3.1 Options and fieldwork

Name: _____ Class: _____ Date: _____ **Total: 25 marks**

KEY WORDS storm hydrograph • stratified sampling

Options and fieldwork

Objective

Use the option kits' anchor concepts (hydrograph, hazard risk, Butler, land-use models), choose fieldwork sampling strategies, and execute the inquiry cycle with a statistics decision (option themes + the fieldwork IA).

1 Key knowledge and worked examples

Options + fieldwork toolkit. Hydrograph: rising limb, peak, lag time (urban = short lag, high peak). Hazard risk = hazard × exposure × vulnerability (Tōhoku 9.0). Butler: exploration → involvement → development → consolidation → stagnation → decline or rejuvenation; carrying capacity (Venice). Epidemiological transition: infectious → chronic. Burgess concentric, Hoyt sectors; megacity 10 million plus. Sampling: random, systematic, stratified. For eight untied pairs, Spearman $r_s = 0.714$ (rounded) is below the exact two-sided 5% critical value 0.738: do not reject the null of no rank association. For an independence test on a 2×2 count table, with independent observations and sufficiently large expected counts, $\chi^2 = 5.2$ exceeds 3.84 (1 degree of freedom, 5%): reject independence.

2 Practice

2.1 Label a storm hydrograph: name the axis, the peak and the lag time. [2]

2.2 State the hazard-risk product and use it to explain why an earthquake of one magnitude can devastate one city and spare another. [2]

2.3 Place the first four stages of the Butler model in order. [2]

2.4 Classify each as random, systematic or stratified sampling: (a) a count every 50 m along a beach transect; (b) grid points drawn from a random-number table; (c) two quadrats per each of three known vegetation zones, in proportion. [3]

2.5 A study of 8 pairs with no tied ranks reports Spearman $r_s = 0.714$ (rounded). For an exact two-sided test at 5%, use the critical absolute value 0.738. State the statistical decision. [3]

3 Exam-style questions

3.1 *(Fieldwork design style.)* Design a fieldwork inquiry into whether pedestrian density falls with distance from a city-centre plaza: state the question, a directional hypothesis, the sampling strategy with a reason, and two evaluation points with their named modifications. [6]

3.2 *(Urban option style.)* A city's outlying district shows a ring of nineteenth-century terraced housing inside a sector of light industry. Explain how Burgess's and Hoyt's models each account for the pattern, and one limitation of using either model. [4]

3.3 *(Coasts option style.)* "Managed realignment is surrender." Evaluate realignment against continued hard defence for a low-value agricultural coastline. [3]

Solutions

2.1 Axes: discharge (cumecs) against time; the PEAK is the maximum discharge (1); the LAG TIME runs from the storm's peak rainfall to the hydrograph's peak discharge (1).

2.2 Risk = hazard magnitude × exposure × vulnerability (1): identical magnitude devastates where exposure and vulnerability are high (dense settlement, weak buildings) and spares the prepared, well-built city – Tōhoku's warning system cut deaths despite magnitude 9.0 (1).

2.3 Exploration, involvement, development, consolidation (2 – 1 for three in order).

2.4 (a) Systematic (1); (b) random (1); (c) stratified (1).

2.5 The observed absolute value $0.714 < 0.738$ (1), so the association is not statistically significant in this exact two-sided test at 5% (1). Do not reject the null hypothesis of no rank association (1); this does not prove that no association exists.

3.1 Question: does pedestrian density decline with distance from the plaza? (place-specific, answerable) (1). Hypothesis: pedestrian density per 2-minute count falls with each successive 100 m from the plaza (directional, measurable) (1). Sampling: systematic, with counts at every 100 m along four transects (one per compass direction) give even coverage of the distance gradient; the transects stratified by direction guard against one street's bias (2). Evaluation: one rainy hour biases counts downward – repeat across days and times (1); four transects may miss the pedestrianised street – add transects where a pilot shows flow, or stratify by street type (1). (Method marks reward choices WITH reasons.)

3.2 Burgess: concentric zones – a ring of older terraced housing sits in the zone of transition/inner city around the centre, industry included with it (2). Hoyt: sectors, not rings – light industry grows outward along a transport sector (canal, rail), with working-class housing beside it, explaining the terraces sitting inside an industrial sector rather than a neat ring (1). Limitation: both are early twentieth-century descriptions of particular cities – modern decentralisation, commuting and regeneration break the rings, so the models are starting points to test against data, not rules (1).

3.3 Realignment is planned adjustment, not surrender: where the land is low-value farmland, the defence cost of hard engineering exceeds the asset protected, and realignment creates intertidal habitat and a buffer that absorbs surge (1). Hard defence protects the immediate line but transfers erosion downdrift and commits rising maintenance as sea level rises (1). Judgement: for low-value coastlines the economics and ecology favour realignment; for cities, the asset value still justifies defence – the choice follows the value at risk (1).

Local review guidance: state statistic, critical value and decision in that order; every method choice carries a because; (R1 3.2/3.3) models and strategies evaluated against place evidence, not recited. Authored classroom guidance.