

# 4732 Probability & Statistics 1

Note: “(3 sfs)” means “answer which rounds to ... to 3 sfs”. If correct ans seen to  $\geq 3$ sfs, ISW for later rounding  
 Penalise over-rounding only once in paper.

<b>1(i)</b>	(a) -1  (b) 0	B1  B1 2	allow $\approx -1$ or close to -1 not “strong corr’n”, not -0.99 allow $\approx 0$ or close to 0 not “no corr’n”
<b>(ii)</b>	4 3 2 1 or 1 2 3 4 1 3 4 2 4 2 1 3 $\Sigma d^2$ (= 14) $1 - \frac{6\Sigma d^2}{4(4^2-1)}$ = -0.4 oe	M1 A1 M1 M1  A1 5	Ranks attempted, even if opp  Dep M1 or $S_{xy} = 23^{-100/4}$ or $S_{xx} = S_{yy} = 30^{-100/4}$ Dep 2 <sup>nd</sup> M1 $S_{xy}/\sqrt{(S_{xx}S_{yy})}$
<b>Total</b>		<b>7</b>	
<b>2(i)</b>	$\frac{{}^7C_2 \times {}^8C_3}{{}^{15}C_5}$  = $56/143$ or $1176/3003$ or 0.392 (3sfs)	M1 M1  A1 3	${}^7C_2 \times {}^8C_3$ or 1176 : M1 (Any C or P)/ ${}^{15}C_5$ : M1 (dep < 1)  or $\frac{7}{15} \times \frac{6}{14} \times \frac{8}{13} \times \frac{7}{12} \times \frac{6}{11}$ or 0.0392: M1 $\times {}^5C_2$ or $\times 10$ : M1 (dep $\geq 4$ probs mult) if 2 $\leftrightarrow$ 3, treat as MR max M1M1
<b>(ii)</b>	$3! \times 2!$ or ${}^3P_3 \times {}^2P_2$ not in denom = 12	M1 A1 2	BABAB seen: M1 120-12: M1A0 NB $4!/2! = 12$ : M0A0
<b>Total</b>		<b>5</b>	
<b>3(i)(a)</b>	0.9368 or 0.937	B1 1	
<b>(b)</b>	$0.7799 - 0.5230$ or ${}^8C_5 \times 0.45^3 \times 0.55^5$ = 0.2569 or 0.2568 or 0.257	M1 A1 2	Allow 0.9368 – 0.7799
<b>(c)</b>	0.7799 seen – 0.0885 (not 1 – 0.0885) = 0.691 (3 sfs)	M1 M1 A1 3	${}^8C_5 \times 0.45^3 \times 0.55^5 + {}^8C_4 \times 0.45^4 \times 0.55^4 + {}^8C_3 \times 0.45^5 \times 0.55^3$ : M2 1 term omitted or wrong or extra: M1
<b>(ii)(a)</b>	${}^{10}C_2 \times (7/12)^8 \times (5/12)^2$ seen = 0.105 (3 sfs)	M1 A1 2	or 0.105 seen, but not ISW for A1
<b>(b)</b>	$2^{31/72}$ or $175/72$ or 2.43 (3 sfs)	B1 1	NB $12/5 = 2.4$ : B0
<b>Total</b>		<b>9</b>	
<b>4(i)</b>	$1/20 \times 1/10$ or $1/200$ or 0.005 $\times 2$ = $1/100$ or 0.01	M1 M1dep A1 3	
<b>(ii)</b>	$E(X) = 0 + 50 \times 1/10 + 500 \times 1/20$ or $0 + 0.5 \times 1/10 + 5 \times 1/20$ = 30p = £0.30 or $3/10$ Charge “30p” + 20p or 0.3 + 0.2  = 50p or 0.50 or 0.5	M1 A1 M1  A1 4	or eg 20 goes: $2 \times £0.50 + £5.00$ = £6.00 (“£6.00” + $20 \times £0.20$ ) $\div 20$ condone muddled units eg 0.3 + 20  $x = 20, 70, 520$ : M1A1 $20 \times 17/20 + 70 \times 1/10 + 520 \times 1/20$ : M1 = 50 : A1  $x, (x - 50), (x - 500)$ : M1A1 $x \times 17/20 + (x - 50) \times 1/10 + (x - 500) \times 1/20 = 20$ : M1 $x = 50$ : A1  Ignore “£” or “p”
<b>Total</b>		<b>7</b>	

