# STATISTICS 2 (A) TEST PAPER 9 : ANSWERS AND MARK SCHEME

| | | | |
|---|---|---|---|
| 1. | (a) A discrete variable can only have certain values, usually integers | B1 | |
| | A continuous variable can take any value, often in a certain range | B1 | |
| | (b) $X$ is continuous, but the calculator number is discrete, e.g. calculator cannot give 0·385721... | B1 | |
| | (c) Sketch : line from (0, 0) to (1, 1); on $x$-axis elsewhere | B2 | 5 |
| 2. | (a) Quicker to use a sample, but it may be inaccurate | B1 B1 | |
| | (b) Catalogue of all videos in stock (c) All the separate videos | B1 B1 | |
| | (d) One particular sort, e.g. horror, may be unrepresentative | B2 | 6 |
| 3 | (a) From tables, extreme 2·5% tails are given by $X \le 3$ and $X \ge 13$, | M1 A1 A1 | |
| | so this is the critical region | A1 | |
| | (b) The bottom 5% tail is still given by $X \le 3$ : region is {0, 1, 2, 3} | M1 M1 A1 | 7 |
| 4 | (a) Mean = 80 x 0·375 = 30, variance = 80 x 0·375 x 0·625 = 18·75 | M1 A1 M1 A1 | |
| | (b) $X \sim B(80, 0{\cdot}375) \approx N(30, 18{\cdot}75)$ | M1 A1 | |
| | $P(X > 40) = P(X > 40{\cdot}5) = P(Z > 10{\cdot}5/4{\cdot}33) = P(Z > 2{\cdot}42)$ | M1 A1 A1 | |
| | $= 1 - 0{\cdot}9922 = 0{\cdot}0078$ | M1 A1 | 11 |
| 5. | (a) Mean = 300/100 = 3 Variance = $1222/100 - 3^2 = 3{\cdot}22$ | M1 A1 M1 A1 | |
| | (b) Mean ≈ Variance, and positive skewness | B1 B1 | |
| | (c) $H_0 : \lambda = 3$ and $H_1 : \lambda > 3$ | B1 B1 | |
| | Under $H_0$, no. of lorries in 15 minutes ~ Po(9) | M1 A1 | |
| | $P(X \ge 18) = 1 - 0{\cdot}995 = 0{\cdot}005 < 1\%$ so reject $H_0$ at 1% level, | M1 A1 | |
| | i.e. accept that mean has increased | A1 | 13 |
| 6. | (a) No. of Cons ~ B(10, 0·35), so $P(X \ge 2) = 1 - 0{\cdot}086 = 0{\cdot}914$ | M1 A1 A1 | |
| | (b) No. of Cons or MRL ~ $B(500, 0{\cdot}37) \approx N(185, 116{\cdot}55)$, so | M1 A1 | |
| | $P(X > 200) = P(X > 199{\cdot}5) = P(Z > 14{\cdot}5/10{\cdot}79) = P(Z > 1{\cdot}34)$ | M1 A1 M1 | |
| | $= 1 - 0{\cdot}9099 = 0{\cdot}0901$ | A1 A1 | |
| | (c) No. of MRL ~ $B(200, 0{\cdot}02) \approx Po(4)$ | M1 A1 | |
| | so $P(X \ge 5) = 1 - 0{\cdot}6288 = 0{\cdot}371$ | M1 A1 | |
| | (d) Binomial to Normal needs continuity correction, going from a | B1 | |
| | discrete to a continuous distribution | B1 | 16 |
| 7. | (a) $k\int_0^1 x^2 - x^3\,dx = 1$ $k\left[\frac{x^3}{3} - \frac{x^4}{4}\right]_0^1 = 1$ $k = 12$ | M1 A1 | |
| | Graph sketched : parabola, vertex upwards, through (0, 0), (1, 0) | B2 | |
| | (b) $E(X) = 12\int_0^1 x^3 - x^4\,dx = 12\left[\frac{1}{4} - \frac{1}{5}\right] = 0{\cdot}6$ | M1 A1 A1 | |
| | $\text{Var}(X) = 12\int_0^1 x^4 - x^5\,dx - 0.6^2 = 12\left[\frac{1}{5} - \frac{1}{6}\right] - 0{\cdot}36 = 0{\cdot}04$ | M1 A1 A1 | |
| | (c) $F(x) = 0\ (x < 0)$, $F(x) = 4x^3 - 3x^4\ (0 \le x \le 1)$, $F(x) = 1\ (x > 1)$ | B1 M1 A1 B1 | |
| | (d) $P(x \le 85\%) = F(0{\cdot}85) = 4(0{\cdot}85^3) - 3(0{\cdot}85^4) = 0{\cdot}89$, so cloud | M1 A1 | |
| | cover is ≤ 85% for 89% of the time | A1 | 17 |