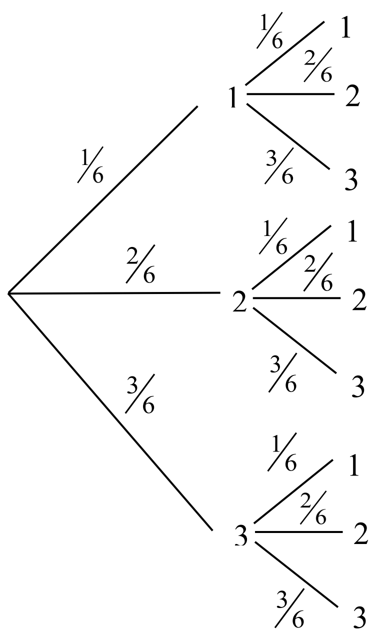
EDEXCEL STATISTICS S1 (6683) – JUNE 2004 **PROVISIONAL MARK SCHEME**

Question Number	Scheme		Marks
1.	(sum table below)	$2 \times (1, 2, \ldots, 3)$	M1
		Adding	M1
		All ≥ 5 correctly indicated	A1
		Attempt to count ≥ 5	M1
	$\therefore$ P (sum at least 5) = $\frac{21}{36} = \frac{7}{12}$	$\frac{21}{36}; \frac{7}{12}; 0.58\dot{3}; 0.583$	A1
			(5 marks)

	1	2	2	3	3	3
1	2	3	3	4	4	4
2	3	4	4	5	5	5
2	3	4	4	5	5	5
3	4	5	5	6	6	6
3	4	5	5	6	6	6
3	4	5	5	6	6	6

Alt 1



Question Number	Scheme	Marks
Alt 1	Tree with relevant branches	M1
	All correct - $\frac{2}{6}$, $\frac{3}{6}$ on those branches	A1
	P(sum at least 5) = $\left(\frac{2}{6} \times \frac{3}{6}\right) + \left(\frac{3}{6} \times \frac{2}{6}\right) + \left(\frac{3}{6} \times \frac{3}{6}\right)$ (At least 2 pairs & adding)	M1 A1
	$= \frac{21}{36}; \frac{7}{12}; 0.58\dot{3}; 0.583$	A1 (5)

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Question Number	Scheme		Marks
Alt 2	Outcomes (2, 3), (3, 3), (3, 2)	Recognising 2 pairs All correct Can be implied	M1 A1
	$\left(\frac{2}{6}\times\frac{3}{6}\right)+\left(\frac{3}{6}\times\frac{3}{6}\right)+\left(\frac{3}{6}\times\frac{2}{6}\right)$	Multiplying 2 pairs of 2 probs. & adding All correct	M1 A1
	$\frac{21}{36}$		A1 (5)
Alt 3	P (sum ≥ 5) = $12\left(\frac{1}{6}\times\frac{1}{6}\right)+9\left(\frac{1}{6}\times\frac{1}{6}\right)$	$a(p_1\times p_2)$ or $b(p_1\times p_2)$	M1
		$p_1 = p_2 = \frac{1}{6}$	A1
		a( ) + b( ) 21 or 12 + 9	M1 A1
	$\frac{21}{36}$	$\frac{21}{36}$	A1 (5)
Alt 4	x: 2, 3, 4, 5, 6 $P(X=x)$: $\frac{1}{36}$, $\frac{4}{36}$, $\frac{10}{36}$, $\frac{12}{36}$, $\frac{9}{36}$	2, 3, 4, 5, 6 Adding probability All correct	M1 M1 A1
	$P(X\geq 5)=\frac{12}{36}+\frac{9}{36}$	Adding P(5) & P(6)	M1
	$\frac{21}{36}$	$\frac{21}{36}$	A1 (5)

