

VU Learning HUB

BIO401 Quiz File

Chapter-wise Solved MCQs

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Lesson 1: Introduction to Biostatistics

1. How is biostatistics specifically defined in the course handouts?

- A) The study of pure mathematical formulas without biological applications
- B) The application of statistical methods to the solution of biological problems
- C) The collection of demographic data for census purposes only
- D) The graphical representation of physical geography

2. Which alternative terms are synonymous with biostatistics according to the source?

- A) Biological statistics or biometry
- B) Theoretical algebra
- C) Demography and bioscience
- D) Environmental accounting

3. Modern statistics is defined as the scientific study of what type of data?

- A) Qualitative opinions from interviews
- B) Numerical data based on natural phenomena
- C) Hypothetical figures without empirical testing
- D) Historical literature archives

4. Which of the following is explicitly listed as a practical application of biostatistics?

- A) Architectural drafting
- B) Genomics data analysis
- C) Mineral mining extraction
- D) Software compiler design

Answer Key

- 1. B — Biostatistics is defined as the application of statistical methods to solve biological problems.
- 2. A — The source notes that biostatistics is also called biological statistics or biometry.
- 3. B — Modern statistics is defined in its modern sense as the scientific study of numerical data based on natural phenomena.
- 4. B — Genomics data analysis is explicitly listed among the practical applications of biostatistics.

Lesson 2: Basic Terminology - I

1. In biostatistics, how is a population of entities defined?

- A) Any small subset selected for testing
- B) The largest collection of entities for which we have an interest at a particular time
- C) A collection restricted exclusively to human beings
- D) A fixed group of 100 randomly chosen individuals

2. What is a sample?

- A) The entire set of observation objects in a country
- B) A part or subset of a population
- C) A constant mathematical parameter
- D) An uncountable collection of germs

3. What term describes an uncountable population where counting individual units is impossible?

- A) Finite population
- B) Target population
- C) Infinite population
- D) Sample population

4. What is a population parameter?

- A) A summary number, such as an average or percentage, that describes an entire population
- B) A single value calculated exclusively from sample data
- C) An observational error in data collection
- D) A category on a nominal scale

Answer Key

1. B — A population of entities is defined as the largest collection of entities of interest at a particular time.
2. B — A sample is simply defined as a part or subset of a population.
3. C — An uncountable population where counting units is impossible is termed an infinite population.
4. A — A parameter is any summary number (like an average or percentage) that describes the entire population.

Lesson 3: Basic Terminology - II

1. What is the fundamental difference between a statistic and a parameter?

- A) A statistic refers to measures about a sample, while a parameter refers to measures about a population
- B) A statistic is a constant, while a parameter is a random variable
- C) A statistic uses Greek letters, while a parameter uses Latin letters
- D) A statistic is always qualitative, while a parameter is always continuous

2. Which statistical notation convention is generally used for sample statistics versus population parameters?

- A) Latin/lower-case letters for statistics, and Greek/capital letters for parameters
- B) Greek letters for statistics, and Latin letters for parameters
- C) Arabic numerals for statistics, and Roman numerals for parameters
- D) Subscripts for statistics, and superscripts for parameters

3. What symbol is used to represent the sample mean versus the population mean?

- A) $\bar{x}$ for sample mean, and μ (μ) for population mean
- B) μ (μ) for sample mean, and $\bar{x}$ for population mean
- C) $\hat{p}$ for sample mean, and P for population mean
- D) s for sample mean, and σ (σ) for population mean

4. Which of the following represents primary data?

- A) Firsthand data gathered directly by the researcher without going through existing sources
- B) Data gathered previously by a third party from government publications
- C) Past data downloaded from journal website archives
- D) Existing internal company records from past decades

Answer Key

1. A — A statistic refers to measures about a sample, whereas a parameter refers to measures about a population.

2. A — Sample statistics are typically represented by Latin/lower-case letters, while population parameters use Greek/capital letters.
3. A — The sample mean is denoted by $\bar{x}$ and the population mean is denoted by μ (μ).
4. A — Primary data refers to firsthand data collected directly from the source for a specific research problem.

Lesson 4: Data

1. How is data defined as the raw material of statistics?

- A) Words and abstract concepts only
- B) Numbers resulting from measurement or counting
- C) Unverifiable personal opinions
- D) Theoretical algebraic proofs

2. Which of the following is an example of data obtained through counting?

- A) A patient's body temperature of 100°F
- B) The weight of a patient recorded as 150 pounds
- C) The number of patients discharged from a hospital on a given day
- D) Blood pressure reading taken by a nurse

3. Which characteristic is associated with secondary data?

- A) First-hand real-time data gathered directly by the researcher
- B) Data collected in the past by someone else made available for others
- C) Highly expensive and time-consuming implementation
- D) Always perfectly tailored to the researcher's specific needs

4. Which data collection method is explicitly categorized as a primary source?

- A) Questionnaires and direct experiments
- B) Government publications
- C) Published journal articles
- D) Internal company records from past years

Answer Key

1. B — Data is defined as numbers resulting from measurements or counting processes.
2. C — Counting hospital discharges yields a count datum, unlike temperature or weight measurements.
3. B — Secondary data refers to past data collected earlier by someone else for another purpose.
4. A — Questionnaires, experiments, and surveys are primary sources, while publications and records are secondary sources.

Lesson 5: Variables

1. What is a variable in statistics?

- A) A value that remains constant across all possessors
- B) A characteristic that takes on different values in different persons, places, or things
- C) A summary statistic calculated exclusively from census data
- D) A parameter fixed by mathematical laws

2. Which variable is categorized as qualitative?

- A) Diastolic blood pressure

- B) Stages of breast cancer (I, II, III, or IV)
- C) Height of adult males
- D) Weight of preschool children

3. What distinguishes a discrete quantitative variable from a continuous quantitative variable?

- A) Discrete variables take on only whole numbers/counts with jumps, while continuous variables are measured on a continuous scale
- B) Discrete variables can never be numeric, while continuous variables are always non-numeric
- C) Discrete variables have a true zero point, while continuous variables lack magnitude
- D) Discrete variables represent heights, while continuous variables represent family sizes

4. Which of the following is an example of a discrete variable?

- A) Body temperature in °C
- B) The number of episodes of diarrhea in the first five years of life
- C) Age in years on a continuous timeline
- D) Body weight in kilograms

Answer Key

1. B — A variable is a characteristic that takes on different values in different possessors.
2. B — Cancer stages (I, II, III, IV) represent a qualitative variable identified by names/categories.
3. A — Discrete variables take integer/count values taken by jumps, whereas continuous variables are measured on a continuous scale.
4. B — The number of diarrhea episodes is a discrete variable representing whole number counts.

Lesson 6: Measurement Scales – I

1. What are the four types of measurement scales in statistics?

- A) Primary, Secondary, Tertiary, Quaternary
- B) Nominal, Ordinal, Interval, Ratio
- C) Discrete, Continuous, Qualitative, Quantitative
- D) Sample, Population, Parameter, Statistic

2. Which property of a measurement scale implies that each value has a unique meaning?

- A) Identity
- B) Magnitude
- C) Equal intervals
- D) Minimum value of zero

3. What is the defining characteristic of a nominal measurement scale?

- A) Numbers serve as tags or labels to identify objects without any implied order
- B) Data is ranked with precise, equal distances between units
- C) It contains an absolute true zero point
- D) Values allow full multiplication and division operations

4. Which example represents data on an ordinal scale?

- A) Survival status (Alive / Dead)
- B) Eye color (Brown, Black, Blue)
- C) Ranking of school students (1st, 2nd, 3rd)
- D) Height measured in centimeters

Answer Key

1. B — The four measurement scales are Nominal, Ordinal, Interval, and Ratio.
2. A — The property of identity means each value on the scale has a unique meaning.
3. A — Nominal scales use numbers or names as tags/labels for categories without implied order.
4. C — Student rankings (1st, 2nd, 3rd) report ordering and ranking, which defines ordinal data.

Lesson 7: Measurement Scales – II

1. What characterizes an interval scale of measurement?

- A) Quantitative measurement scale where differences between variables are meaningful, but the zero point is arbitrary
- B) Data consists only of unordered named categories
- C) It has an absolute true zero point below which no values exist
- D) It cannot quantify differences between numerical values

2. Which scale of measurement is considered the highest level and possesses an absolute true zero point?

- A) Nominal scale
- B) Ordinal scale
- C) Interval scale
- D) Ratio scale

3. Which of the following variables is measured on an interval scale?

- A) Temperature measured in Fahrenheit or Celsius
- B) Weight measured in kilograms
- C) Height measured in feet
- D) Sex (male / female)

4. What statistical advantage does a ratio scale provide over an interval scale?

- A) It allows calculating ratios, unit conversions, and multiplication/division due to its true zero point
- B) It is the only scale that allows calculating median and mode
- C) It ignores ordered relationships between values
- D) It uses arbitrary non-zero reference points exclusively

Answer Key

1. A — Interval scales feature quantitative, meaningful differences between values but have an arbitrary zero point.
2. D — The ratio scale is the highest level of measurement and is characterized by a true zero point.
3. A — Temperature in Fahrenheit or Celsius is measured on an interval scale.
4. A — Ratio scales feature an absolute true zero point, enabling unit conversions, ratios, and full arithmetic operations.

