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|---------------|---|--|----------------------------|---|--|---------------|----------------------------|---|--|
| 1 | (i) | A Points lie close to straight line | B1 B1 | 2 | Valid reason, eg "linear". Not "strong correlation" | | | | |
| | (ii) | C Non-linear relationship | B1 B1 | 2 | eg curve or quadratic | | | | |
| 2 | (i) | Median 8 Quartiles 6, 24 | B1 B2 | 3 | B1 for each Allow IQR = 24 - 6 | | | | |
| | (ii) | Extreme values/skew distort mean or 35 mentioned | B1 | 1 | Accept just "data skewed". Not "anomaly" | | | | |
| | (iii) | Advantage: retains data values Disadv: harder to read (eg) median harder to compare distr's visual comparison harder | B1 B1 | 2 | Not "Can be shown on same diag" | | | | |
| 3 | (i) | <table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 2px;">2 3 4 1 6 5 7</td> <td style="padding: 2px;">6 5 4 7 2 3 1</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">1 2 3 4 5 6 7</td> <td style="padding: 2px;">7 6 5 4 3 2 1</td> </tr> </table> $\Sigma d^2 = 14$ $r_s = 1 - \frac{6\Sigma d^2}{7(7^2 - 1)}$ $r_s = \frac{3}{4}$ | 2 3 4 1 6 5 7 | 6 5 4 7 2 3 1 | 1 2 3 4 5 6 7 | 7 6 5 4 3 2 1 | M1 M1 A1 M1 A1 | 5 | Rank both sets consistently Find Σd^2 , dep ranks attempted. Allow arith errors $\Sigma d^2 = 14$ Use formula correctly, dep 2 nd M1 Answer $\frac{3}{4}$ or a.r.t. 0.750 |
| | 2 3 4 1 6 5 7 | 6 5 4 7 2 3 1 | | | | | | | |
| 1 2 3 4 5 6 7 | 7 6 5 4 3 2 1 | | | | | | | | |
| (ii) | Rankings generally agree dep $r_s > 0.5$ | B1f | 1 | Must have "agree" or "similar" etc, Not 'rankings well correlated' If $r_s < 0.5$, "generally don't agree": B1 | | | | | |
| 4 | (i) | $k = 1 - \left(\frac{1}{4} + \frac{1}{5} + \frac{2}{5} + \frac{1}{10}\right)$ $\frac{1}{20}$ | M1 A1 | 2 | Use $\Sigma p = 1$ or 0.05 | | | | |
| | (ii) | $E(X) = \Sigma xp(x)$ $= -1/10$ $\Sigma x^2 p(x) = 2$ $\Sigma x^2 p(x) - \mu^2$ $= 1.99$ | M1 A1 M1 M1 A1 | 5 | Use $\Sigma xp(x)$ with a value for k and correct signs -1/10 or -0.1 only Attempt $\Sigma x^2 p(x)$ } or $\Sigma (x - \mu)^2 p(x)$: M2 Subtract their μ^2 } Answer, 1.99 or 1 99/100 | | | | |
| 5 | (i) | (a) Geo(0.05) $(19/20)^5(1/20)$ $= 0.0387$ | M1 M1 A1 | 3 | Geo(0.05) or 0.95 stated or implied $q^5 p$ attempted Answer, a.r.t. 0.0387 ISW | | | | |
| | | (b) $(19/20)^{10}$ $= 0.599$ | M1 M1 A1 | 3 | q^{10} or $1 - p - pq \dots - pq^9$ [q^9 or q^{11} , or one wrong term: M1M0] Answer, a.r.t. 0.599 $1 - (19/20)^{10}$: M0M0A0 | | | | |
| | (ii) | Mean = $1/p$ $= 20$ | M1 A1 | 2 | 20, cao | | | | |
| 6 | (i) | B(5, 3/8) ${}^5C_2(3/8)^2(5/8)^3$ $= 5625/16384$ or 0.343 | M1 M1 A1 | 3 | B(5, 3/8) stated or ${}^3/8, {}^5/8$ seen and sum of powers = 5 Correct expression Answer, a.r.t. 0.343 ISW | | | | |