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Question Number	Scheme		Marks
2. (a)	Scatter diagram	Labels (not x, y)	B1
		Sensible scales allow axis interchange	B1
		Points	B2
		(–1 ee)	(4)
(b)	$S_{hc} = 884484 - \dfrac{1562 \times 5088}{9} = 1433\frac{1}{3}$	correct use of S	M1
		$1433\frac{1}{3}$; $1433.\dot{3}$	A1
	$S_{hh} = 1000\frac{2}{9}$; $S_{cc} = 2550$	$1000\frac{2}{9}$, $1000.\dot{2}$; 2550	A1; A1 (4)
	(NB: accept :- 9; i.e.:- $159\frac{7}{27}$; $111\frac{11}{81}$; $283\frac{1}{3}$)		
(c)	$r = \dfrac{1433\frac{1}{3}}{\sqrt{1000\frac{2}{9} \times 2550}}$	substitution in correct formula	M1 A1 ft
	$= 0.897488\ldots.$	AWRT 0.897(accept 0.8975)	A1 (3)
(d)	Taller people tend to be more confident	context	B1 (1)
(e)	$b = \dfrac{1433.\dot{3}}{1000.\dot{2}} = 1.433014\ldots..$		M1
	$a = \dfrac{5088}{9} - \dfrac{1433.\dot{3}}{1000.\dot{2}} \times \dfrac{1562}{9} = 316.6256...$	allow use of their b	M1
	$\therefore c = 317 + 1.43h$	3sf	A1 (3)
(f)	$h = 180 \Rightarrow c = 574.4$ or $574.5683\ldots.$	subt. of 180	M1
		574 - 575	A1 (2)
(g)	$161 \le h \le 193$		B1 (1)
			(18 marks)
	NB (a) No graph paper $\Rightarrow$ 0/4		

Question Number	Scheme		Marks
3. (a)	$0.5 + b + a = 1$	use of $\Sigma P(X = x) = 1$	M1 A1
	$0.3 + 2b + 3a = 1.7$	use of $E(x) = \Sigma xP(X = x)$	M1 A1
	$\therefore\ a = 0.4$		
	$b = 0.1$	$a = 0.4,\ b = 0.1$	B1 (5)
(b)	$P(0 < X < 1.5) = P(X = 1) = 0.3$		B1 (1)
(c)	$E\ (2X - 3) = 2E(X) - 3$	Use of $E(aX + b)$	M1
	$= 2 \times 1.7 - 3 = 0.4$		A1 (2)
(d)	$\text{Var}(X) = (1^2 \times 0.3) + (2^2 \times 0.1) + (3^2 \times 0.4) - 1.7^2$	Use of $E(x^2) - \{E(x)\}^2$	M1
	$= 1.41$ (*)		A1 ft
		cso	A1 (3)
(e)	$\text{Var}(2X - 3) = 2^2\ \text{Var}(X)$	Use of Var	M1
	$= 4 \times 1.41 = 5.64$		A1 (2)
			(13 marks)

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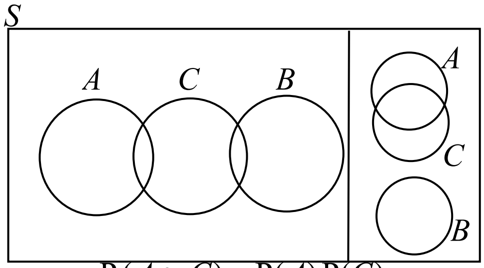
Question Number	Scheme		Marks
4. (a)(i)	$\bar{x} = \frac{270}{16} = 16.875$	16.875, $16\frac{7}{8}$; 16.9; 16.88	B1
	$\text{sd} = \sqrt{\frac{4578}{16} - 16.875^2}$	$\frac{\sum x^2}{16} - \bar{x}^2$ & $\sqrt{}$	M1
		All correct	A1 ft
	$= 1.16592….$	AWRT 1.17	A1
(ii)	Mean % attendance $= \frac{16.875}{18} \times 100$ (= 93.75)	cao	B1 ft (5)
(b)	First 4|1 means 14 Second 1|8 means 18		

