STATISTICS 2 (A) TEST PAPER 1 : ANSWERS AND MARK SCHEME

1.	(a) Census considers whole population; survey looks at a subset	B1	
	(b) Census : ask the whole village Survey : ask a proportion	B1 B1	
	(c) The sampling units are the individual residents	B1	4
2.	(a) $X \sim \text{Po}(1{\cdot}5)$ From tables, $\text{P}(X = 0) = 0{\cdot}223$	B1	
	(b) $\text{P}(X > 5) = 1 - 0{\cdot}9955 = 0{\cdot}0045$	M1 A1	
	(c) $\text{P}(X \leq 3) = 0{\cdot}9344$ and $\text{P}(X \leq 4) = 0{\cdot}9814$, so he needs 4 copies	M1 M1 A1	6
3.	(a) No. of '6's $\sim \text{B}(60, p) \approx \text{Po}(60p)$. $\text{H}_0 : p = \frac{1}{6}$ $\text{H}_1 : p \neq \frac{1}{6}$	B1 B1	
	Under H_0, $\text{P}(X \geq 16 \text{ or } X \leq 4) = 0{\cdot}0487 + 0{\cdot}0293 = 0{\cdot}078 > 5\%$	M1 A1 A1	
	Do not reject H_0 at 5% significance level; accept that $p = \frac{1}{6}$	A1	
	(b) Now $\text{H}_1 : p > \frac{1}{6}$ $\text{P}(X \geq 16) = 0{\cdot}0487 < 5\%$, so reject H_0	B1 M1 A1 A1	10
4.	(a) Need $\text{F}(x) = 0{\cdot}5$, so $x^2 = 58$ $x = \sqrt{58} = 7{\cdot}62$	M1 A1	
	(b) $\frac{1}{84}(p^2 - 16) = 0{\cdot}25 : p = 6{\cdot}083$ $\frac{1}{84}(q^2 - 16) = 0{\cdot}75 : q = 8{\cdot}888$	M1 A1 A1	
	$\text{IQR} = 8{\cdot}888 - 6{\cdot}083 = 2{\cdot}81$	A1	
	(c) $\text{f}(x) = \text{F}'(x) = \frac{x}{42}$, $4 \leq x \leq 10$; $\text{f}(x) = 0$ otherwise	M1 A1 A1	
	(d) Graph drawn Mode = 10 : maximum value of $\text{f}(x)$ on graph	B1 M1 A1	12
5.	(a) $R \sim \text{B}(15, 0{\cdot}4) : \text{P}(R < 2) = \text{P}(R \leq 1) = 0{\cdot}0052$	B1 M1 A1	
	(b) $\text{P}(R \geq 8) = 1 - \text{P}(R \leq 7) = 1 - 0{\cdot}7869 = 0{\cdot}213$	M1 A1	
	(c) Number of greens is $G \sim \text{B}(150, 0{\cdot}6) \approx \text{N}(90, 36)$	M1 A1	
	$\text{P}(G > 100{\cdot}5) = \text{P}(Z > 10{\cdot}5 \div 6) = \text{P}(Z > 1{\cdot}75) = 0{\cdot}0401$	M1 A1 M1 A1 A1	12
6.	(a) Mean $= \int_0^4 \frac{3}{64} t^3(4 - t)\,\text{d}t = \frac{3}{64}\left[t^4 - t^5/5\right]_0^4 = 2{\cdot}4$	M1 A1	
	$\text{Var}(T) = \int_0^4 \frac{3}{64} t^4(4 - t)\,\text{d}t - 2{\cdot}4^2 = \frac{3}{64}\left[4t^5/5 - t^6/6\right]_0^4 - 5{\cdot}76$	M1 A1 A1	
	$= 0{\cdot}64$ Standard deviation $= \sqrt{0{\cdot}64} = 0{\cdot}8$	M1 A1	
	(b) $\text{P}(T \leq 3) = \int_0^3 \frac{3}{64} t^2(4 - t)\,\text{d}t = 0{\cdot}738$ $\text{P}(T > 3) = 0{\cdot}262$	M1 A1 M1 A1	
	(c) $0{\cdot}738^2 = 0{\cdot}545$ (d) Unlikely that all recover within 4 days	M1 A1; B1	14
7.	(a) (i) $\text{e}^{-0{\cdot}8} = 0{\cdot}449$ (ii) $0{\cdot}8\text{e}^{-0{\cdot}8} = 0{\cdot}359$	B1 B1	
	(b) $\text{P}(0) + \text{P}(1) = 0{\cdot}449^{10} + 10 \times 0{\cdot}449^9 \times 0{\cdot}359 = 0{\cdot}002996$	M1 M1 A1 A1	
	(c) No. in 10 patches $\sim \text{Po}(8)$; then $\text{P}(X < 2) = \text{P}(X \leq 1) = 0{\cdot}0030$	B1 M1 A1	
	(d) Good agreement, but Poisson is easier to calculate	B1 B1	
	(e) In 1 m^2, expect 8000 daisies, so use $\text{Po}(8000) \approx \text{N}(8000, 8000)$	M1 A1	
	$\text{P}(X > 8100{\cdot}5) = \text{P}(Z > 100{\cdot}5/89{\cdot}44) = \text{P}(Z > 1{\cdot}12) = 0{\cdot}131$	M1 A1 M1 A1	17