## Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

**2.1**

hypothesis: a testable statement that a relationship exists, e.g. "river width increases downstream"; null hypothesis: the statement that there is **no** relationship, which a statistical test can reject

**2.2**

$r_s = 1 - \dfrac{6 \times 30}{10 \times 99} = 1 - \dfrac{180}{990} \approx \mathbf{0.82}$; $0.82 > 0.648$, so a significant positive relationship: reject the null hypothesis

**2.3**

systematic: samples at regular intervals, e.g. every 100 m along a street or every tenth person; stratified: the number of samples in each zone is in proportion to the size of the zone, so every zone is represented

**2.4**

A: scatter graph; B: divided bar chart or pie chart; C: desire-line or flow map

**2.5**

any two, explained: count at several times and on different days, so one unusual hour does not distort the result; repeat counts at each site and take the mean, which reduces random error; use the same length of count (e.g. 5 minutes) and a clicker counter at every site, so results are comparable; use more sites or several streets, so the pattern is not caused by one street's shops

**3.1**

(a) there is no relationship between channel width and distance downstream

(b) ranks of width (1 = narrowest): 1, 3, 2, 4, 6, 5, 7, 8; $d$: 0, −1, 1, 0, −1, 1, 0, 0; $\sum d^2 = 4$; $r_s = 1 - \dfrac{6 \times 4}{8 \times 63} = 1 - \dfrac{24}{504} \approx \mathbf{0.95}$; $0.95 > 0.738$: a significant positive relationship, so reject the null hypothesis

**3.2**

Mark with the markbands: [9-10] focused on the command term, detailed and accurate knowledge, well-developed explanation, specific named examples (places, dates, numbers), balanced evaluation and a supported conclusion; [7-8] mostly focused, good knowledge and examples, some evaluation; [5-6] relevant knowledge and examples, explanation partly developed, little evaluation; [3-4] general knowledge, few examples, mostly description; [1-2] little that is relevant. Points that may be included: strength: systematic sampling every 500 m covers the whole stretch evenly; the method is simple and easy to repeat; a statistical test gives an objective judgement; limitation: only one width measurement per site, so a narrow or wide spot can distort the result; only 8 sites; more sites would give a more reliable test; width depends on the water level, which changes with rain, so all sites should be measured on the same day in similar weather; bends, bridges or channel works can change width locally; improvements: measure three widths at each site and use the mean; add depth and velocity to calculate discharge; carry out a risk assessment and never enter deep or fast water; conclusion: a sound simple method whose reliability would improve with repeated measurements and more sites





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