PMT

EDEXCEL FOUNDATION - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **STATISTICS 6684** Paper No. **S2**

Question number	Scheme	Marks
1. (a)	(i) small village so use **census**	B1
	e.g. use electoral **register** or some other suitable **list**	B1
	(ii) **Sample survey**	B1
	eg. **list** of times and days when no. of vehicles travelling through can be counted. (some suitable list of time periods)*	B1 (4)
(b)	eg. X = no. of vehicles passing through in a 10min period	B1
	X could have a **Poisson** distribution	B1 (2)
	* time period must be specified e.g. 10mins, 1hour, 7am-7pm but < 1day.	(6)
2. (a)	X = no. of accidents in the next month $X \sim Po(0.9)$	
	$P(X=0) = e^{-0.9} = 0.4065\ldots = \underline{0.407}$ (*)	B1 c.s.o. (1)
(b)	Y = no. of accidents in next 6 months. $Y \sim Po(\underline{5.4})$	B1
	$P(Y=2) = \frac{e^{-5.4} \times (5.4)^2}{2}$, $= 0.06585\ldots$ 0.066 or 0.0658/9	M1, A1 (3)
(c)	M = no. of months with no accidents	
	$M \sim B(4, 0.407)$ Identifies correct binomial AWRT	B1 (√ their (a))
	$P(M=2) = \binom{4}{2}(0.407)^2(0.593)^2$, $= 0.3495$ (0.349 ~ 0.350)	M1, A1 (3)
		(7)

EDEXCEL FOUNDATION - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **STATISTICS 6684** Paper No. **S2**

Question number	Scheme	Marks
3.	$H_0: p = \frac{1}{4}$; $H_1: p \neq \frac{1}{4}$	B1 ; B1
	X = no. of gold beads in sample of 20. Under H_0 $X \sim B(20, \frac{1}{4})$	
	Critical Region: $P(X \leq 1) = 0.0243$; $P(X \leq 8) = 0.9591$; C.R. $X \leq 1$ or $X \geqslant 9$	M1
	Probability: $E(X) = 5$; $P(X \leqslant 2) = 0.8913$; $P(X \geqslant 8) = 1 - 0.8982 = 0.1018$	A1 each value.
	OR: $2 \times P(X \leqslant 2) = 2 \times 0.0913 = 0.1826$	A1
	Not significant (either $x = 2$ not in C.R. or prob $> 10\%$)	M1
	Insufficient evidence of a change in proportion of gold beads	A1√ (7)
4.	X = no. of letters marked 1st class $X \sim B(10, 0.20)$	
(a)	$P(X \geqslant 3) = 1 - P(X \leqslant 2) = 1 - 0.6778 = 0.3222$ or 0.322	M1, A1 (2)
(b)	$P(X < 2) = P(X \leqslant 1) = 0.3758$ or 0.376	M1, A1 (2)
(c)	F = no. of 1st class stamps in batch of 70 $F \sim B(70, 0.20)$	M1 (Normal approx)
	$F \approx N(14, \sqrt{11.2}^2)$	A1 μ; A1 σ or σ^2
	$P(F \leqslant 12) \approx P\left(z \leqslant \frac{12.5 - 14}{\sqrt{11.2}}\right)$	± ½ M1; Standardising M1
	$= P(z \leqslant -0.4482\ldots)$	AWRT -0.45 A1
	$= 1 - 0.6736$	
	$= 0.3264$ (AWRT 0.326~0.327)	A1 (7)
(d)	The 70 letters form a random sample or are representative or letters are independent	B1 (1)
		(12)

PMT

EDEXCEL FOUNDATION - LONDON EXAMINATIONS

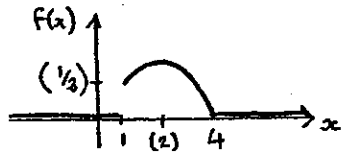
Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **STATISTICS 6684** Paper No. **S2**

