

# 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>	attempts at threading indep prob of succeeding in threading const	B1 B1 2	in context in context
<b>(ii) (a)</b>	$0.7^4 \times 0.3$ $= 0.0720$ (3sf)	M1 A1 2	Condone 0.072
<b>(b)</b>	$0.7^5$  $= 0.168$ ( 3 sfs)	M2  A1 3	or $1-(0.3+0.7 \times 0.3+0.7^2 \times 0.3+0.7^3 \times 0.3+0.7^4 \times 0.3)$ M1 for one term omitted or extra or wrong or $1-0.7^5$ or $(0.3+\dots+0.7^4 \times 0.3)$ or 0.3, 0.7 muddle or $0.7^4$ or $0.7^6$ alone. 0.6 not 0.7 M0 in (a) M1 in (b) 1/3,2/3 used M1 in (a) M1 in (b)
<b>(iii)</b>	likely to improve with practice  hence independence unlikely or prob will increase each time	B1  B1 2	or thread strands gradually separate 1 <sup>st</sup> B1 must be in context. hence independence unlikely or prob will decrease each time or similar Allow ‘change’
<b>Total</b>		<b>[9]</b>	
<b>2 (i) (a)</b>	Use of correct midpts $\Sigma lf \div \Sigma f$ (= 706 $\div$ 40) $= 17.65$  $\Sigma l^2 f$ (= 13050.5) $\sqrt{\frac{"13050.5"}{40} - "17.65"}^2$ (= $\sqrt{14.74}$ ) $= 3.84$ ( 3 sfs)	B1 M1 A1  M1  M1  A1 6	11,14,18,25.5 $l$ within class, $\geq$ three $lf$ seen [17.575,17.7]  $\geq$ three $l^2 f$ seen  $\div 40, -\text{mean}^2, \sqrt{\text{Dep}} > 0.$ $\Sigma (l-17.65)^2 f$ , at least 3 M1, $\div 40, \sqrt{\quad}$ M1, 3.84 A1. $\div 4 \Rightarrow \text{max B1M0A0M1M0A0}$
<b>(b)</b>	mid pts used or data grouped or exact values unknown oe	B1 1	not “orig values were guesses”
<b>(ii)</b>	$20 \div 5$ $= 4$	M1 A1 2	condone $20 \div [4,5]$ or ans 5
<b>(iii)</b>	$20.5^{\text{th}}$ value requ’d and 1 <sup>st</sup> two classes contain 14 values $16 - 20$	M1 B1 2	condone $20^{\text{th}}$ oe or third class oe
<b>(iv) (a)</b>	increase	B1 1	
<b>(b)</b>	decrease	B1 1	
<b>Total</b>		<b>[13]</b>	
<b>3 (i)</b>	$S_{hm} = 0.2412$ $S_{hh} = 0.10992$ $S_{mm} = 27.212$ $r = \frac{S_{hm}}{\sqrt{(S_{hh}S_{mm})}}$ $= 0.139$ (3 sfs)	B1 M1  A1 3	Allow x or $\div 5$  any one $S$ correct fit their $S$ s
<b>(ii)</b>	Small, low or not close to 1 or close to 0 oe pts not close to line oe	B1 ft  B1	1 <sup>st</sup> B1 about value of $r$ 2 <sup>nd</sup> B1 about diag
<b>(iii)</b>	none or unchanged or “0.139” oe	B1 1	
<b>(iv)</b>	Larger oe	B1 1	
<b>Total</b>		<b>[7]</b>	

