

HLTH 204: Biostatistics for Biological and Health Sciences

Midterm Examination 1: Overview

Date: February 27, 2026

Coverage: Chapters 1, 2, 3, 4, and 5

This examination covers the fundamental concepts of descriptive statistics, including data collection, graphical summaries, measures of central tendency and variation, probability theory, and discrete probability distributions.

Chapter 1: Introduction to Statistics

- **Statistical Thinking Fundamentals:**
 - Define Data, Statistics (as a field), Population, Sample, and Census.
 - Understand the key steps in a statistical study: Preparation (Context, Source, Sampling Method), Analysis, and Conclusion.
 - Distinguish between **Statistical Significance** (a result unlikely to occur by chance) and **Practical Significance** (a result large enough to matter in the real world).
- **Data Types and Measurement:**
 - Differentiate between a **Parameter** (a property of the population) and a **Statistic** (a property of the sample).
 - Identify **Quantitative** (numerical) data versus **Categorical** (non-numerical labels or attributes) data.
 - Distinguish between **Discrete** data (countable, finite or infinitely countable values) and **Continuous** data (measurable, infinitely many values over a range).
 - Identify the four Levels of Measurement: Nominal, Ordinal, Interval, and Ratio.
- **Sampling and Study Design:**
 - Define and identify a **Voluntary Response Sample** and understand why conclusions based on it are generally not valid.
 - Identify appropriate sampling techniques: Simple Random Sample, Systematic Sampling, Convenience Sampling, Stratified Sampling, and Cluster Sampling.
 - Differentiate between an **Experiment** (treatment applied) and an **Observational Study** (characteristics measured without modification).

- Understand the importance of good experimental design, including **Replication**, **Blinding**, and **Randomization**.

Chapter 2: Exploring Data with Tables and Graphs

- **Frequency Distributions:**
 - Construct and interpret Frequency Tables, Relative Frequency Distributions (percentages or proportions), and Cumulative Frequency Distributions.
 - Identify table components: Class Limits (lower and upper), Class Boundaries, Class Midpoints, and Class Width.
- **Visualizing Data:**
 - Construct and interpret **Histograms** and **Relative Frequency Histograms**.
 - Identify characteristics of a distribution: **Center**, **Variation** (spread), **Distribution Shape**, **Outliers**, and changes over **Time** (CVDOT).
 - Identify common shapes: **Normal** (bell-shaped), **Uniform** (flat), **Skewed Left** (long left tail), and **Skewed Right** (long right tail).
- **Other Graphical Tools:**
 - Interpret Dotplots, Stemplots, Time-Series Graphs (for trends), Bar Graphs, Pareto Charts (categorical data sorted by frequency), and Pie Charts.
 - Recognize deceptive graphs (e.g., using a non-zero vertical axis, or pictographs that distort visual ratios).
- **Correlation (Introduction):**
 - Interpret **Scatterplots** to visually determine the presence and direction (positive/negative) of a linear correlation.

Chapter 3: Describing, Exploring, and Comparing Data

- **Measures of Center:**
 - Calculate and interpret the Mean (arithmetic average), Median (middle value in a sorted set), Mode (most frequent value), and Midrange.
 - Understand which measures are **Resistant** (not affected by outliers, like the Median).
- **Measures of Variation:**
 - Calculate and interpret the Range (Max minus Min), Variance, and Standard Deviation.
 - Apply the **Range Rule of Thumb** to interpret standard deviation and determine if a data value is significantly low or significantly high (typically values more than two standard deviations from the mean).

- Use the **Coefficient of Variation (CV)** to compare the spread of data sets, especially when their means or measurement units are different.
- **Measures of Relative Standing:**
 - Calculate and interpret the **z-Score** (Standard Score), defining it as the number of standard deviations a value is above or below the mean.
 - Use the criterion that values are significantly extreme if their z-scores are less than negative two or greater than positive two.
 - Define and find **Percentiles**.
 - Define the **Quartiles** (first quartile, second quartile/median, and third quartile).
 - Define the **5-Number Summary** (Minimum, Quartile 1, Median, Quartile 3, Maximum) and interpret **Boxplots** (or Box-and-Whisker Diagrams).

Chapter 4: Probability

- **Concepts and Approaches:**
 - Understand the three ways to determine the probability of an event: Relative Frequency (based on observation), Classical (based on equally likely outcomes), and Subjective (based on knowledge/experience).
 - Define the **Complement** of an event (the event does not occur).
 - Understand the **Rare Event Rule** for making statistical inferences.
- **Rules of Probability:**
 - Apply the **Addition Rule** to find the probability of Event A or Event B (distinguishing between Disjoint and non-Disjoint events).
 - Apply the **Multiplication Rule** to find the probability of Event A and Event B (distinguishing between Independent and Dependent events).
 - Apply the **5% Guideline** when sampling without replacement from a large population.
 - Calculate **Conditional Probability** and identify the **Confusion of the Inverse**.
- **Measuring Risk and Counting:**
 - Calculate and interpret **Absolute Risk Reduction**, **Relative Risk (Risk Ratio)**, **Odds Ratio**, and **Number Needed to Treat (NNT)**.
 - Understand and interpret various **Rates** (e.g., Mortality Rate, Incidence Rate).
 - Apply **Counting Techniques**: Multiplication Rule, Factorial Rule, Permutations (when order matters), and Combinations (when order does not matter).

Chapter 5: Discrete Probability Distributions

- **Distribution Definition and Parameters:**
 - Define a **Random Variable** and a **Probability Distribution**.
 - Verify the requirements for a valid probability distribution.
 - Calculate the Mean and Standard Deviation for a discrete probability distribution.
 - Identify **Expected Value**.
- **Binomial Distribution:**
 - Identify procedures that satisfy the four requirements for a Binomial Distribution.
 - Calculate binomial probabilities using formulas or technology.
 - Determine the mean and standard deviation for a binomial distribution.
- **Poisson Distribution:**
 - Recognize situations where a Poisson distribution applies (occurrences over a specified interval).
 - Know the criteria for using the Poisson distribution to approximate binomial probabilities.