<p><b>5(i)</b></p>	${}^{12}/_{22} \times {}^{11}/_{21}$ $= {}^2/_{7} \text{ oe or } 0.286 \text{ (3 sfs)}$	<p>M1 A1 2</p>	<p>or <math>{}^{12}C_2 / {}^{22}C_2</math></p>
<p><b>(ii)</b></p>	${}^7/_{15} \times {}^6/_{14} \times {}^8/_{13} \text{ or } {}^8/_{65} \text{ oe}$ $\times 3 \text{ oe}$ $= {}^{24}/_{65} \text{ or } 0.369 \text{ (3 sfs)}$	<p>M1 M1 A1 3</p>	<p>Numerators any order <math>{}^7C_2 \times {}^8C_1</math> :M1          3 x prod any 3 probs (any C or P)<math>{}^{15}C_3</math> :M1          (dep &lt;1)</p> <p><math>1 - ({}^8/_{15} \times {}^7/_{14} \times {}^6/_{13} + 3 \times {}^8/_{15} \times {}^7/_{14} \times {}^7/_{13} + {}^7/_{15} \times {}^6/_{14} \times {}^5/_{13})</math> :          M2</p> <p>one prod omitted or wrong: M1</p>
<p><b>(iii)</b></p>	$\frac{x}{45} \times \frac{x-1}{44} = \frac{1}{15} \text{ oe}$ $x^2 - x - 132 = 0 \text{ or } x(x-1) = 132$ $(x-12)(x+11) = 0$ $\text{or } x = \frac{1 \pm \sqrt{(1^2 - 4 \times (-132))}}{2}$ <p>No. of Ys = 12</p>	<p>M1  A1  M1  A1 4</p>	<p>not <math>\frac{x}{45} \times \frac{x}{44} = \frac{1}{15}</math> or <math>\frac{x}{45} \times \frac{x}{45} = \frac{1}{15}</math> or <math>\frac{x}{45} \times \frac{x-1}{45} = \frac{1}{15}</math></p> <p>oe</p> <p>ft 3-term QE for M1          condone signs interchanged          allow one sign error</p> <p>Not <math>x = 12</math> or <math>-11</math>          ans 12 from less wking, eg <math>12 \times 11 = 132</math>          or T &amp; I: full mks</p> <p>Some incorrect methods:</p> $\frac{x}{45} \times \frac{x-1}{44} = \frac{1}{15} \text{ oe M1}$ $x^2 + x = 132 \text{ A0}$ $x = 11 \text{ M1A0}$ $12 \times 11 = 132 \text{ M1A1M1}$ $x = 12 \text{ and (or "or") } 11 \text{ A0}$ <p>NB 12 from eg 12.3 rounded, check method</p>
<p><b>Total</b></p>		<p><b>9</b></p>	



7(i)	Geo stated $0.7^3 \times 0.3$ $\frac{1029}{10000}$ oe or 0.103 (3 sfs)	M1 M1 A1 3	or implied by $0.7^7 \times 0.3$ or $0.3^7 \times 0.7$ Allow $0.7^4 \times 0.3$
(ii)	$0.7^6$ alone = 0.118 (3 sfs)	M1 A1 2	$1 - (0.3 + 0.3 \times 0.7 + \dots + 0.3 \times 0.7^5)$ not $1 - 0.7^6$
(iii)	$0.7^9$ $1 - 0.7^9$ 0.960 (3 sfs)	M1 M1 A1 3	not $0.3 \times 0.7^9$ allow $1 - 0.7^{10}$ or 0.972 for M1 allow 0.96, if no incorrect wking seen  $0.3 + 0.7 \times 0.3 + \dots + 0.7^8 \times 0.3$ : M2 1 term omitted or wrong or "correct" extra: M1
(iv)	Bin stated  ${}^5C_2 \times 0.7^3 \times 0.3^2$ or 0.8369 – 0.5282 = 0.3087 or 0.309 (3 sfs)	M1  M1 A1 3	or implied by table or ${}^nC_r$ or $0.7^3 \times 0.3^2$ or 0.0309
<b>Total</b>		<b>11</b>	
8(i)	$168.6 - \frac{88 \times 16.4}{8}$ $\sqrt{\left(1136 - \frac{88^2}{8}\right)\left(34.52 - \frac{16.4^2}{8}\right)}$ = -0.960 (3 sfs)	M2  A1 3	$\left(= \frac{-11.8}{\sqrt{168 \times 0.9}}\right)$ M1: correct subst in any correct $S$ formula M2: correct substn in any correct $r$ formula  allow -0.96, if no incorrect wking seen
(ii)	must refer to, or imply, external constraint on $x$ e.g $x$ is controlled or values of $x$ fixed or chosen allow $x$ is fixed	B1 1	not $x$ is not random not $x$ affects $y$ not $x$ not affected by $y$ not $x$ goes up same amount each time not charge affects no. of vehicles not $x$ not being measured
(iii)	$168.6 - \frac{88 \times 16.4}{8}$ $1136 - \frac{88^2}{8}$ = -0.0702 (3 sfs) or $^{-59/840}$ or $^{-11.8/168}$  $y - \frac{16.4}{8} = \text{"-0.0702"}(x - \frac{88}{8})$ $y = -0.07x + 2.8$ or better	M1  A1  M1 A1 4	ft their $S_{xy}$ and $S_{xx}$ incl $\frac{168.6}{1136}$ if used in (i)  or -0.07 if no incorrect wking  or $a = \frac{16.4}{8} - (\text{"-0.0702"}) \times \frac{88}{8}$ or $\frac{2371}{840}$ oe eg $y = \frac{-59}{840}x + \frac{2371}{840}$
(iv)(a)	"-0.07" x 20 + "2.8" = 1.4(2) million (2 sfs)	M1 A1 2	no ft
(b)	$r$ close to -1 or corr'n is high         just outside given data, so reliable	B1       B1 2	or good corr'n or pts close to line but not if "close to -1, hence unreliable" if $r$ low in (i), ft: " $r$ low" or "poor corr'n" etc  or outside given data so unreliable  not "reliable as follows trend" not "reliable as follows average" no ft from (iv)(a)
(v)	$y$ on $x$ $x$ is indep	B1 B1 2	or $x$ controlled or $y$ depends on $x$ or $y$ not indep dep on not " $x$ on $y$ "  $r$ close to -1 so makes little difference: B2
<b>Total</b>		<b>14</b>	