	First		Stem	Second		
(1)	4		1	4 4 4	(3)	Both Labels and 1 key — B1
(1)	5		1	5 5 5 5	(4)	Back-to-back
(3)	6 6 6		1	6 6 6	(3)	S and L — M1
(5)	7 7 7 7 7		1	7	(1)	(ignore totals) — dep.
(6)	8 8 8 8 8 8		1	8 8 8	(3)	Sensible splits of 1 — M1
(0)			1	9	(1)	First-correct — A1
(0)			2	0	(1)	Second - correct — A1 (5)

Question Number	Scheme		Marks
(c)		Mode / Median / IQR	
	First	18 / 17 / 2	B1 B1 B1
	Second	15 / 16 / 3	B1 B1 B1 (6)
(d)	$\text{Median}_S < \text{Median}_F$; $\text{Mode}_F > \text{Mode}_S$; Second had larger spread/IQR Only 1 student attends all classes in second $\text{Mean\%}_F > \text{Mean\%}_S$	ANY THREE sensible comments	B1 B1 B1 (3)
			(19 marks)

Question Number	Scheme		Marks
5.	Let L represent length of visit $\therefore L \sim N(90, \sigma^2)$		
(a)	$P(L < 125) = 0.80$ or $P(L > 125) = 0.20$		
	$\therefore P\left(Z < \dfrac{125-90}{\sigma}\right) = 0.8$ $\therefore P\left(L > \dfrac{125-90}{\sigma}\right) = 0.20$	Standardising, $\pm(125 - 90)$, $\sigma/\sigma^2/\sqrt{\sigma}$	M1
	$\therefore \dfrac{125-90}{\sigma} = 0.8416$	0.8416	B1
		$\dfrac{\pm(125-90)}{\sigma} = z$ value	M1
	$\therefore \quad \sigma = \dfrac{35}{0.8416} = 41.587\ldots..$	AWRT 41.6	A1 (4)
(b)	$P(L < 25) = P\left(Z < \dfrac{125-90}{41.587....}\right)$	Standardising 25, 90, their +ve 41.587	M1
	$= P(Z < -1.56)$		
	$= 1 - P(Z < 1.56)$	For use of symmetry or $\Phi(-z) = 1 - \Phi(z)$; $p < 0.5$	M1
	$= 0.0594$		A1 (3)
(c)	$90 + 3\sigma = 215 \Rightarrow 6.25$ pm for latest arrival	Based on $2\sigma/3\sigma$ rule	B1
	$90 + 2\sigma = 173.\dot{3} \Rightarrow 7.07$ pm for latest arrival		
	$\therefore$ This normal distribution is <u>not</u> suitable.		B1 (2)
			(9 marks)

Question Number	Scheme	Marks
6. (*a*)		
	A, B, C inside S	B1
	A, B no overlap	B1
	A, C overlap	B1 (3)
(b)	$P(A\|C) = \dfrac{P(A \cap C)}{P(C)} = \dfrac{P(A)P(C)}{P(C)} = P(A)$ Use of independence	M1
	$= 0.2$	A1 (2)
(c)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ use of $P(A \cup B)$ & $P(A \cap B) = 0$ can be implied	M1
	$= 0.2 + 0.4 - 0$	
	$= 0.6$	A1 (2)
(d)	$P(A \cup C) = P(A) + P(C) - P(A \cap C)$ Use of $P(A \cup C)$ & independence	M1
	$\therefore 0.7 = 0.2 + P(C) - 0.2\,P(C)$	A1
	$\therefore 0.5 = P(C)\,\{1 - 0.2\}$ Solving for $P(C)$ from an equation with $2P(C)$ terms	M
	$\therefore P(C) = \frac{5}{8}$	A1 (4)
		(11 marks)
	NB $P(B \cup C) = P(B) + P(C) - P(B \cap C)$ $= 0.4 + 0.625 - P(B \cap C) \Rightarrow P(B \cap C) > 0$	