Lesson 8: Types of Statistics

1. What are the two major branches of Applied Statistics?

- A) Mathematical Statistics and Theoretical Statistics
- B) Descriptive Statistics and Inferential Statistics
- C) Primary Statistics and Secondary Statistics

D) Nominal Statistics and Ratio Statistics

2. What is the primary role of Descriptive Statistics?

- A) Drawing conclusions about a population based on sample variations
- B) Organizing, summarizing, and presenting data using tables, graphs, and summary measures
- C) Testing hypothesis equations for future predictions
- D) Estimating unknown parameters with margin of error

3. Which of the following is categorized as a measure of dispersion in descriptive statistics?

- A) Mean, Median, and Mode
- B) Percentile and Quartile ranks
- C) Range, Variance, and Standard Deviation
- D) Frequency counts and percentages

4. Measures of central tendency include which statistical metrics?

- A) Standard deviation and Variance
- B) Mean, Median, and Mode
- C) Interquartile range and Minimum value
- D) Skewness and Kurtosis only

Answer Key

1. B — Applied statistics is divided into Descriptive Statistics and Inferential Statistics.
2. B — Descriptive statistics organizes, summarizes, and presents data using tables, graphs, and summary measures.
3. C — Range, Variance, and Standard Deviation are explicit measures of dispersion.
4. B — Mean, median, and mode are the central tendencies of a dataset.

Lesson 9: Sampling and Statistical Inference

1. What is Inferential Statistics used for?

- A) To collect primary survey data from participants
- B) To draw conclusions, make predictions, or infer population parameters from sample data
- C) To simply plot histograms without calculating summaries
- D) To assign nominal labels to qualitative observations

2. What is an estimator?

- A) A rule or function used to calculate an estimate of a population parameter from observed sample data
- B) The total count of entities in a census
- C) The absolute error of a measurement instrument
- D) A qualitative category on an ordinal scale

3. How does point estimation differ from interval estimation?

- A) Point estimation calculates a single value, whereas interval estimation provides a range of values likely to contain the parameter
- B) Point estimation applies to populations, while interval estimation applies only to individual subjects
- C) Point estimation uses Greek letters, while interval estimation uses lower-case numbers
- D) Point estimation has a 100% margin of error, while interval estimation has zero error

4. What is a sampling distribution?

- A) The list of raw values in a single primary survey
- B) The probability distribution of a statistic obtained from repeated samples of the same size
- C) A frequency table of qualitative variables
- D) The exact count of all units in a census

Answer Key

1. B — Inferential statistics allows using sample data to draw conclusions, make predictions, or infer population characteristics.
2. A — An estimator is a rule or function for calculating an estimate of a parameter based on sample data.
3. A — Point estimation provides a single calculated value, while interval estimation provides an interval likely to contain the parameter.
4. B — A sampling distribution is the probability distribution of a statistic over repeated samples.

Lesson 10: Basic Terminology for Sampling

1. What symbol is generally used to denote population size?

- A) n
- B) N
- C) μ (μ)
- D) s

2. What is a census?

- A) A partial survey of 10% of a population
- B) A complete count or 100% sample of all observation units in a population
- C) An estimation method using sample standard deviations
- D) A non-probability convenience sample

3. How does sample size (n) compare to population size (N)?

- A) n is always equal to N
- B) n is always less than the total size of the population N
- C) n is always greater than N
- D) n is calculated independently of the population

4. What are sampling units in sample surveys?

- A) The specific elements or collection of units (e.g., households, people, cities) from which a sample is selected
- B) The equations used to calculate variance
- C) The visual charts used in SPSS tutorials
- D) The probability levels of a t-table

Answer Key

1. B — Total population size is generally denoted by capital N.
2. B — A census is a 100% sample that conducts a complete count of all sampling units in the population.
3. B — The size of the sample (n) is always less than the total size of the population (N).
4. A — Sampling units are individual or grouped entities like households, people, or cities selected during surveys.

Lesson 11: Types of Sampling Methods

1. Into which two primary categories are sampling methods broadly classified in the course handout?

- A) Primary sampling and Secondary sampling
- B) Probability sampling methods and Non-probability sampling methods
- C) Qualitative sampling and Quantitative sampling
- D) Finite sampling and Infinite sampling

2. Which of the following is explicitly listed as a probability sampling method?

- A) Convenience sampling
- B) Quota sampling
- C) Stratified sampling
- D) Snowball sampling

3. When is Simple Random Sampling typically used according to Topic 11?

- A) When detailed prior information about every subgroup is available
- B) When we do not have any kind of prior information about the target population
- C) When sampling cost is extremely high and subject availability is rare
- D) When participants are asked to refer their acquaintances

4. Which sampling method is described as a combination of one or more basic sampling techniques?

- A) Multistage sampling
- B) Simple random sampling
- C) Convenience sampling
- D) Quota sampling

Answer Key

1. B — Sampling methods are broadly categorized into probability sampling and non-probability sampling methods.
2. C — Stratified sampling is classified as a probability sampling method, unlike convenience, quota, or snowball sampling.
3. B — Simple Random Sampling is used when there is no prior information available about the target population.
4. A — Multistage sampling combines one or more distinct sampling methods across multiple stages.

Lesson 12: Simple Random Sampling

1. What condition defines a Simple Random Sample (SRS)?

- A) Every unit in the population and every possible sample of the same size has an equal probability of selection
- B) Units are chosen at fixed regular intervals from a serial list
- C) The population is divided into heterogeneous clusters first
- D) Selection relies entirely on researcher convenience

2. By what alternative name is a simple random sample also known?

- A) Restricted random sample
- B) Unrestricted random sample
- C) Non-probability convenience sample
- D) Stratified cluster sample

3. Which of the following is listed as a physical procedure for drawing a simple random sample?

- A) The Goldfish Bowl Procedure
- B) The Snowball Referral Method
- C) The Quota Allocation Grid
- D) The Contingency Table Method

4. An important advantage of simple random sampling is that it provides unbiased estimates of which population parameters?

- A) Population mean, population total, and sampling variances of estimates
- B) Qualitative ranks and ordinal medians only
- C) Non-random error margins and quota ratios
- D) Secondary data biases and interval zero points

Answer Key

1. A — In SRS, each population unit and each possible sample of the same size has an equal probability of selection.
2. B — A simple random sample is also known as an unrestricted random sample.
3. A — The Goldfish Bowl Procedure is a physical sampling method described for drawing a simple random sample.
4. A — An advantage of SRS is providing unbiased estimates of the population mean, population total, and sampling variances.

Lesson 13: Stratified Random Sampling

1. How are strata formed in Stratified Random Sampling?

- A) Units within each stratum are homogeneous, while different strata are externally heterogeneous
- B) Units within each stratum are heterogeneous, while different strata are identical
- C) Units are selected purely based on convenience without subgroups
- D) Units are chosen at fixed numerical intervals ($k = N/n$)

2. What prerequisite is necessary before performing Stratified Random Sampling?

- A) Prior information about the population to create meaningful subgroups
- B) A complete list of all population units selected at random
- C) Knowledge of the population variance only
- D) Availability of a computer random number generator

3. Which allocation method distributes the total sample size in proportion to each stratum's population fraction?

- A) Equal allocation
- B) Proportional allocation
- C) Optimum allocation
- D) Convenience allocation

4. What is a key advantage of proportional allocation in stratified sampling?

- A) It does not require information on stratum variances or sampling costs in different strata
- B) It always gives the smallest possible sample size
- C) It eliminates the need for stratification
- D) It works without any population information

Answer Key

1. A — Stratification requires strata be internally homogeneous and externally heterogeneous.
2. A — Prior information about the target population is required to create strata subgroups.
3. B — Proportional allocation distributes sample size based on the stratum population fraction.
4. A — Proportional allocation's advantage is it does not require prior knowledge of stratum variances or costs.

