

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

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