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Statistics S1 (6683)

Summer 2005

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Mark Scheme (Results)

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June 2005
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
1.	Diagram A : *y* & *x* : r = - 0.79; As *x* increases, *y* decreases or most points lie in the 2nd and 4th quadrant.	B1;B1dep
	Diagram B : *v* & *u*: r = 0.08; No real pattern. Several values of v for one value of u or points lie in all four quadrants, randomly scattered.	B1;B1dep
	Diagram C : *t* & *s* : r = 0.68; As *s* increases, *t* increases or most points lie in the 1st and 3rd quadrants	B1;B1dep (6)
2. (a)	Distance is a continuous. continuous	B1 (1)
(b)	F.D = freq/class width $\Rightarrow$ 0.8, 3.8, 5.3, 3.7, 0.75, 0.1 or the same multiple of	M1 A1 (2)
(c)	$Q_2 = 50.5 + \frac{(67-23)}{53}\times 10 = 58.8$ awrt 58.8/58.9	M1 A1
	$Q_1 = 52.48$; $Q_3 = 67.12$ awrt 52.5/52.6 67.1/67.3	A1 A1 (4)
	Special case : no working B1 B1 B1 (≡ A's on the epen)	
(d)	$\bar{x} = \frac{8379.5}{134} = 62.5335...$ awrt 62.5	B1
	$s = \sqrt{\frac{557489.75}{134} - \left(\frac{8379.5}{134}\right)^2}$	M1 A1√
	s = 15.8089…. ($S_{n-1} = 15.86825...$) awrt 15.8 (15.9)	A1 (4)
	Special case : answer only B1 B1 (≡ A's on the epen)	
(e)	$\frac{Q_3 - 2Q_2 + Q_1}{Q_3 - Q_1} = \frac{67.12 - 2\times 58.8 + 52.48}{67.12 - 52.48}$ subst their Q_1,Q_2 &Q_3 need to show working for A1√ and have reasonable values for quartiles	M1 A1√
	$= 0.1366 \Rightarrow$; +ve skew awrt 0.14	A1; B1 (4)
(f)	For +ve skew Mean > Median & 62.53 > 58.80 or $Q_3 - Q_2$ (8.32) > $Q_2 - Q_1$(6.32) Therefore +ve skew	B1 (1)

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3. (a)	$S_{xy} = 8880 - \frac{130 \times 48}{8} = (8100)$	may be implied	B1
	$S_{xx} = 20487.5$		
	$b = \frac{s_{xy}}{s_{xx}} = \frac{8100}{20487.5} = 0.395363...$	allow use of their S_{xy} for M awrt 0.395	M1 A1
	$a = \frac{48}{8} - (0.395363...)\frac{130}{8} = -0.424649...$	allow use of their b for M awrt -0.425	M1 A1
	$y = -0.425 + 0.395x$	3s.f.	B1 √ (6)
	Special case answer only B0 M0 B1 M0 B1 B1(fully correct 3sf) (≡ to B0 M0 A1 M0 A1 B1 on the epen)		
(b)	$f - 100 = -0.424649... + 0.395...(m - 250)$	subst f - 100 & m - 250	M1 A1√
	$f = 0.735 + 0.395m$	3 s.f.	A1 (3)
(c)	$m = 235 \Rightarrow f = 93.64489....$	awrt 93.6/93.7	B1 (1)

4(a)	$1.5\ (Q_3 - Q_1) = 1.5\ (28 - 12) = 24$	may be implied	B1
	$Q_3 + 24 = 52 \Rightarrow 63$ is an outlier	att Q3 +… or Q1 - …, 52 and -12or <0 or evidence of no lower outliers	M1, A1
	$Q_1 - 24 < 0 \Rightarrow$ no outliers	63 is an outlier	A1
			M1 A1 A1 (7)
(b)	Distribution is +ve skew; $Q_2 - Q_1$ (5) < $Q_3 - Q_2$ (11);		B1; B1 (2)
(c)	Many delays are small so passengers should find these acceptable or sensible comment in the context of the question.		B1 (1)

5.(a)	$k + 2k + 3k + 5k + 6k = 1$	use of $\sum P(X = x) = 1$	M1
	$17k = 1$		
	$k = \frac{1}{17} = 0.0588$		A1 (2)
(b)	$E(X) = 1 \times \frac{1}{17} + 2 \times \frac{2}{17} + ... + 5 \times \frac{6}{17} = \frac{64}{17}$	use of $\sum xP(X = x)$ and at least 2 prob correct	M1
	$= 3\frac{13}{17}$	Do not ignore subsequent working	A1
(c)	$E(X^2) = 1^2 \times \frac{1}{17} + 2^2 \times \frac{2}{17} + ... + 5^2 \times \frac{6}{17} = \left(\frac{266}{17} = 15.6\right)$	use of $\sum x^2 P(X = x)$ and at least 2 prob correct	M1 A1
	$\text{Var}(X) = \frac{266}{17} - \left(\frac{64}{17}\right)^2$	use of $\sum x^2 P(X = x)$ - $(E(X))^2$	M1 A1
	$= 1.4740...$	awrt 1.47	(4)
(d)	$\text{Var}(4 - 3X) = 9\,\text{Var}(X) = 9 \times 1.47 = 13.23 \Rightarrow 13.2$ or $9 \times 1.4740... = 13.266 \Rightarrow 13.3$	cao 9 Var X	M1 A1 (2)

6(a)	$M \sim N(155, 3.5^2)$		
	$P(M > 160) = P\left(z > \frac{160-155}{3.5}\right)$	standardising $\pm(160-155), \sigma, \sigma^2, \sqrt{\sigma}$	M1
	$= P(z > 1.43)$		A1
	$= 0.0764$		A1 (3)
(b)	$P(150 \le M \le 157) = P(-1.43 \le z \le 0.57)$	awrt -1.43, 0.57	B1 B1
	$= 0.7157 - (1 - 0.9236)$	p>0.5	M1
	$= 0.6393$	0.6393 - 0.6400 4dp	A1 (4)
	special case : answer only B0 B0 M1 A1		
(c)	$P(M \le m) = 0.3 \Rightarrow \frac{m-155}{3.5} = -0.5244$	-0.5244 att stand = z value for A1 may use awrt to -0.52.	B1 M1 A1
	$m = 153.2$	cao	A1 (4)

7.			

	Glasses	No Glasses	Totals	
Science	18	**12**	30	
Arts	**27**	**23**	**50**	50 may be seen in (a)
Humanities	44	**24**	68	23 may be seen in (b) B1
Totals	89	**59**	148	B1

(a)	$P(\text{Arts}) = \frac{50}{148} = \frac{25}{74} = 0.338$	a number/148	M1 A1 (4)
(b)	$P(\text{No glasses / Arts}) = \frac{23/148}{50/148} = \frac{23}{50} = 0.46$	$\frac{\text{prob}}{\text{their(a)prob}}$ or $\frac{\text{number}}{\text{their } 50}$	M1 A1 (2)
(c)	$P(\text{Right Handed}) = (\frac{30}{148} \times 0.8) + (\frac{50}{148} \times 0.7) + (\frac{68}{148} \times 0.75)$	attempt add three prob A1 √ on their (a)	M1 A1 √
	$= \frac{55}{74} = 0.743$	awrt 0.743	A1 (3)
(d)	$P(\text{Science / Right handed}) = \frac{\frac{30}{148} \times 0.8}{(c)} = \frac{12}{55} = 0.218$	√ on their (c)	M1 A1√ A1 (3)

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