GCE

Mathematics

Advanced GCE **4732**

Probability and Statistics 1

Mark Scheme for June 2010

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.

1i	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	M1		eg 26 mks → 150th 27 mks → 180th
	Double & attempt read x	M1		eg read at cf = 300 or 360 Indep of first M1 May be implied by ans
	Max C = 29 to 31.5	A1	3	Answer within range, no working, M1M1A1 32 without working, sc B1
v	LQ = 25.5-26.5 or UQ = 34-35.5	M1		M1 for one correct quartile
	IQR = 8-10	A1		dep ≥ 1 correct quartile or no working
	(German) more spread	B1ft	3	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)	M1		
	$1 - \frac{6 \times \Sigma d^2}{3(3^2 - 1)}$	M1		dep 1st M1 Allow use wrong table for M1M1
	$= -\frac{1}{2}$ oe	A1	3	
iii	3! or $^3P_3$ or 6	M1		r attempt list possible orders of 1,2,3 (≥3 orders)
	1 ÷ their '6'	M1		2nd M1 for fully correct method only or $\frac{1}{3} \times \frac{1}{2}(\times 1)$: M1M1
	$\frac{1}{6}$ oe eg $\frac{6}{36}$	A1	3	
Total		**7**		
3i	If x is contr (or indep) or y depend't, use y on x	 B1		Allow x increases constantly, is predetermined, you choose x, you set x, x is fixed, x is chosen
	If neither variable contr'd (or indep) AND want est y from x: use y on x	 B1	 2	Allow y not controlled AND want est y from x Ignore incorrect comments
iia	$S_{xx} = 510000 - \frac{1800^2}{9}$ (= 150000)			or $\frac{510000}{9} - 200^2$ (= 16666.7)
	$S_{xy} = 4080 - \frac{1800 \times 14.4}{9}$ (= 1200)	M1		or $\frac{4080}{9}$ - 200×1.6 (= 133.33) M1 for either S
	$b = \frac{'1200'}{'150000'}$ (= 0.008)	M1		$b = \frac{'133.33'}{'16666.7'}$ dep correct expressions both S's
	$y - \frac{14.4}{9} = 0.008(x - \frac{1800}{9})$	M1		or $a = \frac{14.4}{9} - 0.008 \times \frac{1800}{9}$ (= 0) Must be all correct for M1
	$y = 0.008x$ (+ 0)	A1	4	CAO
iib	312.5 or 313	B1ft	1	ft their equn in (iia)
iic	−0.4	B1ft	1	ft their equn in (iia)

iid	Contraction oe	B1(ft)	or length decreased, shorter, pushed in, shrunk, smaller
	Unreliable because extrapolated oe	B1 2	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
iia	$^{15}C_4 \times (1-0.22)^{11} \times 0.22^4$ = 0.208 (3 sf)	M1 A1 2	Allow M1 for $^{15}C_4 \times 0.88^{11} \times 0.22^4$
iib	$(15 \times 0.22 =)$ 3.3 $15 \times 0.22 \times (1-0.22)$ or '3.3'$\times(1-0.22)$ = 2.57 (3 sf)	B1 M1 A1 3	Allow M1 for $15 \times 0.22 \times 0.88$
Total		**8**	
5i	$\frac{1}{2} \times \frac{1}{3}$ or $\frac{2}{4} \times \frac{1}{3}$ or $\frac{1}{^4C_2}$ or $\frac{2}{12}$ $(=\frac{1}{6}$ **AG**$)$	B1	or 1 out of 6 or 2 out of 12 or $\frac{2!}{4!} \times 2$
	$\frac{1}{4} \times \frac{2}{3}$ or $2 \times \frac{1}{4} \times \frac{1}{3}$ or $\frac{1}{2} \times \frac{1}{3}$ or $\frac{2}{4} \times \frac{1}{3}$	B1	or $\frac{2}{12}$ or $\frac{1}{6}$ or $\frac{1}{3!}$ or $\frac{1}{^4C_2}$ or $\frac{2!}{4!} \times 2$
	Add two of these or double one $(=\frac{1}{3}$ **AG**$)$	B1 3	or $\frac{2}{^4C_2}$ 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 $\frac{1}{6}$ 3 4 5 6 $\frac{1}{6}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{6}$ 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	Σxp $= 4\frac{1}{2}$ $\Sigma x^2 p$ $(= 21\frac{1}{6})$ $- '4\frac{1}{2}'^2$ $= \frac{11}{12}$ or 0.917 (3 sf)	M1 A1 M1 M1 A1 5	$\geq$ 2 terms correct ft $\geq$ 2 terms correct ft Independent except dependent on +ve result
Total		**12**	

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