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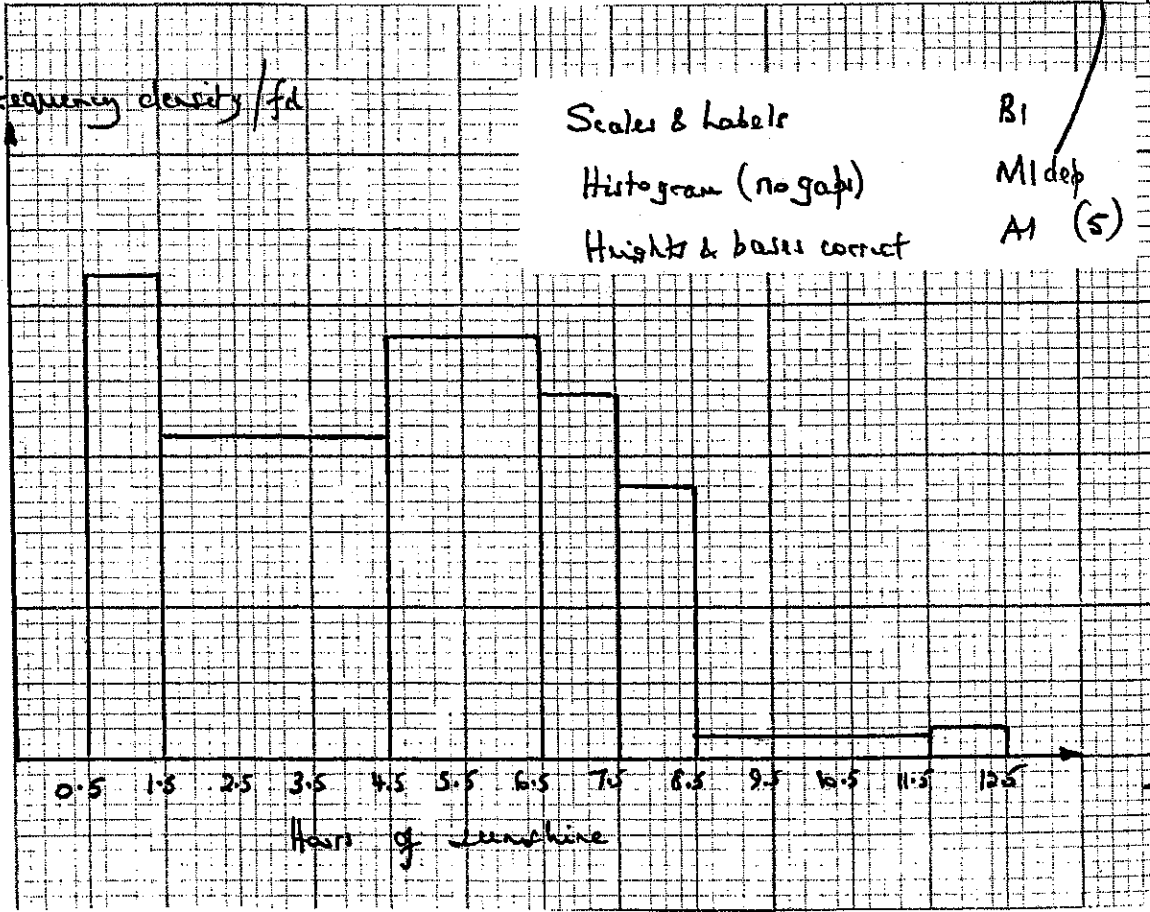
January 2002

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **STATISTICS 6683**   Paper No. **S1**

Question number	Scheme	Marks
1.	(a)(i) A test/investigation/process adopted for collecting data to provide evidence for or against a hypothesis	B1 (1)
	(ii) Sub-set of possible outcomes of an experiment.	B1 (1)
	(b) Advantage — Quick, cheap, vary parameters/predict	B1
	Disadvantage — Does not replicate real-world situation in every detail.	B1 (2)
2.	(a) Frequency densities : 16, 10⅔, 14, 12, 9, ⅔, 1 can be implied	M1 A1
	Scales & Labels	B1
	Histogram (no gaps)	M1 dep
	Heights & bases correct	A1 (5)
	(b) No. of days $= (14 \times \frac{1}{2}) + (12 \times 1) + (9 \times 1) + (\frac{1}{2} \times \frac{2}{3})$	M1
	$= 28\frac{1}{3}$ Allow $28\frac{1}{3}$; $28.\dot{3}$; 28.3	A1 (2)
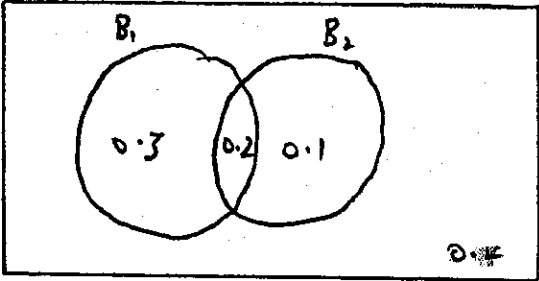
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Question number	Scheme	Marks
3.	(a) $a + 2\left(\tfrac{2}{3} - a\right) = \tfrac{5}{6}$ $\therefore \quad \underline{a = \tfrac{1}{2}}$	Use of $E(X)$ M1 correct equation A1 cao A1 (3)
	(b) $\operatorname{Var}(X) = 1^2 \times \tfrac{1}{2} + 2^2 \times \tfrac{1}{6} - \left(\tfrac{5}{6}\right)^2$ $= \dfrac{17}{36} = 0.47\dot{2}$	Use of $\sum x^2 P(X=x)$ M1 $- \mu^2$ M1 allow ISW; cao A1 (3)
	(c) $P(X \le 1.5) = P(0) + P(1) = \tfrac{2}{3} + \tfrac{1}{2} = \tfrac{5}{6}$	B1 √(1)
4.		Venn diagram M1 0.3, 0.2, 0.1 A1
	(a) $P(\text{Does not win either}) = 0.4$	A1 (3)
	(b) $P(\text{Wins exactly one}) = 0.3 + 0.1$ $= 0.4$	M1 A1 √(2)
	(c) $P(B_2 \mid B_1') = \dfrac{P(B_2 \cap B_1')}{P(B_1')} = \dfrac{0.1}{0.5}$ $= 0.2$	Use of cond" prob. M1 A1 (2)
	(d) For independence $P(B_1 \cap B_2) = P(B_1) \times P(B_2)$ $P(B_1 \cap B_2) = 0.2 \,; \quad P(B_1) \times P(B_2) = 0.15$ LHS $\ne$ RHS $\Rightarrow$ events not independent NB: Accept alternative correct solutions.	M1 0.2; 0.15 A1 A1 (3)

