4732 Probability & Statistics 1

Note: "(3 sfs)" means "answer which rounds to ... to 3 sfs". If correct ans seen to ≥ 3sfs, 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+0.7×0.3+0.7^2×0.3+0.7^3×0.3 +0.7^4×0.3) M1 for one term omitted or extra or wrong or 1-0.7^5 or(0.3+...+0.7^4×0.3) 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 M1in **(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 1st 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 ÷ 40) = 17.65 $\Sigma l^2 f$ (= 13050.5) $\sqrt{\frac{"13050.5"}{40} - "17.65"^2}$ (= √14.74) = 3.84 (3 sfs)	B1 M1 A1 M1 M1 A1 6	11,14,18,25.5 l within class, ≥ three lf seen [17.575,17.7] ≥ three l^2f seen ÷40,-mean²,√.Dep>0. ∑(l-17.65)²f, at least 3 M1,÷40,√ M1,3.84 A1. ÷ 4 ⇒ max B1M0A0M1M0A0
(b)	mid pts used or data grouped or exact values unknown oe	 B1 1	not "orig values were guesses"
(ii)	20 ÷ 5 = 4	M1 A1 2	condone 20 ÷ [4,5] or ans 5
(iii)	20.5th value requ'd and 1st two classes contain 14 values 16 – 20	 M1 B1 2	condone 20th 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 ÷ 5 any one S correct ft their Ss
(ii)	Small, low or not close to 1 or close to 0 oe pts not close to line oe	B1 ft B1	1st B1 about value of r 2nd B1 about diag
(iii)	none or unchanged or "0.139" oe	B1 1	
(iv)	Larger oe	B1 1	
Total		**[7]**	

4 (i)	$(0\times\frac{1}{2})+1\times\frac{1}{4}+2\times\frac{1}{8}+3\times\frac{1}{8}$ $=\frac{7}{8}$ 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 A1 M1 M1 A1 5	$\geq$ 2 non-zero terms seen If ÷3 or 4 M0M0M1(poss) $\geq$ 2 non-zero terms seen dep +ve result M1 all4 $(x-0.875)^2$ terms seen. M1 mult p,$\sum$ 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≠ 1) or10C4 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)	$\frac{6}{14}\times\frac{5}{13}\times\frac{3}{12}$ × 3! oe $=\frac{45}{182}$ or 0.247 (3 sfs)oe	M1 M1 A1 3	$^6C_1\times{}^5C_1\times{}^3C_1$ $\div{}^{14}C_3$ With repl M0M1A0
(ii)	$\frac{6}{14}\times\frac{5}{13}\times\frac{4}{12}+\frac{5}{14}\times\frac{4}{13}\times\frac{3}{12}+\frac{3}{14}\times\frac{2}{13}\times\frac{1}{12}$ $=\frac{31}{364}$ 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$(6/14)^3+(5/14)^3+(3/14)^3$
Total		**[6]**	
6 (a)	A: diag or explanation showing pts close to st line, always increasing B:Diag or expl based on r=1=>pts on st line =>r(s)=1	B1 B1 B1 3	. Diag or expl based on r(s)≠ 1=>pts not on st line =>r≠ 1 r=1=>pts on st line&r(s)≠ 1=>pts not on st line B1B1 r=1=>r(s)=1 B2
(b)	$\bar{y}$ = 2.4 × 4.5 + 3.7 = 14.5 4.5 = 0.4 × "14.5"- c c = 1.3 a'=x-b'y :-14.5 M1A1; then a'=4.5-0.4x14.5=-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 sub14.5 M1 c=1.3 A1
Total		**[7]**	
7 (i)	$^{25}/_{37}$	B2 2	B1 num, B1 denom 25/37xp B1
(ii)	$\frac{15}{23}$ 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
Total		**[6]**	

8 (i)	$^{5!}/_{2}$ = 60	M1 A1 2	Allow 5P3
(ii)	4! = 24	M1 A1 2	Allow 2×4!
(iii)	$^{2}/_{5} \times {}^{3}/_{4}$ or3/5×2/4 × 2 = $^{3}/_{5}$ oe	M1 M1 A1 3	allow M1 for $^{2}/_{5} \times {}^{3}/_{5} \times 2$ or $^{12}/_{25}$ or (6×3!)÷**(i)** M2 or 3!÷**(i),**6÷**(i)**,(6+6)÷**(i)**,6k÷**(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=q² a/(1-r) used $(S_\infty =)\ \dfrac{p^2}{1-q^2}$ $= \dfrac{p^2}{1-(1-p)^2}$ p/(2-p) AG	B1 M1 A1 M1 A1 5	May be implied With a=p²and r=q²or q ⁴ Attempt to simplify using p+q=1 correctly. Dep on r = q² or q⁴ $\dfrac{(1-q)^2}{(1-q)(1+q)}$ or p²/p(1+q) Correctly obtain given answer showing at least one intermediate step.
P2Total		**[7]**	

Total 72 marks