<b>4 (i)</b>	$(0 \times \frac{1}{2}) + 1 \times \frac{1}{4} + 2 \times \frac{1}{8} + 3 \times \frac{1}{8}$ $= \frac{7}{8}$ or 0.875 oe $(0 \times \frac{1}{2}) + 1 \times \frac{1}{4} + 2^2 \times \frac{1}{8} + 3^2 \times \frac{1}{8}$ (= $1 \frac{7}{8}$ ) $- (\frac{7}{8})^2$ $= \frac{71}{64}$ or 1.11 (3 sfs) oe	M1	$\geq 2$ non-zero terms seen
		A1	If $\div 3$ or 4 M0M0M1(poss)
		M1	$\geq 2$ non-zero terms seen
		M1	dep +ve result
		A1 5	M1 all 4 $(x-0.875)^2$ terms seen. M1 mult p, $\Sigma$ A1 1.11
<b>(ii)</b>	Bin stated or implied 0.922 (3 sfs)	M1 A1 2	Eg table or $\frac{1}{4}^n \times \frac{3}{4}^m$ ( $n+m=10, n, m \neq 1$ ) or 10C4 or 5(or 4 or 6) terms correct
<b>(iii)</b>	$n = 10$ & $p = \frac{1}{8}$ stated or implied ${}^{10}C_4 \times \frac{7}{8}^6 \times \frac{1}{8}^4$ $= 0.0230$ (3 sfs)	M1 M1 A1 3	condone 0.023
<b>Total</b>		<b>[10]</b>	
<b>5 (i)</b>	$\frac{6}{14} \times \frac{5}{13} \times \frac{3}{12}$ $\times 3!$ oe $= \frac{45}{182}$ or 0.247 (3 sfs)oe	M1	${}^6C_1 \times {}^5C_1 \times {}^3C_1$
		M1	$\div {}^{14}C_3$
		A1 3	With repl M0M1A0
<b>(ii)</b>	$\frac{6}{14} \times \frac{5}{13} \times \frac{4}{12} + \frac{5}{14} \times \frac{4}{13} \times \frac{3}{12} + \frac{3}{14} \times \frac{2}{13} \times \frac{1}{12}$ $= \frac{31}{364}$ or 0.0852 (3 sf)	M2 A1 3	${}^6C_3 + {}^5C_3 + {}^3C_3$ M1 for any one ( $\div {}^{14}C_3$ )M1 all 9 numerators correct. With repl M1(6/14) <sup>3</sup> +(5/14) <sup>3</sup> +(3/14) <sup>3</sup>
<b>Total</b>		<b>[6]</b>	
<b>6 (a)</b>	A: diag or explanation showing pts close to st line, always increasing B: Diag or expl based on $r=1 \Rightarrow$ pts on st line $\Rightarrow r(s)=1$	B1	.
		B1	Diag or expl based on $r(s) \neq 1 \Rightarrow$ pts not on st line
		B1 3	$\Rightarrow r \neq 1$ $r=1 \Rightarrow$ pts on st line & $r(s) \neq 1 \Rightarrow$ pts not on st line B1B1 $r=1 \Rightarrow r(s)=1$ B2
<b>(b)</b>	$\bar{y} = 2.4 \times 4.5 + 3.7$ $= 14.5$ $4.5 = 0.4 \times "14.5" - c$ $c = 1.3$  $a^2 = x - b^2 y \therefore -14.5$ M1A1; then $a^2 = 4.5 - 0.4 \times 14.5 = -1.3$ M1A1	M1 A1 M1 A1 4	Attempt to sub expression for y $x = 0.96x + 1.48 - c$ oe sub $x = 4.5$ and solve $c = 1.3$  14.5 M1A1. $(y - 3.7)/2.4 = 0.4y - c$ and sub 14.5 M1 $c = 1.3$ A1
<b>Total</b>		<b>[7]</b>	
<b>7 (i)</b>	$\frac{25}{37}$	B2 2	B1 num, B1 denom 25/37xp B1
<b>(ii)</b>	$\frac{15}{23}$ seen or implied $\times \frac{39}{59}$ seen or implied $= \frac{585}{1357}$ or 0.431 (3 sfs) oe	M1 M2 A1 4	M1 num, M1 denom Allow M1 for 39/59x or + wrong p
<b>Total</b>		<b>[6]</b>	

<b>8 (i)</b>	$5^{1/2}$ = 60	M1 A1 2	Allow 5P3
<b>(ii)</b>	4! = 24	M1 A1 2	Allow 2×4!
<b>(iii)</b>	$2^{2/5} \times 3^{3/4}$ or $3/5 \times 2/4$ × 2 = $3^{3/5}$ oe	M1 M1 A1 3	allow M1 for $2^{2/5} \times 3^{3/5} \times 2$ or $12^{2/25}$ or $(6 \times 3!) \div (\mathbf{i})$ M2 or $3! \div (\mathbf{i}), 6 \div (\mathbf{i}), (6+6) \div (\mathbf{i}), 6k \div (\mathbf{i})$ or $6 \times 6$ or 36 or 1-correct answer M1 (k, integer ≤ 5)
<b>Total</b>		<b>[7]</b>	
<b>9 (i)</b>	$p^2$	B1 1	
<b>(ii)</b>	$(q^2p)^2$ oe =AG	B1 1	
<b>(iii)</b>	$r=q^2$  a/(1-r) used $(S_{\infty} =) \frac{p^2}{1-q^2}$  $= \frac{p^2}{1-(1-p)^2}$ p/(2-p) AG	B1  M1  A1  M1  A1 5	May be implied  With $a=p^2$ and $r=q^2$ or $q^4$  Attempt to simplify using $p+q=1$ correctly. Dep on $r = q^2$ or $q^4$ $\frac{(1-q)^2}{(1-q)(1+q)}$ or $p^2/p(1+q)$ Correctly obtain given answer showing at least one intermediate step.
<b>P2Total</b>		<b>[7]</b>	

**Total 72 marks**