Lesson 14: Cluster Sampling

1. In Cluster Sampling, how are clusters defined relative to variability?

- A) Variation among clusters is smaller than variation within clusters
- B) Variation among clusters is larger than variation within clusters
- C) All clusters are identical in composition
- D) Clusters contain only one unit each

2. Which of the following is a common real-world example of a cluster?

- A) City blocks, households, or school classes
- B) Individual names drawn from a hat
- C) Stratified income groups
- D) Random telephone digits

3. When is Cluster Sampling particularly recommended?

- A) When sampling frames of adequate coverage are not available
- B) When the population is very small
- C) When every unit must have equal selection probability
- D) When only qualitative data is needed

4. In which practical domain is cluster sampling mostly utilized?

- A) Statistical quality control
- B) Laboratory experiments
- C) Census of entire populations
- D) Case studies of individuals

Answer Key

1. A — In cluster sampling, variation among clusters is smaller than variation within clusters.
2. A — City blocks, households, and school classes are typical real-world clusters.
3. A — Cluster sampling is recommended when adequate sampling frames are unavailable.
4. A — Cluster sampling is mostly utilized in statistical quality control.

Lesson 15: Systematic Sampling

1. How is the sampling interval k calculated?

- A) Population size divided by sample size ($k = N/n$)
- B) Sample size divided by population size
- C) Population size minus sample size
- D) Sample size plus one

2. Which element is selected purely at random in systematic sampling?

- A) Every k th element

- B) The first element selected from the first k units
- C) The last element of the population
- D) The middle element of the list

3. If population size $N = 100$ and desired sample size $n = 20$, what is the interval?

- A) 5
- B) 20
- C) 100
- D) 2000

4. What is a structural advantage of systematic sampling?

- A) The sample is more evenly distributed across the population
- B) It requires no population list at all
- C) It guarantees proportional representation of all subgroups
- D) It eliminates all sampling error

Answer Key

1. A — The sampling interval is calculated as $k = N/n$.
2. B — Only the first element among the first k units is chosen at random.
3. A — With $N = 100$ and $n = 20$, the interval $k = 100/20 = 5$.
4. A — Systematic samples spread more evenly across the population list.

Lesson 16: Non-Probability Sampling Methods

1. What is the defining characteristic of non-probability sampling methods?

- A) They do not rely on randomization and elements do not have an equal chance of selection
- B) Every element has a known equal probability of selection
- C) They always use random number tables
- D) They require a complete sampling frame

2. What is an alternative term for non-probability sampling?

- A) Non-random sampling
- B) Probability sampling
- C) Systematic sampling
- D) Cluster sampling

3. Which technique relies on participants recruiting other participants?

- A) Referral (Snowball) sampling
- B) Simple random sampling
- C) Stratified sampling
- D) Quota sampling

4. Why is snowball sampling used for sensitive topics like HIV/AIDS research?

- A) Because participants may not openly participate, so referrals help contact individuals
- B) Because it gives the largest sample size
- C) Because it is the only probability method
- D) Because it requires no consent

Answer Key

1. A — Non-probability methods do not use randomization; elements lack equal selection chances.
2. A — Non-probability sampling is also called non-random sampling.
3. A — Snowball sampling uses referrals from existing participants.
4. A — Referrals help reach individuals who would not openly participate.

Lesson 17: Convenience Sampling

1. How are units selected in convenience sampling?

- A) Based on ease of availability and accessibility
- B) By random number generation
- C) Through stratified allocation
- D) Using systematic intervals

2. When is convenience sampling preferred?

- A) During initial stages of survey research (quick and easy)
- B) When precise population estimates are required
- C) For final confirmatory studies
- D) When sampling frames are complete

3. What is the primary advantage of convenience sampling?

- A) Inexpensive methodology and quick data collection
- B) Unbiased population estimates
- C) Equal selection probabilities
- D) Complete population coverage

4. Why does convenience sampling take minimal time?

- A) Fewer rules, readily accessible samples
- B) Large field teams are deployed
- C) Computer algorithms do all the work
- D) Populations are always small

Answer Key

1. A — Convenience sampling selects units based on ease of availability.
2. A — It is preferred in early exploratory stages of research.
3. A — Its main advantages are low cost and speed.
4. A — Minimal rules and accessible subjects save time.

Lesson 18: Describing Data with Tables – I

1. What are the three approaches to describing data?

- A) Tabular, Graphical, and Numerical methods
- B) Random, Stratified, and Cluster methods
- C) Mean, Median, and Mode only
- D) Primary, Secondary, and Tertiary methods

2. How are tabular methods defined?

- A) Systematic organization in grid row/column structure
- B) Freehand drawing of charts

- C) Verbal description of data
- D) Random arrangement of values

3. Which two are the most frequent tabular formats?

- A) Frequency tables and Cross-tabulations (contingency tables)
- B) Histograms and Pie charts
- C) Scatter plots and Box plots
- D) Line graphs and Bar charts

4. Which of the following is a graphical method, NOT a tabular one?

- A) Pareto Chart
- B) Frequency table
- C) Contingency table
- D) Stem-and-leaf display

Answer Key

1. A — Data are described via tabular, graphical, and numerical methods.
2. A — Tabular methods organize data systematically in rows and columns.
3. A — Frequency tables and contingency tables are the most common tabular formats.
4. A — The Pareto chart is a graphical display, not a table.

Lesson 19: Describing Data with Tables – II

1. Which frequency distribution is used for qualitative data?

- A) Categorical frequency distribution
- B) Grouped frequency distribution
- C) Cumulative frequency distribution
- D) Relative frequency polygon

2. What does an ungrouped frequency distribution show?

- A) Frequency for each separate data value
- B) Data grouped into classes
- C) Only the total count
- D) Percentages without frequencies

3. What is the first step in constructing a frequency distribution?

- A) Construct an ordered array
- B) Draw a histogram
- C) Compute the mean
- D) Select a random sample

4. Why construct a frequency distribution?

- A) To organize data in a meaningful, intelligible way
- B) To increase the sample size
- C) To remove outliers automatically
- D) To convert qualitative data to quantitative

Answer Key

1. A — Categorical frequency distributions summarize qualitative data.

2. A — Ungrouped distributions list each distinct value with its frequency.
3. A — An ordered array is the starting point.
4. A — Frequency distributions make data meaningful and intelligible.

Lesson 20: Describing Data with Tables – III (Grouped Frequency Distribution)

1. Grouped frequency distributions are used for what type of data?

- A) Quantitative data on interval/ratio scales
- B) Qualitative nominal data
- C) Ordinal ranks only
- D) Binary yes/no responses

2. How is relative frequency calculated?

- A) Class frequency divided by total observations
- B) Total observations divided by class frequency
- C) Class frequency times 100
- D) Cumulative frequency minus class frequency

3. How is percentage frequency obtained?

- A) Relative frequency $\times$ 100
- B) Class frequency $\times$ total observations
- C) Cumulative frequency $/$ 100
- D) Midpoint $\times$ frequency

4. For class limits 30.0–32.9, what are the class boundaries?

- A) 29.95–32.95
- B) 30.0–32.9
- C) 29.9–33.0
- D) 30.5–32.5

Answer Key

1. A — Grouped distributions handle quantitative interval/ratio data.
2. A — Relative frequency = class frequency $/$ total observations.
3. A — Percentage frequency = relative frequency $\times$ 100.
4. A — Boundaries extend 0.05 beyond the limits: 29.95–32.95.

Lesson 21: Contingency Tables

1. What are other names for contingency tables?

- A) Crosstabs or two-way tables
- B) Histograms or bar charts
- C) Scatter plots or line graphs
- D) Frequency polygons

2. What is the purpose of a contingency table?

- A) Summarize relationship between categorical variables
- B) Display a single quantitative variable

- C) Compute regression coefficients
- D) Test normality of data

3. What do the cell entries of a contingency table contain?

- A) Frequency counts or relative frequencies
- B) Means and standard deviations
- C) Correlation coefficients
- D) P-values only

4. What are the row and column totals called?

- A) Marginal frequency totals
- B) Grand means
- C) Cell residuals
- D) Expected counts

Answer Key

1. A — Contingency tables are also called crosstabs or two-way tables.
2. A — They summarize associations between categorical variables.
3. A — Cells hold frequency counts or relative frequencies.
4. A — Row/column totals are marginal frequencies.

Lesson 22: Describing Data with Charts – I

1. What is the progression from raw facts to understanding?

- A) Data → Information → Knowledge
- B) Knowledge → Information → Data
- C) Information → Data → Knowledge
- D) Data → Knowledge → Information

2. What characterizes the "information age"?

- A) Information technology and the internet
- B) The invention of the printing press
- C) Oral storytelling traditions
- D) Handwritten manuscripts

3. Which are foundational concepts for understanding data?

- A) Categorical vs Numerical, Cross-Sectional vs Time-Ordered
- B) Mean vs Median only
- C) Parametric vs Non-parametric only
- D) Primary vs Secondary data only

4. What is an advantage of charts over tables?

- A) Visuals make data intuitive and self-understandable
- B) Charts always show exact values
- C) Charts need no labels
- D) Tables cannot show large data

Answer Key

1. A — Raw data becomes information, then knowledge.

2. A — IT and the internet define the information age.
3. A — Data types and ordering are foundational concepts.
4. A — Charts make patterns visually intuitive.

