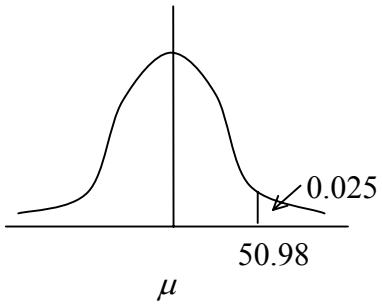
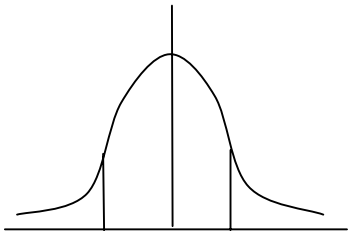
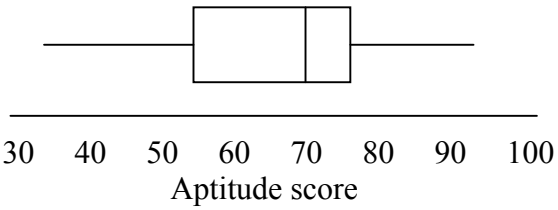
Question Number		Scheme	Marks
1.	(*a*)	Statistical models allow problems to be solved without the need to construct a full-scale physical model, saving time/expense. They allow parameters to be changed and refinements to be made quickly.	B2, 1, 0 **(2)**
	(*b*)	(i) Normal; (ii) Discrete uniform	B1, B1 **(2)**
			(4 marks)
2.	(*a*)	$60A$, $40S$, $2M$	B1
		$\text{P(all only arts)} = \frac{60}{125}\times\frac{59}{124}\times\frac{58}{123}=\frac{3422}{31775}=0.10769.....$	M1 A1 A1 **(4)**
	(*b*)	$\text{P(exactly one only science)} = 3\times\frac{40}{125}\times\frac{85}{124}\times\frac{84}{123}$	B1
		$=\frac{2856}{6355}=0.44940…..$	M1 A1 **(3)**
			(7 marks)
3.	(*a*)	$\text{P}(A\cap B)=\text{P}(A)\text{P}(B)=0.25\times0.30=0.075$	M1 A1 **(2)**
	(*b*)	$\text{P}(\text{A}\cup\text{B})=\text{P}(A)+\text{P}(B)-\text{P}(A\cap B)=0.25+0.30-0.075$	M1
		$=0.475$	A1 **(2)**
	(*c*)	$\text{P}(A\mid B')=\frac{\text{P}(\text{A}\cap\text{B}')}{\text{P}(\text{B}')}=\frac{\text{P(A)}-\text{P}(\text{A}\cap\text{B})}{1-\text{P}(\text{B})}$	M1
		$=\frac{0.25-0.075}{1-0.3}$	M1 A1ft
		$=0.25$	A1 **(4)**
			(8 marks)

Question Number	Scheme	Marks
4. (*a*)	 $P(L > 50.98) = 0.025$	B1
	$P\left(Z > \frac{50.98-\mu}{0.5}\right) = 0.025$	M1 A1
	$\therefore \frac{50.98-\mu}{0.5} = 1.96$	M1 A1 **(5)**
	$\therefore \quad \mu = 50 \quad (*)$	
	 $L \sim N(50, 0.5^2)$	
(*b*)	$P(49.25 < L < 50.75) = P\left(\frac{49.25-50}{0.5} < Z < \frac{50.75-50}{0.5}\right)$	M1
	$= P(-1.5 < Z < 1.5)$ $\quad -1.5$ & $+1.5$	A1
	$= 2\Phi(1.5) - 1$	M1
	$= 0.8664$	A1 **(4)**
(*c*)	$P(\text{Both}) = (1 - 0.8664)^2$	M1
	$= 0.01784\ldots.$	A1 **(2)**
		(11 marks)
5. (*a*)	$S_{ss} = 108.07875$; $S_{st} = 129.1675$	B1; B1
	$q = \frac{S_{st}}{S_{ss}} = \frac{129.1675}{108.07875} = 1.1951239\ldots.$	M1, A1
	$p = \frac{65.0}{8} - (1.951239\ldots.) \times \frac{48.5}{8} = 0.879561\ldots$	M1, A1
	$\therefore t = 0.879561.. + 1.1951259\ldots S$	A1 ft **(7)**
(*b*)	$y - 20 = 0.879561\ldots + 1.1951239\ldots(x - 6)$	M1, A1 ft
	$\therefore y = 13.709 + 1.195x$	A1 **(3)**
(*c*)	0.943; the pmcc is an index (no units) and is not affected by linear transformations of either/both variables	B1; B1 **(2)**
		(12 marks)

Question Number		Scheme	Marks
6.	(*a*)	$\alpha + \beta = 0.5$	B1
		$-2\alpha + 2\beta = -0.2$	M1
		$\therefore \quad \alpha = 0.3, \beta = 0.2$	M1 A1; A1 **(6)**
	(*b*)	F(0.8) = 0.6	B1 ft **(1)**
	(*c*)	$E(X^2) = (4 \times 0.3) + \ldots + (4 \times 0.2), \ = 2.4$	M1, A1
		$\therefore \text{Var}(X) = 2.4 - (-0.2)^2, \ = 2.36$	M1, A1 **(4)**
	(*d*)	$E(3X - 2) = 3E(X) - 2, \ = -2.6$	M1, A1 ft **(2)**
	(*e*)	$\text{Var}(2X + 6) = 4 \text{ Var}(X), \ = 9.44$	M1, A1 ft **(2)**
			(15 marks)
7.	(*a*)	Mode = 78	B1 **(1)**
	(*b*)	$Q_1 = 56; Q_2 = 70; Q_3 = 78$	B1; B1; B1 **(3)**
	(*c*)	$(Q_3 - Q_1) = 22$	
		$Q_1 - 1.0(Q_3 - Q_1) = 34 \Rightarrow$ 31 & 31 are outliers	M1 A1
		$Q_3 + 1.0\,(Q_3 - Q_1) = 100 \Rightarrow$ no outliers	A1 **(3)**
	(*d*)	*(accurate sketch on graph paper required)* boxplot	M1
		 scales and labels	B1
		Q_1 , Q_2 , Q_3	A1
		31, 32, 34 (39), 92	A1 **(4)**
	(*e*)	$\mu = \frac{3363}{50} = 67.26$	B1
		$\sigma^2 = \frac{238305}{50} - (67.26)^2 = 242.1924$	M1
		$\therefore \ \sigma = \sqrt{242.1924} \ = 15.56253\ldots$	A1 **(3)**
	(*f*)	$(Q_3 - Q_2) < (Q_2 - Q_1)$, i.e. $8 < 14 \Rightarrow$ negative skew	M1, A1
		Mean < Median < Mode, i.e. $67.26 < 70 < 78 \Rightarrow$ negative skew	M1, A1 **(4)**
			(18 marks)