

STATISTICS 2 (A) TEST PAPER 4 : ANSWERS AND MARK SCHEME

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|---|--|---|-------------|
| 1. (a) Individual students | (b) Register of all students | B1 B1 | |
| (c) No : they are unlikely to be a representative sample | | B2 | 4 |
| 2. (a) $(n + 1)/2 = 12$ | $n = 23$ | $\text{Var}(X) = (23 - 1)^2/12 = 40\frac{1}{3}$ | B1 M1 A1 |
| (b) $P(10 < X < 14) = \frac{4}{22} = \frac{2}{11}$ | | | M1 A1 |
| | | | 5 |
| 3. (a) $30 \times \frac{1}{4} = 7.5$ | | | M1 A1 |
| (b) $X \sim B(30, p)$ | $H_0 : p = 0.25$ | $H_1 : p > 0.25$ | B1 B1 |
| | Under H_0 , $P(X \geq 15) = 1 - 0.9973 = 0.0027 < 5\%$, so reject H_0 | | M1 A1 A1 |
| (c) $30 \times 0.9 = 27$ | | | B1 |
| (d) $P(\text{More than 25 right}) = P(X < 5)$ | in $B(30, 0.1) = 0.825$ | | M1 A1 |
| | | | 10 |
| 4. (a) Graph : straight line from $(1, k)$ to $(4, 4k)$; on x -axis elsewhere | | | B2 |
| | Area of trapezium $= \frac{1}{2} \times 3 \times (k + 4k) = 1$, so $k = \frac{2}{15}$ | | M1 A1 |
| (b) $E(X) = \int_1^4 \frac{2}{15} x^2 dx = 2.8$ | $E(X^2) = \int_1^4 \frac{2}{15} x^3 dx = 8.5$ | | M1 A1 M1 A1 |
| | $\text{Var}(X) = 8.5 - 2.8^2 = 0.66$ | | M1 A1 |
| | | | 10 |
| 5. (a) Poisson, $Po(3.5)$ | | | B1 |
| (b) (i) $P(X = 0) = 0.0302$ (from tables) | | | B1 |
| | (ii) $P(X > 7) = 1 - P(X \leq 7) = 1 - 0.9733 = 0.0267$ | | M1 A1 |
| (c) Might not be random – possibly aimed at specific targets | | | B1 |
| (d) $Po(45) \approx N(45, 45)$ | | | M1 A1 |
| | $P(X > 60) = P(X > 60.5) = P(Z > 15.5/6.71) = P(Z > 2.31)$ | | M1 A1 A1 |
| | $= 1 - 0.9896 = 0.0104$ | | M1 A1 |
| | A continuity correction must be made, to convert from discrete Poisson to continuous Normal distribution | | B2 |
| | | | 14 |
| 6. (a) No. of blemished apples $\sim B(10, 0.05)$ | | | B1 |
| | From tables, $P(X \geq 2) = 1 - 0.9139 = 0.0861$ | | M1 A1 |
| (b) $P(X = 2) = 0.9885 - 0.9139 = 0.0746$ | | | M1 M1 A1 |
| (c) Now $X \sim B(50, 0.0861)$ | $P(\text{no trays}) = 0.9139^{50} = 0.0111$, | | B1 M1 |
| | $P(1 \text{ tray}) = 50 \times 0.9139^{49} \times 0.0861 = 0.0522$ | | M1 A1 |
| | so $P(X < 2) = 0.0111 + 0.0522 = 0.0633$ | | A1 |
| (d) $50 \times 0.0861 = 4.3$, so expect 4 trays | | | M1 A1 |
| (e) No. blemished in 20 trays $\sim B(200, 0.05) \approx Po(10)$ | | | B1 |
| | $P(X > 10) = 1 - 0.4579 = 0.542$ | | M1 A1 |
| | | | 16 |
| 7. (a) Graph sketched | $\frac{1}{2} \times 2c \times 5 = 1$ | $c = \frac{1}{5}$ | B3 M1 A1 |
| (b) Median m has $P(4 < X < m) = \frac{1}{2} - \frac{2}{5} = \frac{1}{10}$, so | | | M1 A1 |
| | $\frac{2}{15} \int_4^m 7 - t dt = \frac{1}{10}$ | $7m - \frac{1}{2}m^2 - 20 = \frac{3}{4}$ | M1 A1 M1 A1 |
| | $2m^2 - 28m + 83 = 0$ | $m = 4.26$ | A1 M1 A1 |
| (c) Sections of graph will not be precise straight lines in reality | | | B1 |
| | Some people will take longer than 7 hours | | B1 |
| | | | 16 |