

Mark Scheme 4732 June 2007

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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	$(0 \times 0.1) + 1 \times 0.2 + 2 \times 0.3 + 3 \times 0.4$ $= 2(.0)$ $(0^2 \times 0.1) + 1 \times 0.2 + 2^2 \times 0.3 + 3^2 \times 0.4 (= 5)$ $- 2^2$ $= 1$	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 $(-2)^2 \times 0.1 + (-1)^2 \times 0.2 + 0^2 \times 0.3 + 1^2 \times 0.4$: 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 $(= 24)$ $r_s = 1 - \frac{6 \times "24"}{5 \times (5^2 - 1)}$ $= -\frac{1}{5}$ or -0.2	M1 A1 M1 M1 A1 5	Consistent attempt rank other judge <div style="border: 1px solid black; padding: 5px; display: inline-block;"> RCFUP 3 5 2 1 4 3 1 4 5 2 1 2 3 4 5 5 4 3 2 1 </div> All 5 d^2 attempted & added. Dep ranks att'd Dep 2 nd M1 <div style="border: 1px solid black; padding: 5px; display: inline-block;"> $\frac{43 - 15^2/5}{\sqrt{((55 - 15^2/5)(55 - 15^2/5))}}$ Corr sub in ≥ 2 S's M1 All correct: M1 </div>
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	$\frac{1}{3}$ oe	B1 1	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> B\leftrightarrowW MR: max (a)B0(b)M1M1(c)B1M1 </div>
b	P(BB) + P(WB) attempted $= \frac{4}{10} \times \frac{3}{9} + \frac{6}{10} \times \frac{4}{9}$ or $\frac{2}{15} + \frac{4}{15}$ $= \frac{2}{5}$ oe	M1 M1 A1 3	Or $\frac{4}{10} \times \frac{3}{9}$ OR $\frac{6}{10} \times \frac{4}{9}$ correct NB $\frac{4}{10} \times \frac{4}{10} + \frac{6}{10} \times \frac{4}{10} = \frac{2}{5}$: M1M0A0
c	Denoms 9 & 8 seen or implied $\frac{3}{9} \times \frac{2}{8} + \frac{6}{9} \times \frac{3}{8}$ $= \frac{1}{3}$ oe	B1 M1 A1 3	Or $\frac{2}{15}$ as numerator Or $\frac{2/15}{4/10}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Or $\frac{4/10 \times 6/9 \times 3/8 + 4/10 \times 3/9 \times 2/8}{\text{above} + 6/10 \times 5/9 \times 4/8 + 6/10 \times 4/9 \times 3/8}$ </div> 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	

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5i	1991 100 000 to 110 000	B1 ind B1 ind 2	Or fewer in 2001 Allow digits 100 to 110
ii a	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 ×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	

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6ia	<p>Correct subst in \geq two S formulae</p> $767 - \frac{60 \times 72}{8} \quad \text{or} \quad \frac{227}{\sqrt{698}\sqrt{162}}$ $\sqrt{\left(1148 - \frac{60^2}{8}\right)\left(810 - \frac{72^2}{8}\right)}$ <p>= 0.675 (3 sfs)</p>	<p>M1</p> <p>M1</p> <p>A1 3</p>	<p>Any version</p> <p>All correct. Or $\frac{767-8 \times 7.5 \times 9}{\sqrt{((1148-8 \times 7.5^2)(810-8 \times 9^2))}}$</p> <p>or correct substn in any correct formula for r</p>
b	<p>1</p> <p>y always increases with x or ranks same</p> <p>oe</p>	<p>B1</p> <p>B1</p> <p>2</p>	<p>+ve grad thro' out. Increase in steps. Same order. Both ascending order</p> <p>Perfect RANK corr'n</p> <p>Ignore extra</p> <p>NOT Increasing proportionately</p>
iiia	<p>Closer to 1, or increases because nearer to st line</p>	<p>B1</p> <p>B1 2</p>	<p>Corr'n stronger.</p> <p>Fewer outliers. "They" are outliers</p> <p>Ignore extra</p>
b	<p>None, or remains at 1</p> <p>Because y still increasing with x oe</p>	<p>B1</p> <p>B1 2</p>	<p>Σd^2 still 0. Still same order. Ignore extra</p> <p>NOT differences still the same.</p> <p>NOT ft (i)(b)</p>
iii	<p>13.8 to 14.0</p>	<p>B1 1</p>	
iv	<p>(iii) or graph or diag or my est</p> <p>Takes account of curve</p>	<p>B1</p> <p>B1 2</p>	<p>Must be clear which est. Can be implied.</p> <p>"This est" probably \Rightarrow using equn of line</p> <p>Straight line is not good fit. Not linear.</p> <p>Corr'n not strong.</p>
Total		12	
7i	<p>P(contains voucher) constant oe</p> <p>Packets indep oe</p>	<p>B1</p> <p>B1 2</p>	<p>Context essential</p> <p>NOT vouchers indep</p>
ii	<p>0.9857 or 0.986 (3 sfs)</p>	<p>B2 2</p>	<p>B1 for 0.9456 or 0.946 or 0.997(2)</p> <p>or for 7 terms correct, allow one omit or extra</p> <p>NOT $1 - 0.9857 = 0.0143$ (see (iii))</p>
iii	<p>$(1 - 0.9857)$</p> <p>= 0.014(3) (2 sfs)</p>	<p>B1ft</p> <p>1</p>	<p>Allow 1- their (ii) correctly calc'd</p>
iv	<p>B(11, 0.25) or 6 in 11 wks stated or impl</p> <p>${}^{11}C_6 \times 0.75^5 \times 0.25^6$ (= 0.0267663)</p> <p>$P(6 \text{ from } 11) \times 0.25$</p> <p>= 0.00669 or 6.69×10^{-3} (3 sfs)</p>	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1 4</p>	<p>or $0.75^a \times 0.25^b$ ($a + b = 11$) or ${}^{11}C_6$</p> <p>dep B1</p>
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 $2p(1 - p) = 0.42$ 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 2 nd 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	$1 / \frac{1}{5}$ $= 5$	M1 A1 2	
b	$(\frac{4}{5})^3 \times \frac{1}{5}$ $= \frac{64}{625}$ or 0.102 (3 sfs)	M1 A1 2	
c	$(\frac{4}{5})^4$ $= \frac{256}{625}$ or a.r.t 0.410 (3 sfs) or 0.41	M1 A1 2	or $1 - (\frac{1}{5} + \frac{4}{5} \times \frac{1}{5} + (\frac{4}{5})^2 \times \frac{1}{5} + (\frac{4}{5})^3 \times \frac{1}{5})$ NOT $1 - (\frac{4}{5})^4$
iiia	$P(Y=1) = p, P(Y=3) = q^2p, P(Y=5) = q^4p$		$P(Y=1) + P(Y=3) + P(Y=5) = p + q^2p + q^4p$ $p, p(1 - p)^2, p(1 - p)^4$ $q^{1-1}, q^{3-1}, q^{5-1}$ 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 $(= \frac{1}{1 + q}$ AG)	M1 M1 M1 A1 4	or eg $r = \frac{q^2}{p}$ $(= \frac{p}{2p - p^2}) = \frac{p}{p(2 - p)}$ $(= \frac{1}{2 - p}) = \frac{1}{2 - (1 - q)}$

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Total		11	
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