3 1 4 5 2 1 2 3 4 5 5 4 3 2 1 All 5 d^2 attempted & added. Dep ranks att'd Dep 2nd M1 $\frac{43 - 15^2/5}{\sqrt{((55-15^2/5)(55-15^2/5))}}$ Corr sub in ≥ 2 S's M1 All correct: M1
Total		**5**	
3i	${}^{15}C_7$ or $^{15!}/_{7!8!}$ 6435	M1 A1 2	
ii	${}^6C_3 \times {}^9C_4$ or $^{6!}/_{3!3!} \times {}^{9!}/_{4!5!}$ 2520	M1 A1 2	Alone except allow $\div {}^{15}C_7$ Or ${}^6P_3 \times {}^9P_4$ or $^{6!}/_{3!} \times {}^{9!}/_{5!}$ Allow $\div {}^{15}P_7$ NB not $^{6!}/_{3!} \times {}^{9!}/_{4!}$ 362880
Total		**4**	
4ia	$^1/_3$ oe	B1 1	B↔W MR: max (a)B0(b)M1M1(c)B1M1
b	P(BB) + P(WB) attempted $= {}^4/_{10} \times {}^3/_9 + {}^6/_{10} \times {}^4/_9$ or ${}^2/_{15} + {}^4/_{15}$ $= {}^2/_5$ oe	M1 M1 A1 3	Or ${}^4/_{10} \times {}^3/_9$ OR ${}^6/_{10} \times {}^4/_9$ correct NB ${}^4/_{10} \times {}^4/_{10} + {}^6/_{10} \times {}^4/_{10} = {}^2/_5$: M1M0A0
c	Denoms 9 & 8 seen or implied ${}^3/_9 \times {}^2/_8 + {}^6/_9 \times {}^3/_8$ $= {}^1/_3$ oe	B1 M1 A1 3	Or ${}^2/_{15}$ as numerator Or $\frac{{}^2/_{15}}{{}^4/_{10}}$ Or $\frac{{}^4/_{10}\times{}^6/_9\times{}^3/_8 + {}^4/_{10}\times{}^3/_9\times{}^2/_8}{\text{above} + {}^6/_{10}\times{}^5/_9\times{}^4/_8 + {}^6/_{10}\times{}^4/_9\times{}^3/_8}$ May not see wking
ii	P(Blue) not constant or discs not indep, so no	B1 1	Prob changes as discs removed Limit to no. of discs. Fixed no. of discs Discs will run out Context essential: "disc" or "blue" NOT fixed no. of trials NOT because without repl Ignore extra
Total		**8**	

5i	1991 100 000 to 110 000	B1 ind B1 ind 2	Or fewer in 2001 Allow digits100 to 110
iia	Median = 29 to 29.9 Quartiles 33 to 34, 24.5 to 26 = 7.5 to 9.5 140 to 155 23 to 26.3%	B1 M1 A1 M1 A1 5	 Or one correct quartile and subtr NOT from incorrect wking $\times$1000, but allow without Rnded to 1 dp or integer 73.7 to 77% : SC1
b	Older Median (or ave) greater } % older mothers greater oe} % younger mothers less oe}	B1 B1 B1 3	Or 1991 younger Any two Or 1991 steeper so more younger: B2 NOT mean gter Ignore extra
Total		**10**	

6ia	Correct subst in $\geq$ two S formulae $$\frac{767-\frac{60\times72}{8}}{\sqrt{(1148-\frac{60^2}{8})(810-\frac{72^2}{8})}}$$ or $\frac{227}{\sqrt{698}\sqrt{162}}$ = 0.675 (3 sfs)	M1 M1 A1 3	Any version All correct. Or $\frac{767-8\text{x}7.5\text{x}9}{\sqrt{((1148-8\text{x}7.5^2)(810-8\text{x}9^2))}}$ or correct substn in any correct formula for r
b	1 y always increases with x or ranks same oe	B1 B1 2	+ve grad thro'out. Increase in steps. Same order. Both ascending order Perfect RANK corr'n Ignore extra NOT Increasing proportionately
iia	Closer to 1, or increases because nearer to st line	B1 B1 2	Corr'n stronger. Fewer outliers. "They" are outliers Ignore extra
b	None, or remains at 1 Because y still increasing with x oe	B1 B1 2	Σd^2 still 0. Still same order. Ignore extra NOT differences still the same. NOT ft (i)(b)
iii	13.8 to 14.0	B1 1	
iv	(iii) or graph or diag or my est Takes account of curve	B1 B1 2	Must be clear which est. Can be implied. "This est" probably $\Rightarrow$ using equn of line Straight line is not good fit. Not linear. Corr'n not strong.
Total		**12**	
7i	P(contains voucher) constant oe Packets indep oe	B1 B1 2	Context essential NOT vouchers indep
ii	0.9857 or 0.986 (3 sfs)	B2 2	B1 for 0.9456 or 0.946 or 0.997(2) or for 7 terms correct, allow one omit or extra NOT 1 – 0.9857 = 0.0143 (see (iii))
iii	(1 – 0.9857) = 0.014(3) (2 sfs)	 B1ft 1	 Allow 1- their (ii) correctly calc'd
iv	B(11, 0.25) or 6 in 11 wks stated or impl ${}^{11}C_6 \times 075^5 \times 0.25^6$ (= 0.0267663) P(6 from 11) × 0.25 = 0.00669 or 6.69 x 10^{-3} (3 sfs)	B1 M1 M1 A1 4	or $0.75^a \times 0.25^b$ $(a + b = 11)$ or ${}^{11}C_6$ dep B1
Total		**9**	