Lesson 23: Describing Data with Charts – II

1. Which operation applies to numerical data?

- A) Standard arithmetic calculations
- B) Alphabetical sorting only
- C) Color coding only
- D) No operations are possible

2. How do time-series data differ from cross-sectional data?

- A) Ordering is important in time-series
- B) Time-series has no order
- C) Cross-sectional data is always larger
- D) There is no difference

3. At what frequencies can time-series data be recorded?

- A) Hourly, daily, weekly, monthly, quarterly, or annually
- B) Only once per year
- C) Only in real time
- D) Only on weekdays

4. A coded opinion scale of 1–5 represents which measurement scale?

- A) Ordinal scale
- B) Nominal scale
- C) Ratio scale
- D) Interval scale

Answer Key

1. A — Numerical data support arithmetic operations.
2. A — Time order matters in time-series data.
3. A — Time series can be hourly through annual.
4. A — Ordered opinion codes form an ordinal scale.

Lesson 24: Describing Data with Charts – III

1. Which chart graphically displays a frequency distribution?

- A) Frequency Histogram
- B) Pie chart
- C) Scatter plot
- D) Box plot

2. Which charts suit a single categorical variable?

- A) Bar charts and Pie charts
- B) Histograms and Box plots
- C) Scatter plots and Line charts

D) Stem-and-leaf displays

3. Which chart displays two quantitative variables?

- A) Scatter Plot
- B) Bar chart
- C) Pie chart
- D) Pareto chart

4. What goes on the horizontal axis of a Time Series Plot?

- A) Time
- B) Frequency
- C) Categories
- D) Percentages

Answer Key

1. A — Histograms display frequency distributions graphically.
2. A — Bar and pie charts summarize single categorical variables.
3. A — Scatter plots show two quantitative variables.
4. A — Time is plotted on the horizontal axis.

Lesson 25: Box and Whisker Plot

1. What is the five-number summary?

- A) Minimum, Lower quartile (Q1), Median, Upper quartile (Q3), Maximum
- B) Mean, Median, Mode, Range, Variance
- C) Q1, Q2, Q3, Q4, Q5
- D) Minimum, Maximum, Mean, SD, N

2. What does the IQR box contain?

- A) Middle 50% (25th–75th percentiles)
- B) All of the data
- C) Only the median
- D) The outliers

3. How is an outlier defined in a box plot?

- A) Data point outside $Q1 - 1.5 \times IQR$ below or $Q3 + 1.5 \times IQR$ above
- B) Any point above the median
- C) Any repeated value
- D) The maximum value always

4. If the median is closer to the lower quartile with a longer upper whisker, the distribution is:

- A) Positively skewed (skewed right)
- B) Negatively skewed (skewed left)
- C) Perfectly symmetric
- D) Uniform

Answer Key

1. A — The five-number summary is Min, Q1, Median, Q3, Max.
2. A — The box spans the middle 50% of data.

3. A — Outliers lie beyond $1.5 \times \text{IQR}$ from the quartiles.
4. A — A longer upper whisker indicates right (positive) skew.

Lesson 26: Microsoft Excel Demo

1. According to the course handouts, what is MS-Excel primarily defined as?

- A) A database management system for SQL queries
- B) A computer program used to create electronic spreadsheets
- C) A specialized graphic design software for vector art
- D) An operating system compiler for high-level languages

2. Which of the following tasks can a user perform within Excel as outlined in Topic 26?

- A) Organize data, create charts, and perform calculations
- B) Compile C++ executable code files
- C) Render 3D character animations
- D) Manage hardware device drivers

3. Why is MS-Excel described as a convenient spreadsheet program?

- A) It allows users to create large spreadsheets, reference information, and store data effectively
- B) It executes Python scripts without needing an interpreter
- C) It replaces all external SQL database servers automatically
- D) It converts raw sound files into digital audio tracks

4. How does MS-Excel operate in terms of user interface and shortcuts?

- A) It uses a command-line interface exclusively
- B) It operates like other MS Office programs and shares similar functions and shortcuts
- C) It relies strictly on Linux terminal commands
- D) It requires manual assembly code input for cell referencing

Answer Key

1. B — MS-Excel is defined as a computer program used to create electronic spreadsheets.
2. A — Topic 26 notes that users can organize data, create charts, and perform calculations in Excel.
3. A — Excel is convenient because it allows creating large spreadsheets, referencing information, and better storage.
4. B — Excel operates similarly to other Microsoft Office programs with shared functions and shortcuts.

Lesson 27: Describing Data: From its Shapes

1. In the EPA mileage rating example presented in Topic 27, how many car measurements were obtained from the extensive testing?

- A) 10 measurements
- B) 20 measurements
- C) 30 measurements
- D) 50 measurements

2. What organization performed the mileage rating tests on the new car model in the example?

- A) The Federal Aviation Administration
- B) The Environmental Protection Agency (EPA)
- C) The World Health Organization

D) The Department of Agriculture

3. What unit of measurement was evaluated in the car mileage testing example?

- A) Kilometers per hour
- B) Miles per gallon
- C) Liters per 100 meters
- D) Horsepower per cylinder

4. What is the primary analytical objective when examining data shapes from frequency distributions?

- A) To determine how data values are distributed across class intervals
- B) To convert qualitative labels into non-probability referrals
- C) To calculate exact census totals for an entire nation
- D) To replace sample statistics with population parameters

Answer Key

1. C — The Environmental Protection Agency example evaluated 30 measurements obtained from testing a new car model.
2. B — The example specifies that tests were conducted by the Environmental Protection Agency (EPA).
3. B — The car test evaluated fuel efficiency measured in miles per gallon.
4. A — Examining data shapes reveals how frequency measurements spread across intervals.

Lesson 28: Describing Data: From its Peak

1. Which of the following is explicitly listed as a type of frequency curve in Topic 28?

- A) The symmetrical frequency curve
- B) The orthogonal scatter curve
- C) The binomial logarithmic curve
- D) The step-wise Pareto polygon

2. What unique property defines a symmetric frequency curve?

- A) Placing a vertical mirror in the center makes the left side a mirror image of the right side
- B) The right tail extends indefinitely while the left tail is truncated
- C) It possesses two equal peaks at opposite ends of the scale
- D) It takes only integer values taken by jumps

3. What curve type is characterized by a longer tail extending towards higher values on the right?

- A) Symmetrical frequency curve
- B) Positively skewed curve
- C) Negatively skewed curve
- D) U-shaped curve

4. Besides symmetrical and moderately skewed curves, which other curve types are mentioned in Topic 28?

- A) Extremely skewed and U-shaped frequency curves
- B) Linear regression lines and residual scatter curves
- C) Circular pie charts and stacked bar diagrams
- D) Discrete Poisson charts and continuous uniform grids

Answer Key

1. A — Topic 28 lists the symmetrical frequency curve among the primary types of frequency curves.
2. A — A symmetric curve is defined by a central vertical line where the left side is a mirror image of the right side.
3. B — A frequency curve with a longer tail pointing toward higher values to the right is positively skewed.
4. A — Topic 28 explicitly discusses extremely skewed and U-shaped frequency curves.

Lesson 29: Describing Shape: From Box and Whisker Plot

1. Which two quartiles mark the lower and upper boundaries of the box in a Box and Whisker Plot?

- A) Minimum value and Maximum value
- B) First quartile (Q_1) and Third quartile (Q_3)
- C) Mean and Mode
- D) Lower limit and Upper boundary

2. What distance metric defines the width of the main box in a box plot?

- A) Standard Deviation
- B) Interquartile Range (IQR)
- C) Coefficient of Variation
- D) Mean Absolute Deviation

3. How is the lower outlier boundary calculated using the 1.5 rule?

- A) $Q_1 - 1.5 \times IQR$
- B) $Q_3 + 1.5 \times IQR$
- C) $\text{Median} - 1.5 \times \text{Range}$
- D) $\text{Mean} - 1.5 \times \text{Variance}$

4. What feature inside the box indicates the central location of the dataset?

- A) The mean dot
- B) The median line
- C) The mode peak
- D) The whisker end

Answer Key

1. B — The box in a box plot is bounded by the first quartile (Q_1) and third quartile (Q_3).
2. B — The length of the box represents the Interquartile Range ($IQR = Q_3 - Q_1$).
3. A — Values falling below $Q_1 - 1.5 \times IQR$ are classified as lower outliers.
4. B — The median is visually represented by a vertical line inside the box.