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4.	Altitar: (a) P(Does not win either) $= 1 - P(B_1 \cup B_2)$	M1
	$= 1 - (0.5 + 0.3 - 0.2)$	A1
	$= 0.4$	A1 (3)
	(b) $\hat{P}$(Win exactly one) $= P(B_1 \cap B_2') + P(B_1' \cap B_2)$	M1
	$= 0.3 + 0.1$	
	$= 0.4$	A1 (2)
5.	(a) $P(D < 235) = 0.025$	
	$\therefore \dfrac{235 - \mu}{\sigma} = -1.96$ $\dfrac{235-\mu}{\sigma}=z_\alpha$ M1	
	$*\ \therefore \underline{\mu - 235 = 1.96\sigma}\ *$	A1 (2)
	(b) $P(D > 286) = 0.15$ $\dfrac{286-\mu}{\sigma}=z_\alpha$ M1	
	$\therefore \dfrac{286 - \mu}{\sigma} = 1.0364$ $\therefore \underline{286 - \mu = 1.0364\sigma}$ 1.0364 B1	A1/(3)
	(c) Solving for μ or σ	M1
	Substituting for other unknown	M1
	$\mu = 268.360\ldots$ $\sigma = 17.0204\ldots$ AWRT 268 AWRT 17	A1 A1 (4)
	(d) $\mu \pm \sigma = 268.36 \pm 17.02$ $\mu + \text{their } \sigma$	M1
	$= (251, 285)$ 3sf	A1/(2)
		)

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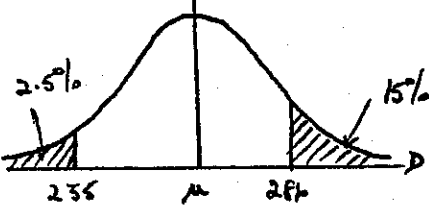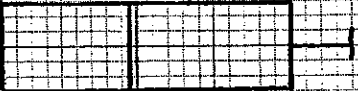
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Question number	Scheme	Marks
6.	(a) $Q_2 = 33$	B1
	$Q_1 = 27$; $Q_3 = 51$ both	B1
	$IQR = 51 - 27 = 24$	B1 ✓ (3)

(b) Boxplot — M1
Labels — A1
27, 33, 51 — A1 ✓ (4)
19, 87 — A1

(d) Boxplot with label — B1
11, 19.5, 30 — B1   (3)
4, 34 — B1

(c) $\mu = \dfrac{618}{15}$ $\sum x^2 / 15$ M1

$= 41.2$ 41.2 cao A1

$\sigma^2 = \dfrac{31864}{15} - 41.2^2$ $\boxed{SR: \sqrt{n-1} = 21.38\ldots \\ B1 \; only}$ $\dfrac{\sum x^2}{15} - \mu^2$ M1

A1 ✓

$\Rightarrow \sigma = 20.65978\ldots$ 20.7   A1 (5)

NB $\sum (x - \bar{x})^2 = 6403.4$

(e) Median male > Median female   ⎫
IQR male > IQR female   ⎬ Any Two sensible   B1
Range male > Range female etc.   ⎭ independent comments   B1 (2)
Males: +ve skew; Females: slight +ve skew/almost symmetrical

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Question number	Scheme	Marks
7.		

(a) Scales & Labels   B1

Points   B2 (3)

(8,9 points → B1)

(e) $(\bar{t}, \bar{s})$ plotted   B1

Correct line   B1 (2)

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7.	(b) $S_{ss} = 694650 - \dfrac{2310^2}{10} = 161040$	M1 A1
	$S_{tt} = 66490 \; ; \quad S_{st} = 87235$	A1 A1
	$r = \dfrac{87235}{\sqrt{66490 \times 161040}}$ $S_{st}/\sqrt{(S_{ss} \times S_{tt})}$	M1 A1
	$= 0.843035\ldots$ 0.843	A1 (7)
	SR: 0.843 without working $\Rightarrow$ B4 only	B1; B1 (2)
	(c) No change; coding does not affect pmcc.	
	(d) $\hat{\beta} = \dfrac{72587.5}{63671.875} = 1.140024\ldots$	M1
	$\hat{\alpha} = 187.5 - (1.140024\ldots \times 125.625) = 44.2844\ldots$	M1
	$\therefore \underline{S = 44.3 + 1.14t}$ must use s & t	A1 (3)
	(e) Graph	ⓐ
	(f) Both points above the line, so move line up	B1
	Predictions of s from t less accurate	B1 (2)
	)	