8i	$\sqrt{0.04}$ (= 0.2) $(1 - \text{their } \sqrt{0.04})^2$ = 0.64	M1 M1 A1 3	
ii	$1 - p$ seen M1 for either $2p(1-p) = 0.42$ or $p(1-p) = 0.21$ oe $2p^2 - 2p + 0.42(= 0)$ or $p^2 - p + 0.21(= 0)$ $\frac{2 \pm \sqrt{((-2)^2 - 4 \times 0.42)}}{2 \times 2}$ or $\frac{1 \pm \sqrt{((-1)^2 - 4 \times 0.21)}}{2 \times 1}$ or $(p-0.7)(p-0.3)=0$ or $(10p-7)(10p-3)=0$ $p = 0.7$ or 0.3	B1 M1 M1 M1 A1 5	$2pq = 0.42$ or $pq = 0.21$ Allow $pq = 0.42$ or opp signs, correct terms any order (= 0) oe Correct Dep B1M1M1 Any corr subst'n or fact'n Omit 2 in 2nd line: max B1M1M0M0A0 One corr ans with no or inadeq wking: SC1 eg $0.6 \times 0.7 = 0.42 \Rightarrow p = 0.7$ or 0.6 $p^2 + 2pq + q^2 = 1$ B1 $p^2 + q^2 = 0.58$ } $p = 0.21/q$ } $p^4 - 0.58p^2 + 0.0441 = 0$ M1 corr subst'n or fact'n M1 $1 - p$ seen B1 $2p(1-p) = 0.42$ or $p(1-p) = 0.21$ M1 $p^2 - p = -0.21$ $p^2 - p + 0.25 = -0.21 + 0.25$ oe } M1 OR $(p - 0.5)^2 - 0.25 = -0.21$ oe } $(p - 0.5)^2 = 0.04$ M1 $(p - 0.5) = \pm 0.02$ $p = 0.3$ or 0.7 A1
Total		**8**	
9ia	$1 / {}^1/_5$ = 5	M1 A1 2	
b	$({}^4/_5)^3 \times {}^1/_5$ $= {}^{64}/_{625}$ or 0.102 (3 sfs)	M1 A1 2	
c	$({}^4/_5)^4$ $= {}^{256}/_{625}$ or a.r.t 0.410 (3 sfs) or 0.41	M1 A1 2	or $1 - ({}^1/_5 + {}^4/_5 \times {}^1/_5 + ({}^4/_5)^2 \times {}^1/_5 + ({}^4/_5)^3 \times {}^1/_5)$ NOT $1 - ({}^4/_5)^4$
iia	$P(Y=1) = p$, $P(Y=3) = q^2p$, $P(Y=5) = q^4p$	B1 1	$P(Y=1)+P(Y=3)+P(Y=5) = p + q^2p + q^4p$ p, $p(1-p)^2$, $p(1-p)^4$ q^{1-1}, q^{3-1}, q^{5-1} or any of these with $1 - p$ instead of q "Always q to even power $\times p$" Either associate each term with relevant prob Or give indication of how terms derived $\geq$ two terms
b	Recog that c.r. $= q^2$ or $(1-p)^2$ $S_\infty = \frac{p}{1-q^2}$ or $\frac{p}{1-(1-p)^2}$ $P(\text{odd}) = \frac{1-q}{1-q^2}$ $= \frac{1-q}{(1-q)(1+q)}$ Must see this step for A1 $\left(= \frac{1}{1+q}\right.$ **AG)**	M1 M1 M1 A1 4	or eg $r = q^2p/p$ $\left(= \frac{p}{2p - p^2}\right) = \frac{p}{p(2-p)}$ $\left(= \frac{1}{2-p}\right) = \frac{1}{2-(1-q)}$