BCB744 Biostatistics Exam Rubric (2025)

Smit, A. J.

2025-05-31

General Structure of the Rubric

Each Task is evaluated under the following axes:

1. Technical Accuracy (50%)
2. Depth of Analysis (20%)
3. Clarity and Communication (20%)
4. Critical Thinking (10%)

Each subcomponent is marked on a 0–100 scale, then scaled to its proportion of the task weight. For example, Task 5 is worth 30% of the total mark, so a sub-question like 5.1 (one of five) may contribute up to 6% if evenly weighted.

Task 1: Initial Processing [10%]

Weight within task:

- 1.1 Extraction and Restructuring (50%)
- 1.2 Conversion and Summarisation (50%)

Rubric:

- Technical Accuracy (50%)
  - Correct unpacking of NetCDF variables (names, dimensionality): 15%
  - Time conversion handled correctly (POSIX timestamps): 10%
  - Data reshaped into appropriate long format: 15%
  - Presence of appropriate columns (year, quarter, etc.): 10%
- Depth of Analysis (20%)
  - Efficient use of methods (e.g. hyper_tibble() or expand.grid() vs brute loops): 10%
  - Use of Cartesian indexing or equivalent vectorised operation: 10%
- Clarity and Communication (20%)
  - Code is readable, well-commented: 10%
  - Summary of the resulting data structure shown and interpretable: 10%
- Critical Thinking (10%)
  - Indicates understanding of spatial × temporal structure and mentions NA implications: 10%

Task 2: Exploratory Data Analysis [10%]

2.1 Weighted Mean Time Series

- (1) Weighted mean across time: 15%
- (2) Time series for 100 pixels: 15%

2.2 Summary Statistics:

- (1) Descriptive stats: 20%
- (2) Visualisations: 20%
- (3) Interpretation: 20%

2.3 Observation Density Map: 10%

Rubric:

- Technical Accuracy (50%)
  - Proper handling of weights and NA filtering: 10%
  - Correct aggregation logic (quarter, pixel, etc.): 10%
  - Appropriateness of visualisation syntax and ggplot conventions: 10%
  - Use of statistical descriptors (mean, sd, skew, etc.) correctly: 10%
  - Map projection/geodesic coordinates and section overlay accuracy: 10%
- Depth of Analysis (20%)
  - Commentary on skewness, kurtosis, and statistical implications: 10%
  - Recognition of seasonal/temporal signals in plots and stats: 10%
- Clarity and Communication (20%)
  - Plot labels, axes, titles intelligible and precise: 10%
  - Logical narrative supporting visualisations/statistics: 10%
- Critical Thinking (10%)
  - Justification of metric choices, handling of anomalous years: 5%
  - Suggestions of ecological explanations (e.g., photoperiod, storminess): 5%

Task 3: Inferential Statistics I [20%]

Weight within task:

- (1) Hypotheses: 10%
- (2) Model selection and justification: 20%
- (3) Assumption testing: 20%
- (4) Result interpretation and diagnostics: 50%

Rubric:

- Technical Accuracy (50%)
  - Correct use of linear model and specification (additive, no interaction): 20%
  - Explicit assumptions tested (normality, homogeneity): 10%
  - Proper model diagnostics and visual checks: 10%
  - Use of correct significance thresholds and p-value interpretation: 10%
- Depth of Analysis (20%)
  - Justification for using aggregate means vs raw data: 10%
  - Consideration of alternative models (e.g., GAMs): 10%
- Clarity and Communication (20%)
  - Hypotheses stated cleanly, concisely: 10%
  - Figure/Table references integrated smoothly in the narrative: 10%
- Critical Thinking (10%)
  - Recognition of model limitations and implications (e.g. low R^2): 10%

Task 4: Spatial Assignment [10%]

4.1 Section Assignment: 5%

4.2 Bioregion Assignment: 5%

Rubric:

- Technical Accuracy (50%)
  - Correct application of Haversine formula or great-circle logic: 20%
  - Accurate section_id assignment: 10%
  - Bioregion mapping via join or merge: 10%
  - Correct data columns preserved/renamed: 10%
- Depth of Analysis (20%)
  - Efficiency of matching routine (e.g., mapply() or vectorised join): 10%
  - Consideration of spatial boundaries (e.g., limiting to section 1–22): 10%
- Clarity and Communication (20%)
  - Annotated code, explanation of proximity logic: 10%
  - Output (head(), summary(), tail()) shows assignment integrity: 10%
- Critical Thinking (10%)
- Considers effect of section resolution or mapping error: 10%

Task 5: Inferential Statistics II [30%]

Each sub-task contributes approximately 6% unless reweighted explicitly.

Rubric per sub-task (5.1–5.5):

- Technical Accuracy (50%)
  - Model type (ANOVA, LM, ANCOVA) appropriate: 15%
  - Correct test execution (summary, diagnostics): 15%
  - Assumptions evaluated, violations addressed: 10%
  - Non-parametric alternative proposed when appropriate: 10%
- Depth of Analysis (20%)
  - Explicit rationale for model choice: 10%
  - Discussion of structure in data (nesting, lack of interaction): 10%
- Clarity and Communication (20%)
  - Hypotheses clearly and formally stated: 10%
  - Visualisations appropriately labelled and explained: 10%
- Critical Thinking (10%)
  - Insight into ecological implications of findings (e.g., BMP trend): 10%

Add 1–2 bonus marks if:

- Multicollinearity (e.g., VIF) or autocorrelation (e.g., DW test) is discussed
- Advanced diagnostics (e.g., Breusch–Pagan, TukeyHSD) are used correctly

Task 6: Write-up [10%]

Rubric:

- Technical Accuracy (50%)
  - Consistent reference to previous results, correct figure/table interpretation: 25%
  - Accurate paraphrasing of statistical results: 15%

  - Adherence to 2-page length limit, integration of material: 10%
- Depth of Analysis (20%)
  - Rich synthesis across Tasks 2–5, not isolated repetition: 10%
  - Conceptual connection of seasonality, trend, and spatial heterogeneity: 10%
- Clarity and Communication (20%)
  - Coherent scientific writing style, flowing paragraph structure: 10%
  - Effective integration of figure references and literature: 10%
- Critical Thinking (10%)
  - Limitations clearly acknowledged and reflected on: 5%
  - Forward-looking ecological insight or recommendation offered: 5%