Lesson 30: The Central Tendency of a Data-Set

1. How is central tendency defined in Topic 30?

- A) A descriptive summary of a dataset through a single value reflecting the center of the distribution
- B) The total spread between the smallest and largest values in a population
- C) The probability that an event occurs given prior evidence
- D) The sum of squared deviations divided by sample size

2. Along with variability (dispersion), central tendency forms a major branch of what statistical area?

- A) Inferential statistics
- B) Descriptive statistics
- C) Theoretical probability
- D) Non-parametric hypothesis testing

3. Which three classic metrics represent the primary measures of central tendency?

- A) Mean, Median, and Mode
- B) Variance, Standard Deviation, and Range
- C) Quartiles, Deciles, and Percentiles
- D) Skewness, Kurtosis, and Interquartile Range

4. Although central tendency provides a comprehensive central value, what does it NOT provide information about?

- A) The average value of the dataset
- B) Individual values in the dataset
- C) The location of the distribution center
- D) The general summary of observed scores

Answer Key

1. A — Central tendency is a descriptive summary through a single value reflecting the center of the distribution.
2. B — Central tendency and dispersion together constitute the core of descriptive statistics.
3. A — The three primary measures of central tendency are the mean, median, and mode.
4. B — While summarizing the center, central tendency does not provide information about individual values.

Lesson 31: Measures of Dispersion

1. What is the fundamental definition of statistical dispersion in Topic 31?

- A) The single most frequent score in an array
- B) The extent to which numerical data is likely to vary about an average value
- C) The total count of sampling units in a census
- D) The assignment of nominal tags to categories

2. What property of a dataset do measures of dispersion help researchers interpret?

- A) The exact parameters of an infinite population
- B) How homogeneous or heterogeneous the data is
- C) The initial random number seed in software
- D) The probability of selecting a primary survey unit

3. In simple terms, what do measures of dispersion demonstrate regarding a variable?

- A) How squeezed or scattered a variable's values are
- B) Which qualitative category has the largest name label
- C) The cumulative sum of all observation counts
- D) The ratio scale multiplier for unit conversion

4. Why is measuring dispersion critical alongside measuring central tendency?

- A) Because central tendency alone does not show how spread out the scores are around the average

- B) Because dispersion replaces the need for calculating dataset means
- C) Because dispersion converts continuous data into discrete counts
- D) Because measures of dispersion eliminate sampling error

Answer Key

1. B — Dispersion refers to the extent to which numerical data varies about an average value.
2. B — Measures of dispersion help interpret variability, indicating data homogeneity or heterogeneity.
3. A — In simple terms, dispersion shows how squeezed or scattered a variable's values are.
4. A — Dispersion provides essential context on data spread that central tendency metrics omit.

Lesson 32: Mean Deviation, Standard Deviation, Variance & Coefficient of Variation

1. How is the Mean Deviation (or Mean Absolute Deviation) defined?

- A) The arithmetic mean of the absolute deviations of observations from a measure of central tendency
- B) The difference between maximum and minimum values
- C) The square root of the population size
- D) The ratio of median to interquartile range

2. How is the Coefficient of Mean Deviation calculated?

- A) $\text{Coefficient of M.D.} = \frac{\text{Mean Deviation}}{\text{Mean}}$
- B) $\text{Coefficient of M.D.} = \text{Mean Deviation} \times \text{Mean}$
- C) $\text{Coefficient of M.D.} = \frac{\text{Variance}}{\text{Standard Deviation}}$
- D) $\text{Coefficient of M.D.} = \text{Range} - \text{Median}$

3. What is Variance in relation to Standard Deviation?

- A) Variance is the square root of Standard Deviation
- B) Variance is the square of the Standard Deviation
- C) Variance is the absolute value of Mean Deviation
- D) Variance is equal to the Interquartile Range

4. What type of measure is the Coefficient of Variation?

- A) An absolute measure of dispersion
- B) A relative measure of dispersion expressed as a percentage
- C) A non-parametric nominal scale rank
- D) A cumulative frequency distribution curve

Answer Key

1. A — Mean Deviation is the arithmetic mean of absolute deviations from a central tendency.
2. A — The Coefficient of Mean Deviation is computed by dividing Mean Deviation by the Mean.
3. B — Variance is mathematically defined as the square of the Standard Deviation.
4. B — The Coefficient of Variation is a relative measure of dispersion used for comparison.

Lesson 33: Chebychev's Inequality, The Empirical Rule & The Five-Number Summary

1. According to Chebychev's Inequality, for any positive constant $(k > 1)$, what minimum proportion of data falls within (k) standard deviations of the mean?

- A) At least $(1 - \frac{1}{k^2})$
- B) Exactly $(k \times 100\%)$
- C) At most $(\frac{1}{k})$
- D) At least $(1 - k^2)$

2. Under Chebychev's Inequality, what minimum percentage of data must lie within $(k = 2)$ standard deviations of the mean?

- A) At least 50%
- B) At least 68%
- C) At least 75%
- D) At least 95%

3. For a bell-shaped (symmetrical) distribution, what approximate percentage of data lies within 1 standard deviation of the mean according to the Empirical Rule?

- A) Approximately 50%
- B) Approximately 68%
- C) Approximately 95%
- D) Approximately 99.7%

4. What five values constitute the Five-Number Summary?

- A) Minimum, (Q_1) , Median, (Q_3) , and Maximum
- B) Mean, Median, Mode, Variance, and Range
- C) Standard Error, Sample Size, (N) , (p) -value, and (t) -statistic
- D) Class Limit, Class Boundary, Midpoint, Frequency, and Tally

Answer Key

1. A — Chebychev's Inequality states that the probability of falling within (k) standard deviations is at least $(1 - \frac{1}{k^2})$.
2. C — For $(k = 2)$, $(1 - \frac{1}{2^2}) = 1 - 0.25 = 0.75$ or at least 75% of data.
3. B — The Empirical Rule specifies that roughly 68% of data lies within 1 standard deviation in a bell-shaped distribution.
4. A — The Five-Number Summary includes the Minimum, (Q_1) , Median, (Q_3) , and Maximum.

Lesson 34: Box and Whisker Plot, Pearson's Coefficient of Skewness

1. What is the formula for Pearson's Coefficient of Skewness (Modified) using median?

- A) $(\text{Skewness}) = \frac{3(\text{Mean}) - \text{Median}}{s}$
- B) $(\text{Skewness}) = \frac{\text{Mean} - \text{Mode}}{\text{Variance}}$
- C) $(\text{Skewness}) = \frac{Q_3 - Q_1}{\text{Median}}$
- D) $(\text{Skewness}) = \frac{\text{Standard Deviation}}{\text{Mean}}$

2. What does a Pearson's Coefficient of Skewness equal to zero (0) indicate?

- A) The distribution is perfectly symmetric
- B) The distribution is positively skewed
- C) The distribution is negatively skewed
- D) The distribution is U-shaped

3. If the Pearson's Coefficient of Skewness yields a negative value (e.g., -0.55), how is the distribution described?

- A) Symmetric
- B) Positively skewed
- C) Negatively skewed
- D) Exponential

4. In the example regarding children of manual vs. non-manual workers in Topic 34, what skewness result was obtained for manual workers' children?

- A) Positive skewness (+0.55)
- B) Zero coefficient (symmetric)
- C) Negative skewness (-0.55)
- D) Infinite coefficient

Answer Key

1. A — Pearson's Coefficient of Skewness is calculated as $\frac{3(\text{Mean} - \text{Median})}{s}$.
2. A — A skewness coefficient of 0 indicates a symmetrical distribution.
3. C — A negative Pearson's coefficient indicates that the distribution is negatively skewed.
4. B — For manual workers' children, the coefficient was 0, indicating a symmetric age distribution.

Lesson 35: Set Theory, Counting Rules

1. How is a "Set" defined in Topic 35?

- A) Any well-defined collection or list of distinct objects
- B) A continuous line connecting data points on a graph
- C) A sample parameter obtained from non-random sampling
- D) A cumulative percentage of qualitative survey scores

2. What does the term "well-defined" mean in set theory?

- A) Any object must be classified as either belonging or not belonging to the set
- B) Objects must be arranged in numerical ascending order
- C) The collection must contain an infinite number of elements
- D) Every element must be represented by Greek letters

3. What does the term "distinct" imply regarding elements in a set?

- A) Each object must appear only once in the set
- B) Objects must have equal physical measurements
- C) Elements must be gathered using primary questionnaires
- D) All members must be numerical whole numbers

4. How are sets and their elements conventionally denoted in mathematical notation?

- A) Sets by capital letters (A, B, C), elements by small letters (a, b, c)
- B) Sets by Greek letters, elements by Arabic numerals
- C) Sets by lower-case letters, elements by Roman numerals
- D) Sets by subscripts, elements by superscripts

Answer Key

1. A — A set is defined as any well-defined collection or list of distinct objects.

2. A — Well-defined means there is no ambiguity whether an object belongs or does not belong to the set.
3. A — Distinct implies that each element appears only once without duplication.
4. A — Conventionally, sets are denoted by capital letters and their elements by small letters.