| | (ii) | $\frac{1}{2} p_1 = \frac{3}{8}$ $p_1 = \frac{3}{4}$ AG | M1 A1 | 2 | or ${}^3/8 / \frac{1}{2}$ or ${}^3/8 \times 2$ $\frac{3}{4}$ correctly obtained. Must see explicit step. Verification eg $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$ or ${}^3/8 / \frac{1}{2} = \frac{3}{4}$: M1A1 | | | | |
| | (iii) | $\frac{1}{2} p_2 = \frac{1}{3}$ $p_2 = \frac{2}{3}$ | M1 A1 | 2 | or $\frac{1}{3} / \frac{1}{2}$ or $\frac{1}{3} \times 2$ Answer 2/3 or a.r.t. 0.667 | | | | |

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| 7 (i) Boxes are independent Probability same for each box | B1 B1 2 | Both must be in context |
| (ii) (a) B(8, 0.1) 0.4305 (b) 1 – P(≤ 1) 0.1869 | M1 A1 M1 A1 4 | B(8, 0.1) stated or 0.1, 0.9 seen and sum of powers =8 0.43[05] correct 1 – 0.8131 or 1 – (0.9 ⁸ + 8x0.9 ⁷ x 0.1) correct Answer, a.r.t. 0.187 |
| (iii) 2 × 0.4305 × 0.1869 0.16092 | M1 M1 A1 3 | (a) x (b) } 2 x (a) × (b) } Answer, a.r.t. 0.161 |
| 8 (i) $\frac{2 \times 7!}{8!}$ = 1/4 | M1 M1 A1 3 | 7! and 8! used or ⁷ P ₇ and ⁸ P ₈ Correct formula, with “2 ×” Answer, 1/4 or 0.25 only |
| (ii) 1/4 or 4! × 4! or 3! × 3! or ^{3!} / _{4!} $\left(\frac{1}{4}\right)^2$ or $\frac{3! \times 3!}{4! \times 4!}$ = 1/16 | M1 M1 A1 3 | Correct expression or 0.0625 |
| (iii) Attempt subdivide, allow one error. Correct subdivision into 3 or 13 cases Correct expression = $\frac{13}{16}$ | M1 M1 M1 A1 4 | By description or listing or implied by probs, eg 1 – (ii) – P(sep by 1) All 3 or all 13 cases clearly present or 0.8125 or a.r.t. 0.813 only |
| Eg correct: $1 - 3 \times \frac{1}{16}$; 1 – (ii) – $2 \times \frac{3 \times 3!}{4 \times 4!}$ $\frac{3! \times 3! \times 13}{(4! \times 4!)}$; $(\frac{3}{4})^2 + 2 \times \frac{1}{4} \times \frac{2}{4}$ | | Eg incorrect: $1 - \frac{3! \times 3! \times 3}{8!}$: M1M1M0A0 $1 - \frac{1}{16} - \frac{3! \times 3!}{4! \times 4!}$: M1M0M0A0 |
| 9 (i) $\frac{264 - \frac{90 \times 15}{5}}{1720 - \frac{90^2}{5}}$ or $\frac{264 - 5 \times 18 \times 3}{1720 - 5 \times 18^2}$ = –0.06 AG $y - \frac{15}{5} = -0.06(x - \frac{90}{5})$ $y = 4.08 - 0.06x$ | M1 A1 M1 A1 4 | Formula correctly used –0.06 correctly obtained or $a = \frac{15}{5} - (-0.06) \times \frac{90}{5}$ Complete equation correct |
| (ii) Substitute $x = 20.5$ ($y = 2.85$) Substitute $x = 19.5$ ($y = 2.91$) $2.91 - 2.85 = 0.06$ | M1 M1 A1 3 | Allow 20 ($y = 2.88$) or 20.49 Answer 0.06 or –0.06, c.w.d |
| (iii) –0.6, 0.5 | B1 B1 2 | –0.6 correct 0.5 correct |
| (iv) 1.5 Calculated equation minimises this quantity | B1 B1 2 | Not “Low value for Σe^2 means points near line” |
| (v) $\bar{e} = \Sigma e_i / 5$ = 0 $\Sigma e_i^2 / 5$ (– her \bar{e}) ² = 0.3 | M1 A1 M1 A1 4 | $\Sigma e_i / 5$ used Answer 0, c.w.d, cao $\Sigma e_i^2 / 5$ 0.3 only, must see – 0 ² or – 0 in variance. ie: No working: $\bar{e} = 0$: M1A1; Var = 0.3: M1A0 |