

Mathematics

Advanced GCE 4732

Probability and Statistics 1

Mark Scheme for June 2010

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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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.

i	590	B1 1	Allow approximately 590
ii	Graph horiz (for ≥ 55 mks) oe	B1 1	or levels off, or grad = 0, grad not increase Allow line not rise, goes flat, plateaus, stops increasing, not increase, doesn't move
iii	39 to 41	B1 1	
iv	Attempt read cf at 26 or 27 Double & attempt read x Max C = 29 to 31.5	M1 M1 A1 3	eg 26 mks \rightarrow 150 th 27 mks \rightarrow 180 th eg read at cf = 300 or 360 Indep of first M1 May be implied by ans Answer within range, no working, M1M1A1 32 without working, sc B1
v	LQ = 25.5-26.5 or UQ = 34-35.5 IQR = 8-10 (German) more spread	M1 A1 B1ft 3	M1 for one correct quartile dep ≥ 1 correct quartile or no working or less consistent, less uniform, less similar, more varied, more variable, greater variance, more spaced apart, further apart ft their IQR; must be consistent with IQR Correct comment with no working: M0A0B1
Total		9	
2i	Opposite orders or ranks or scores or results or marks $r_s = -1$	B1 1	or reversed, or backwards, or inverse or as one increases the other decreases Needs reason AND value
ii	Attempt Σd^2 (= 6) $1 - \frac{6 \times \Sigma d^2}{3(3^2-1)}$ $= -\frac{1}{2}$ oe	M1 M1 A1 3	dep 1 st M1 Allow use wrong table for M1M1
iii	3! or 3P_3 or 6 1 \div their '6' $\frac{1}{6}$ oe eg $\frac{6}{36}$	M1 M1 A1 3	r attempt list possible orders of 1,2,3 (≥ 3 orders) 2 nd M1 for fully correct method only or $\frac{1}{3} \times \frac{1}{2} (\times 1)$: M1M1
Total		7	
3i	If x is contr (or indep) or y depend't, use y on x If neither variable contr'd (or indep) AND want est y from x : use y on x	B1 B1 2	Allow x increases constantly, is predetermined, you choose x , you set x , x is fixed, x is chosen Allow y not controlled AND want est y from x Ignore incorrect comments
iiia	$S_{xx} = 510000 - \frac{1800^2}{9}$ (= 150000) $S_{xy} = 4080 - \frac{1800 \times 14.4}{9}$ (= 1200) $b = \frac{1200}{150000}$ (= 0.008) $y - \frac{14.4}{9} = 0.008(x - \frac{1800}{9})$ $y = 0.008x (+ 0)$	M1 M1 M1 A1 4	or $\frac{510000}{9} - 200^2$ (= 16666.7) or $\frac{4080}{9} - 200 \times 1.6$ (= 133.33) M1 for either S $b = \frac{133.33}{16666.7}$ dep correct expressions both S 's or $a = \frac{14.4}{9} - 0.008 \times \frac{1800}{9}$ (= 0) Must be all correct for M1 CAO
iib	312.5 or 313	B1ft 1	ft their eqn in (iia)
iic	-0.4	B1ft 1	ft their eqn in (iia)

iid	Contraction oe Unreliable because extrapolated oe	B1(ft) B1 2	or length decreased, shorter, pushed in, shrunk, smaller or not in the range of x or not in range of previous results
Total		10	
4ia	0.299 (3 sf)	B1 1	
ib	0.2991 – 0.1040 = 0.195 (3 sf) or $\frac{1280}{6561}$ oe	M1 A1 2	Must subtract correct pair from table
iii	${}^{15}C_4 \times (1-0.22)^{11} \times 0.22^4$ = 0.208 (3 sf)	M1 A1 2	Allow M1 for ${}^{15}C_4 \times 0.88^{11} \times 0.22^4$
iib	(15 × 0.22 =) 3.3 15 × 0.22 × (1 – 0.22) or '3.3' × (1 – 0.22) = 2.57 (3 sf)	B1 M1 A1 3	Allow M1 for 15 × 0.22 × 0.88
Total		8	
5i	$\frac{1}{2} \times \frac{1}{3}$ or $\frac{2}{4} \times \frac{1}{3}$ or $\frac{1}{4}C_2$ or $\frac{2}{12}$ (= $\frac{1}{6}$ AG) $\frac{1}{4} \times \frac{2}{3}$ or $2 \times \frac{1}{4} \times \frac{1}{3}$ or $\frac{1}{2} \times \frac{1}{3}$ or $\frac{2}{4} \times \frac{1}{3}$ Add two of these or double one (= $\frac{1}{3}$ AG)	B1 B1 B1 3	or 1 out of 6 or 2 out of 12 or $\frac{2!}{4!} \times 2$ or $\frac{2}{12}$ or $\frac{1}{6}$ or $\frac{1}{3!}$ or $\frac{1}{4}C_2$ or $\frac{2!}{4!} \times 2$ or $\frac{2}{4}C_2$ or $4 \times \frac{1}{4} \times \frac{1}{3}$ or $\frac{2}{4} \times \frac{2}{3}$ or $\frac{4}{12}$ or $\frac{2!}{4!} \times 4$ B1B1 or $\frac{2}{6}$ or $2 \times \frac{1}{6}$ or $\frac{2}{3!}$ or $\frac{2!}{3!}$ B1B1
ii	$X = 3, 4, 5, 6$ only, stated or used $P(X=5)$ wking as for $P(X=4)$ above or $1 - (\frac{1}{6} + \frac{1}{3} + \frac{1}{6})$ or $\frac{1}{3}$ $P(X=3)$ wking as for $P(X=6)$ above or $1 - (\frac{1}{3} + \frac{1}{3} + \frac{1}{6})$ or $\frac{1}{6}$ $\begin{matrix} 3 & 4 & 5 & 6 \\ \frac{1}{6} & \frac{1}{3} & \frac{1}{3} & \frac{1}{6} \end{matrix}$ oe	B1 M1 M1 A1 4	Allow repetitions Allow other values with zero probabilities. or M1 for total of their probs = 1, dep B1 or $P(X=3)=\frac{1}{6}$, $P(X=4)=\frac{1}{3}$, $P(X=5)=\frac{1}{3}$, $P(X=6)=\frac{1}{6}$ Complete list of values linked to probs
iii	$\sum xp$ = $4\frac{1}{2}$ $\sum x^2p$ (= $21\frac{1}{6}$) – $4\frac{1}{2}$, ² = $\frac{11}{12}$ or 0.917 (3 sf)	M1 A1 M1 M1 A1 5	≥ 2 terms correct ft ≥ 2 terms correct ft Independent except dependent on +ve result
Total		12	