Question number	Scheme	Marks
5.	X = no. of requests for bulbs in a week. $X \sim Po(2)$	
(a)	$P(X=4) = \frac{e^{-2}.2^4}{4!}$ or $[P(X\leq 4) - P(X\leq 3)]$ $0.9473 - 0.8571$	M1
	$= \underline{0.0902}$ or $\underline{0.090}$ or $\underline{0.09}$	A1 (2)
(b)	$P(X>5) = 1 - P(X\leq 5), = 1 - 0.9834 = \underline{0.0166}$	M1, A1 (2)
(c)	Y = no. of requests in 3 weeks. $Y \sim Po(6)$	B1
	$P(Y\leq 5), = \underline{0.4457}$	M1, A1 (3)
(d)	$H_0: \lambda = 2$ (or $\mu = 8$) ; $H_1: \lambda < 2$ (or $\mu < 8$)	B1 ; B1
	R = no. of requests in 4 weeks. $R \sim Po(8)$	
	$P(R\leq 3), = 0.0424$ [c.r. ≤ 3 or prob $< 5\%$] sig	M1, A1
	There is evidence that the rate of requests has decreased	A1√ (5)
		(12)
6 (a)	$f(x) = \frac{d}{dx}F(x) = \underline{\frac{1}{27}(-3x^2 + 12x)}$ Attempt $\frac{d}{dx}$	M1
		A2/1/0 -1 e.e.o.o. (3)
(b)	$\frac{d}{dx}[f(x)] = 0 \Rightarrow -6x + 12 = 0, \Rightarrow \underline{x = 2}$ is mode	M1, A1 (2)
(c)	 x, f(x) axes marked and at least 1, 4	B1 B1 B1 (3)
(d)	$\mu = \int_1^4 \left(\frac{4x^2}{9} - \frac{x^3}{9}\right)dx$ Attempt $\int xf(x)dx$	M1 some integration attempted
	$= \frac{1}{9}\left[\frac{4x^3}{3} - \frac{x^4}{4}\right]_1^4 = \left(\frac{256}{27} - \frac{256}{36}\right) - \left(\frac{4}{27} - \frac{1}{36}\right)$ Use of correct limits	M1
	$= \underline{2.25 \text{ or } 9/4}$	A1 (3)
(e)	$F(2.25) = \frac{1}{27}(-2.25^3 + 6\times 2.25^2 - 5) = 0.517$ (AWRT 0.52)	B1 (1)
(f)	$F(\mu) > 0.5 \Rightarrow \mu >$ median	B1√ (from (e))
	$F(2) = \frac{1}{27}(-8 + 24 - 5) = 11/27 = 0.407 \Rightarrow$ mode < median	B1 (14) (2)

PMT

EDEXCEL FOUNDATION - LONDON EXAMINATIONS

Stewart House 32 Russell Square London WC1B 5DN

June 2001

Advanced Supplementary/Advanced Level

General Certificate of Education

Subject **STATISTICS 6684** Paper No. **S2**

Question number	Scheme	Marks
7.	(a) $P(T<0.2) = \underline{0.2}$	B1 (1)
	(b) $\mu = E(T) = \underline{0.5}$	B1 (1)
	(c) $E(T^2) = \int_0^1 t \times t^2\,dt = \left[t^3/3\right]_0^1$ ($\int t^2$)	M1 A1 dep ([ ])
	$Var(T) = (1/3) - (0) - \mu^2 = \underline{\frac{1}{12}}$ ($-\mu^2$, $1/12$)	M1 A1 (4)
	(d) X = no. of children with $T<0.2$ $\quad X \sim B(20, 0.2)$ (Identify binomial)	M1 (✓ p from (a))
	$P(X \le 4) = \underline{0.6296}$	M1, A1 (3)
	(e) Expect mean to still be close to 0.5 (or no change)	B1
	Expect variance to be reduced	B1 (2)
	(f) $P(T<0.2) = \int_0^{0.2} 4t\,dt$ (Attempt $\int 4t\,dt$ between 0, 0.2)	M1
	$= \left[4t^2/2\right]_0^{0.2}$	
	$= 2\times(0.2)^2 - 0 = \underline{0.08}$ ⊛	A1 c.s.o. (2)
	(g) Y = no. of players stopping star in under 2s.	
	$Y \sim B(75, 0.08) \approx P_0(6)$ (P_0, $\lambda = 6$)	M1 A1
	$P(Y>7) = 1 - P(Y \le 7)$	M1
	$= 1 - 0.7440$	
	$= \underline{0.256}$	A1 (4)
		(17)
S.C.	Normal Approx $\quad N(6, 5.52)$ $\quad \sqrt{6}, \sqrt{5.52}$	M1 A1 } i.e. 2/4 only
	$\rightarrow$ $(0.261 \sim 0.262)$	