Lesson 36: Permutations, Combinations

1. What is a permutation defined as in counting rules?

- A) Any ordered subset from a set of (n) distinct objects
- B) An unordered selection of elements where sequence does not matter
- C) The sum of all elements in a primary survey
- D) A continuous probability density function

2. What primary distinction separates a permutation from a combination?

- A) Order matters in permutations, whereas order does not matter in combinations
- B) Permutations apply to populations, combinations apply only to samples
- C) Permutations use addition, combinations use division
- D) Permutations apply to qualitative data, combinations to quantitative data

3. What visual device is used to enumerate all possible outcomes of two or more sequential events?

- A) A Tree Diagram
- B) A Box Plot
- C) A Scatter Diagram
- D) A Histogram

4. Under the Multiplication Rule of counting, if an operation can be performed in (m) ways and a second in (n) ways, how many total outcomes exist?

- A) $(m + n)$ outcomes
- B) $(m \times n)$ outcomes
- C) (m^n) outcomes
- D) $(\frac{m}{n})$ outcomes

Answer Key

1. A — A permutation is defined as any ordered subset selected from (n) distinct objects.
2. A — The key difference is that arrangement order is essential in permutations but ignored in combinations.
3. A — A tree diagram enumerates all possible outcomes of sequential events along its branches.
4. B — The basic multiplication rule states that sequential independent operations yield $(m \times n)$ total outcomes.

Lesson 37: Definitions of Probability

1. How is an "Event" defined in probability theory?

- A) Any subset of a sample space (S) of a random experiment
- B) A single value of a population parameter
- C) A qualitative scale ranking
- D) The square root of sample variance

2. What distinguishes a simple event from a compound event?

- A) A simple event contains exactly one sample point, while a compound event contains more than one sample point
- B) Simple events use primary data, compound events use secondary data
- C) Simple events are continuous, compound events are discrete
- D) Simple events have zero probability, compound events have 100% probability

3. According to the relative frequency definition, how is the probability of an event determined?

- A) As the proportion in which the event occurs in a very large number of repeated trials
- B) By taking the ratio of standard error to sample size
- C) By assigning equal subjective weights without empirical testing
- D) By calculating the interquartile range of the sample

4. If an experiment has n mutually exclusive, equally likely outcomes and m outcomes are favorable to event A , what is the classical probability $P(A)$?

- A) $P(A) = \frac{m}{n}$
- B) $P(A) = m \times n$
- C) $P(A) = n - m$
- D) $P(A) = \frac{n}{m}$

Answer Key

- 1. A — An event is defined as any subset of the sample space S resulting from a random experiment.
- 2. A — A simple event consists of a single sample point, whereas a compound event combines multiple sample points.
- 3. A — Relative frequency defines probability as the limiting proportion of event occurrences in large repeated trials.
- 4. A — Under classical probability, $P(A) = m/n$ (favorable outcomes divided by total outcomes).

Lesson 38: Application of Addition Theorem, Conditional Probability & Multiplication Theorem

1. According to the Addition Theorem of Probability, if events A and B are mutually exclusive, what is $P(A \text{ or } B)$?

- A) $P(A) + P(B)$
- B) $P(A) \times P(B)$
- C) $P(A) - P(B)$
- D) $\frac{P(A)}{P(B)}$

2. How is the conditional probability $P(B|A)$ of event B given event A calculated?

- A) $P(B|A) = \frac{P(A \cap B)}{P(A)}$ (where $P(A) > 0$)
- B) $P(B|A) = P(A) + P(B)$
- C) $P(B|A) = P(A) \times P(B)$
- D) $P(B|A) = \frac{P(B)}{P(A \cap B)}$

3. If two events A and B are independent, what does the Multiplication Theorem state for $P(A \cap B)$?

- A) $P(A \cap B) = P(A) \times P(B)$
- B) $P(A \cap B) = P(A) + P(B)$
- C) $P(A \cap B) = P(A) - P(B)$
- D) $P(A \cap B) = 0$

4. In the England and Wales birth statistics example (1956), what was the conditional probability of a stillbirth given that the birth was male?

- A) Approximately 0.0233 (or 0.0234)
- B) Exactly 0.5000
- C) Exactly 0.1000
- D) Approximately 0.0010

Answer Key

1. A — For mutually exclusive events, the Addition Theorem states $P(A \cup B) = P(A) + P(B)$.
2. A — Conditional probability is computed as joint probability divided by the probability of the given event: $P(A \cap B)/P(A)$.
3. A — For independent events, joint probability equals the product of individual probabilities: $P(A)P(B)$.
4. A — The conditional probability of a stillbirth among male births in the study was approximately 0.0233.

Lesson 39: Bayes' Theorem, Discrete Random Variable

1. What is the main application of Bayes' Theorem in probability?

- A) To update or revise prior probabilities based on new sample evidence
- B) To calculate the exact range of a continuous variable
- C) To convert ratio measurements into nominal labels
- D) To select a simple random sample using goldfish bowl draws

2. What defines a Discrete Random Variable?

- A) A variable that can assume only distinct, countable whole values with specific assigned probabilities
- B) A variable that can take any value within a continuous real interval
- C) A constant population parameter with zero variance
- D) A qualitative label without numerical meaning

3. In the biological example in Topic 39, if a biologist counts the number of petals on a flower (taking values 3, 4, 5, 6, 7, 8, 9), what type of variable is the petal count?

- A) Discrete random variable
- B) Continuous random variable
- C) Nominal qualitative variable
- D) Systematic sampling interval

4. In the pollutant emission testing example for cars, if 25% of cars emit excessive pollutants, what does this 25% represent in Bayes' theorem?

- A) Prior probability
- B) Posterior probability
- C) Conditional likelihood
- D) Standard error of estimation

Answer Key

1. A — Bayes' Theorem calculates posterior probabilities by incorporating new observational evidence into prior probabilities.
2. A — A discrete random variable assumes distinct, countable values each associated with a probability.
3. A — Flower petal counts (3, 4, 5...) represent a discrete random variable.

4. A — The initial 25% rate of excessive emission cars represents the prior probability before test results.

Lesson 40: Graphical Representation of the Distribution Function of a Discrete Random Variable

1. What type of graphical plot represents the Cumulative Distribution Function (CDF), $F(x)$, of a discrete random variable?

- A) A step function graph (jump graph)
- B) A smooth continuous bell curve
- C) A circular pie chart with slices
- D) A scatter plot with a straight trend line

2. In the CDF graph $F(x) = P(X \leq x)$ of a discrete random variable, what happens to the graph at each possible value of x ?

- A) It makes a vertical jump equal to the probability $P(X = x)$
- B) It drops down to zero
- C) It forms a continuous 45-degree slope
- D) It oscillates symmetrically

3. What is the maximum value that a Cumulative Distribution Function $F(x)$ can reach as x becomes large?

- A) 1.0
- B) 0.5
- C) 100.0
- D) Infinity

4. For a sum obtained from rolling two dice (where sum ranges from 2 to 12), how is $P(X > 9)$ calculated?

- A) $P(X = 10) + P(X = 11) + P(X = 12)$
- B) $P(X = 1) + P(X = 2) + P(X = 3)$
- C) $1 - P(X = 9)$
- D) $P(X = 7) \times P(X = 8)$

Answer Key

1. A — The cumulative distribution function of a discrete variable is visually rendered as a step (jump) function.
2. A — The graph jumps vertically at each point x by an amount equal to the point probability $P(X = x)$.
3. A — As a cumulative probability, $F(x)$ reaches a maximum value of 1.0.
4. A — $P(X > 9)$ is calculated by summing the discrete probabilities for outcomes 10, 11, and 12.

Lesson 41: Properties of Expected Values, Covariance & Correlation & Discrete Probability Distributions

1. What does Chebychev's Inequality state regarding a random variable X with mean μ and variance σ^2 , for any positive constant k ?

