

4732 Probability & Statistics 1

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

1 (i)	attempts at threading indep prob of succeeding in threading const	B1 B1 2	in context in context
(ii) (a)	$0.7^4 \times 0.3$ = 0.0720 (3sf)	M1 A1 2	Condone 0.072
(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)
(iii)	likely to improve with practice hence independence unlikely or prob will increase each time	B1 B1 2	or thread strands gradually separate 1 st B1 must be in context. hence independence unlikely or prob will decrease each time or similar Allow ‘change’
Total		[9]	
2 (i) (a)	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)	mid pts used or data grouped or exact values unknown oe	B1 1	not “orig values were guesses”
(ii)	$20 \div 5$ = 4	M1 A1 2	condone $20 \div [4,5]$ or ans 5
(iii)	20.5^{th} value requ’d and 1 st two classes contain 14 values $16 - 20$	M1 B1 2	condone 20^{th} oe or third class oe
(iv) (a)	increase	B1 1	
(b)	decrease	B1 1	
Total		[13]	
3 (i)	$S_{hm} = 0.2412$ $S_{hh} = 0.10992$ $S_{mm} = 27.212$ $r = \frac{S_{hm}}{\sqrt{(S_{hh}S_{mm})}}$ = 0.139 (3 sfs)	B1 M1 A1 3	Allow x or $\div 5$ any one S correct fit their S s
(ii)	Small, low or not close to 1 or close to 0 oe pts not close to line oe	B1 ft B1	1 st B1 about value of r 2 nd B1 about diag
(iii)	none or unchanged or “0.139” oe	B1 1	
(iv)	Larger oe	B1 1	
Total		[7]	

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

8 (i)	$5!_2$ = 60	M1 A1 2	Allow 5P3
(ii)	4! = 24	M1 A1 2	Allow 2×4!
(iii)	${}^2_5 \times {}^3_4$ or $3/5 \times 2/4$ × 2 = 3_5 oe	M1 M1 A1 3	allow M1 for ${}^2_5 \times {}^3_5 \times 2$ or ${}^{12}_{25}$ 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 6×6 or 36 or 1-correct answer M1 (k, integer ≤ 5)
Total		[7]	
9 (i)	p^2	B1 1	
(ii)	$(q^2p)^2$ oe =AG	B1 1	
(iii)	$r=q^2$ 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.
P2Total		[7]	

Total 72 marks