6	$m = (9 \times 6 + 3) \div 10$ $= 5.7$ $2 = \frac{\Sigma x^2}{9} - 6^2$ $\Sigma x^2 = 2 \times 9 + 6^2 \times 9$ or 342 $v = \frac{(342 + 3^2)}{10} - 5.7^2$ $= 2.61$ oe	M1 A1 M1 A1 M1 A1 6	or $((\text{Sum of any 9 nos totalling 54}) + 3) \div 10$ or $\frac{\Sigma(x-6)^2}{9} = 2$ M1 or $\Sigma x^2 = 18 + 12 \times 54 - 36 \times 9$ or 342 A1 dep Σx^2 attempted, eg $(\Sigma x)^2 (= 3249)$ or just state ' Σx^2 '; allow $\sqrt{\quad}$ CAO
Total		6	
7i	${}^4C_2 \times {}^6C_3 \times {}^5C_4$ or $6 \times 20 \times 5$ $= 600$	M1M1 A1 3	M1 for any 2 correct combs seen, even if added
ii	$\frac{2}{4}$ or $\frac{{}^3C_1}{{}^4C_2}$ or $\frac{{}^3C_1 \times {}^6C_3 \times {}^5C_4}{{}^4C_2 \times {}^6C_3 \times {}^5C_4}$ or $\frac{{}^3C_1 \times {}^6C_3 \times {}^5C_4}{'600'}$ $= \frac{1}{2}$ oe	M1 A1 2	or $\frac{1}{4} \times 1 + \frac{3}{4} \times \frac{1}{3}$ or $\frac{1}{4} \times 2$ or $\frac{1}{4} + \frac{1}{4}$
iii	${}^3C_1 \times {}^6C_3 (\times {}^4C_4) + {}^3C_2 \times {}^6C_3 \times {}^5C_4$ 360	M1M1 A1 3	M1 either product seen, even if \times or \div by something
Total		8	

8			
8ia	Geo(0.3) stated or implied $0.7^3 \times 0.3$ $= 0.103$ (3 sf)	M1 M1 A1 3	by $0.7^n \times 0.3$
b	0.7^3 or 0.343 $1 - 0.7^3$ $= 0.657$	M1 M1 A1 3	0.7^3 must be alone, ie not $0.7^3 \times 0.3$ or similar allow $1 - 0.7^4$ or 0.7599 or 0.76 for M1 only or $0.3 + 0.7 \times 0.3 + 0.7^2 \times 0.3$: M1M1 1 term wrong or omitted or extra M1 or $1 - (0.3 + 0.7 \times 0.3 + 0.7^2 \times 0.3)$ or 0.343: M1
iii	State or imply one viewer in 1 st four ${}^4C_1 \times 0.7^3 \times 0.3$ (= 0.412) $\times 0.3$ $= 0.123$ (3 sf)	M1 M1 M1 A1 4	or B(4, 0.3) stated, or 4C_1 used, or YNNNY dep 1st M1
b	$0.7^5 + {}^5C_1 \times 0.7^4 \times 0.3$ $= 0.528$ (3 sf)	M1 A1 2	or $1 - (0.3^2 + 2 \times 0.3^2 \times 0.7 + 3 \times 0.3^2 \times 0.7^2 + 4 \times 0.3^2 \times 0.7)$ Not ISW, eg $1 - 0.528$: M1A0
Total		12	

Total 72 marks

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