- A) The probability that X falls within k standard deviations of μ is at least $1 - \frac{1}{k^2}$
- B) The probability that X falls outside k standard deviations is exactly $\frac{1}{k^2}$
- C) The probability that X falls within k standard deviations is equal to $k \times \sigma$
- D) The probability that X equals μ is at least $1 - k$

2. Which statistical properties are evaluated when analyzing continuous probability distributions in Topic 41?

- A) Mathematical expectation, variance, and moments
- B) Tally marks and stem-and-leaf ranks
- C) Non-probability snowball referrals
- D) Sample size ratio allocations

3. For a discrete probability distribution, how is the probability of a value (X) falling within (k) standard deviations of the mean constrained by Chebychev's inequality?

- A) It is bounded from below by $(1 - \frac{1}{k^2})$
- B) It is bounded from above by zero
- C) It is always equal to (0.50) regardless of (k)
- D) It cannot be calculated for discrete variables

4. Which topics are introduced alongside Chebychev's Inequality in Topic 41?

- A) Concept of Continuous Probability Distribution and mathematical expectation, variance & moments
- B) Simple random sampling without replacement only
- C) Qualitative pie chart angles
- D) Secondary database publications

Answer Key

1. A — Chebychev's inequality specifies that the probability of (X) falling within (k) standard deviations of the mean is at least $(1 - \frac{1}{k^2})$.
2. A — Topic 41 outlines mathematical expectation, variance, and moments for probability distributions.
3. A — Chebychev's inequality provides a lower bound of $(1 - \frac{1}{k^2})$ for probability around the mean.
4. A — Continuous probability distributions, mathematical expectation, variance, and moments are introduced alongside Chebychev's inequality.

Lesson 42: Binomial Distribution, Introduction to the Hypergeometric Distribution

1. What formula calculates the probability of obtaining (x) successes in (n) trials for a binomial distribution with success probability (p) and failure probability (q) ?

- A) $(P(X = x) = \binom{n}{x} p^x q^{n-x})$
- B) $(P(X = x) = \frac{e^{-\mu} \mu^x}{x!})$
- C) $(P(X = x) = \frac{\binom{k}{x} \binom{N-k}{n-x}}{\binom{N}{n}})$
- D) $(P(X = x) = \frac{x}{n})$

2. What two parameters define a Binomial Distribution?

- A) (n) (total number of trials) and (p) (probability of success in each trial)
- B) (μ) (mean) and (σ^2) (variance)
- C) (N) (population size) and (k) (number of successes in population)
- D) (Q_1) (first quartile) and (Q_3) (third quartile)

3. How many distinct values can the random variable (X) assume in a binomial experiment with $(n = 5)$ coin tosses?

- A) 6 values $(0, 1, 2, 3, 4, 5)$
- B) 5 values $(1, 2, 3, 4, 5)$

- C) 2 values ($\{0\}$ and $\{1\}$)
- D) Infinite values

4. What three parameters characterize the Hypergeometric Distribution introduced in Topic 42?

- A) $\{N\}$ (population units), $\{n\}$ (sample units), and $\{k\}$ (population successes)
- B) $\{n\}$ (sample size), $\{p\}$ (success rate), and $\{q\}$ (failure rate)
- C) $\{\mu\}$ (mean), $\{\sigma\}$ (standard deviation), and $\{s\}$ (sample variance)
- D) $\{a\}$ (minimum), $\{b\}$ (maximum), and $\{h\}$ (class height)

Answer Key

1. A — The binomial probability formula is $P(X=x) = \binom{n}{x} p^x q^{n-x}$ where $q = 1 - p$.
2. A — The binomial distribution is defined by parameters $\{n\}$ and $\{p\}$.
3. A — In 5 tosses, $\{X\}$ can take 6 possible values: $\{0, 1, 2, 3, 4, 5\}$.
4. A — The hypergeometric distribution is characterized by parameters $\{N\}$, $\{n\}$, and $\{k\}$.

Lesson 43: Hypergeometric Distribution, Poisson Distribution & Continuous Uniform Distribution

1. Under what sampling condition is the Hypergeometric Probability Distribution appropriate?

- A) When a random sample of size $\{n\}$ is drawn WITHOUT REPLACEMENT from a finite population of $\{N\}$ units
- B) When sampling is conducted WITH REPLACEMENT from an infinite population
- C) When success probability $\{p\}$ remains constant across independent trials
- D) When participants are recruited via snowball referrals

2. Under what conditions does the Poisson Distribution arise as a limiting approximation to the Binomial Distribution?

- A) When $\{p\}$ is very small and $\{n\}$ is so large that $\{np = \mu\}$ is of moderate size
- B) When $\{p = 0.50\}$ and $\{n = 1\}$
- C) When sampling without replacement from a small population of 10 items
- D) When $\{n\}$ is less than 5 percent of $\{N\}$

3. What unique property holds for the mean $\{E(X)\}$ and variance $\{Var(X)\}$ of a Poisson Distribution?

- A) Mean is equal to variance ($\{E(X) = Var(X) = \mu\}$)
- B) Variance is always double the mean
- C) Mean is always equal to zero
- D) Variance is equal to $\{n \times p \times q\}$

4. What is true regarding the shape of the Poisson Distribution compared to the Binomial Distribution?

- A) The Poisson distribution is positively skewed and can never be negatively skewed
- B) The Poisson distribution is always symmetric regardless of $\{\mu\}$
- C) The Poisson distribution is negatively skewed for small $\{\mu\}$
- D) The Poisson distribution has a U-shaped frequency curve

Answer Key

1. A — The hypergeometric distribution applies when sampling without replacement from a finite population.

2. A — The Poisson distribution approximates the binomial when (p) is very small and (n) is large such that $(np = \mu)$.
3. A — For a Poisson distribution, the mean and variance are equal $(E(X) = \text{Var}(X) = \mu)$.
4. A — The Poisson distribution is positively skewed and can never be negatively skewed.

Lesson 44: Appropriate Use of Measures of Location

1. What is the primary purpose of measures of location in descriptive statistics?

- A) To summarize a list of numbers by a "typical" value
- B) To measure the total spread between extreme scores
- C) To calculate the probability of stillbirths
- D) To select clusters of city blocks

2. Which measure of location has the smallest possible sum of squared differences from members of the list?

- A) Mean
- B) Median
- C) Mode
- D) Range

3. How is the Median defined in terms of its mathematical optimization property?

- A) It has the smallest possible sum of absolute differences from members of the list
- B) It maximizes the sum of squared errors
- C) It represents the value with the highest tally frequency
- D) It equals the ratio of standard deviation to mean

4. What defines the Mode of a dataset?

- A) The most frequently occurring value(s) in a dataset
- B) The exact center value in a sorted list
- C) The arithmetic sum divided by sample size (n)
- D) The upper 75th percentile cut point

Answer Key

1. A — Measures of location summarize a list of numbers by a "typical" value.
2. A — The mean is the average value and has the smallest possible sum of squared differences.
3. A — The median minimizes the sum of absolute differences from dataset values.
4. A — The mode is defined as the most frequently occurring value(s) in a dataset.

Lesson 45: Quantiles (Cut Points)

1. From which word does the term "quantile" originate, and what is its simple definition?

- A) From "quantity"; it is where a sample is divided into equal-sized, adjacent subgroups
- B) From "quality"; it classifies nominal categories into names
- C) From "equation"; it solves linear regression parameters
- D) From "quota"; it selects convenience sample subjects

2. By what alternative name are quantiles sometimes called?

- A) Fractiles

- B) Parameters
- C) Estimators
- D) Deviations

3. What do the first, second, and third quartiles, together with the median, achieve regarding the total area?

- A) Division of the total area into four equal parts
- B) Division of the distribution into ten equal parts
- C) Division of the dataset into two unequal halves
- D) Calculation of absolute standard errors

4. Which quartile is mathematically identical to the Median?

- A) Second Quartile ((Q_2))
- B) First Quartile ((Q_1))
- C) Third Quartile ((Q_3))
- D) Interquartile Range ((IQR))

Answer Key

1. A — Quartile comes from "quantity" and divides a sample into equal-sized adjacent subgroups.
2. A — Quartiles are sometimes referred to as fractiles.
3. A — Quartiles and the median divide the total distribution area into four equal parts.
4. A — The second quartile ((Q_2)) is identical to the median.

Lesson 46: Examples of Quantiles

1. When finding quartiles from raw data, what is the mandatory first step before applying position formulas?

- A) Arrange the data values in ascending order of magnitude
- B) Calculate the sample standard deviation
- C) Construct a pie chart
- D) Subtract the minimum value from the maximum value

2. For a raw dataset of (n) ordered values, what position formula yields the lower quartile (Q_1) ?

- A) The $\frac{1}{4}(n+1)$ -th value
- B) The $\frac{1}{2}(n+1)$ -th value
- C) The $\frac{3}{4}(n+1)$ -th value
- D) The $(n-1)$ -th value

3. If a raw dataset contains $(n = 9)$ scores, which ordered position represents the Median (Q_2) ?

- A) 5th value ($(\frac{9+1}{2} = 5)$)
- B) 2.5th value
- C) 7.5th value
- D) 9th value

4. In grouped frequency tables, what formula is used to compute (Q_1) ?

- A) $Q_1 = l + \frac{h}{f} \left(\frac{n}{4} - c \right)$
- B) $Q_1 = l + \frac{h}{f} \left(\frac{n}{2} - c \right)$

- C) $Q_1 = \bar{X} - 1.5 S$
 D) $Q_1 = \frac{Q_3 - Q_2}{2}$

Answer Key

1. A — The first step for raw data is arranging data values in ascending order of magnitude.
2. A — The lower quartile (Q_1) is determined by the $\frac{1}{4}(n+1)$ -th value.
3. A — For $(n=9)$, the median position is the 5th value ($\frac{9+1}{2} = 5$).
4. A — For grouped data, $Q_1 = l + \frac{h}{f}(\frac{n}{4} - c)$.

Lesson 47: Measures of Dispersion

1. How is statistical dispersion defined in Topic 47?

- A) The degree to which numerical data are dispersed or squished around an average value
 B) The most frequently occurring score in a sample
 C) The probability that an estimator equals a parameter
 D) The number of rows in a contingency table

2. What does a dataset with values "0, 30, 60, 90, 120" illustrate compared to "1, 2, 2, 3, 3, 4, 4"?

- A) Widely dispersed data versus densely grouped data
 B) Qualitative nominal data versus quantitative ratio data
 C) Secondary census data versus primary survey data
 D) Symmetric normal data versus negatively skewed data

3. Why is measuring dispersion necessary in addition to measuring central tendency?

- A) Central tendency alone does not indicate how tightly or broadly data points cluster around the center
 B) Central tendency cannot be computed without knowing variance
 C) Dispersion eliminates all measurement errors
 D) Measures of dispersion convert continuous variables into discrete counts

4. What physical concept does "dispersion" refer to in general terms?

- A) The distribution of objects over a region
 B) The height of a histogram bar
 C) The number of trials in a Bernoulli experiment
 D) The square root of sample size $\sqrt{n}$

Answer Key

1. A — Dispersion is the degree to which numerical data are dispersed or squished around an average.
2. A — Topic 47 contrasts widely dispersed data with densely grouped data using these examples.
3. A — Dispersion reveals data spread, providing essential context that central tendency alone omits.
4. A — In general terms, dispersion refers to the distribution of objects over a region.

Lesson 48: Absolute Measures of Dispersion

1. What defines an "Absolute Measure of Dispersion"?

- A) A measure expressed in the same physical units as the original observations
 B) A dimensionless ratio expressed as a percentage
 C) A measure that is always equal to zero
 D) A qualitative category label

2. Which of the following is categorized as an absolute measure of dispersion?

- A) Range, Quartile Deviation, Mean Deviation, and Standard Deviation
- B) Coefficient of Variation and Coefficient of Skewness
- C) Relative frequency and percentage frequency
- D) Pearson's r and Multiple correlation coefficient

3. How is the Mean Deviation (or Mean Absolute Deviation) defined in Topic 48?

- A) The arithmetic mean of the absolute deviations of observations from a measure of central tendency
- B) The difference between (Q_3) and (Q_1) divided by median
- C) The ratio of standard deviation to mean
- D) The maximum observation divided by sample size (n)

4. How does Quartile Deviation (Semi-Interquartile Range) relate to (Q_1) and (Q_3) ?

- A) $(\text{Quartile Deviation}) = \frac{Q_3 - Q_1}{2}$
- B) $(\text{Quartile Deviation}) = Q_3 + Q_1$
- C) $(\text{Quartile Deviation}) = \frac{Q_1}{Q_3}$
- D) $(\text{Quartile Deviation}) = Q_3 \times Q_1$

Answer Key

1. A — Absolute measures of dispersion are measured in the same units as the original data.
2. A — Range, Quartile Deviation, Mean Deviation, and Standard Deviation are absolute measures.
3. A — Mean deviation is the arithmetic mean of absolute deviations from a central tendency measure.
4. A — Quartile deviation (semi-IQR) is half the interquartile range: $(\frac{Q_3 - Q_1}{2})$.

Lesson 49: Examples for Absolute Measures of Dispersion**1. How is the Range calculated in numerical examples?**

- A) $(\text{Range}) = \text{Maximum Value} - \text{Minimum Value}$
- B) $(\text{Range}) = \text{Mean} \div \text{Standard Deviation}$
- C) $(\text{Range}) = Q_3 + Q_1$
- D) $(\text{Range}) = \sqrt{\text{Variance}}$

2. What information does the Range provide about a data series?

- A) A good indication of how dispersed the data is between its extreme values
- B) The exact probability distribution of all middle observations
- C) The degree of kurtosis in the distribution tails
- D) The conditional likelihood of an event

3. What is the formula for the Interquartile Range (IQR)?

- A) $(\text{IQR}) = Q_3 - Q_1$
- B) $(\text{IQR}) = Q_3 + Q_1$
- C) $(\text{IQR}) = \frac{\sum X}{S}$
- D) $(\text{IQR}) = \text{Max} - \text{Min}$

4. In calculating sample standard deviation (S) , what denominator is used for (n) sample observations?

- A) $(n - 1)$
- B) $(n + 1)$
- C) (N)

D) $\sqrt{n^2}$

Answer Key

1. A — Range is the difference between the maximum and minimum values in a series.
2. A — The range gives a good indication of data dispersion between extreme values.
3. A — Interquartile Range is computed as $(Q_3 - Q_1)$.
4. A — Sample standard deviation (S) uses $(n-1)$ in the denominator.

Lesson 50: Relative Measures of Dispersion

1. What is the key characteristic of a Relative Measure of Dispersion?

- A) It is dimensionless (pure number or percentage) and independent of units of measurement
- B) It is measured in squared units of the original data
- C) It can only be applied to nominal qualitative variables
- D) It is always larger than the total population size (N)

2. Why are relative measures of dispersion preferred when comparing two or more datasets?

- A) They allow fair comparison between datasets with different units or widely different means
- B) They eliminate the need for sample sizes greater than 1
- C) They replace inferential hypothesis testing
- D) They are easier to plot on pie charts

3. How is the Coefficient of Variation (CV) defined?

- A) $CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100\%$
- B) $CV = \frac{\text{Mean}}{\text{Standard Deviation}} \times 100\%$
- C) $CV = \frac{\text{Range}}{\text{Median}}$
- D) $CV = (Q_3 - Q_1) \times \bar{X}$

4. How is the Coefficient of Quartile Deviation calculated?

- A) $\frac{Q_3 - Q_1}{Q_3 + Q_1}$
- B) $\frac{Q_3 + Q_1}{Q_3 - Q_1}$
- C) $\frac{Q_3 - Q_1}{2}$
- D) $\frac{Q_2}{Q_3 - Q_1}$

Answer Key

1. A — Relative measures of dispersion are unitless coefficients used for comparative analysis.
2. A — They enable comparison of variability across datasets measured in different units or scale magnitudes.
3. A — Coefficient of Variation is $CV = \frac{S}{\bar{X}} \times 100\%$.
4. A — Coefficient of Quartile Deviation is computed as $\frac{Q_3 - Q_1}{Q_3 + Q_1}$.

Lesson 51: Examples of Measures of Dispersion

1. If a dataset has a Mean Deviation of (2.684) and a Mean of (9.3) , what is its Coefficient of Mean Deviation?

- A) (0.288) $(\frac{2.684}{9.3} \approx 0.288)$
- B) (3.465)
- C) (24.96)
- D) (1.000)

2. When comparing two stock investments or biological groups using (CV) , which group is considered more consistent (less variable)?

- A) The group with the smaller Coefficient of Variation
- B) The group with the larger Coefficient of Variation
- C) The group with the smaller sample size
- D) The group with a negative mean

3. In numerical step-by-step calculations of dispersion, what column is created after finding deviations to compute standard deviation?

- A) Squared deviations $((x - \bar{X})^2)$
- B) Logarithmic values $(\log(x))$
- C) Cumulative percentages
- D) Class midpoints

4. If Series A has $(CV = 15\%)$ and Series B has $(CV = 25\%)$, what can be concluded regarding variability?

- A) Series A is less variable (more stable) than Series B
- B) Series B is less variable than Series A
- C) Both series have identical absolute standard deviations
- D) Series A has a higher maximum score than Series B

Answer Key

1. A — $(\text{Coefficient of M.D.}) = \frac{\text{M.D.}}{\text{Mean}} = \frac{2.684}{9.3} = 0.288$.
2. A — A lower Coefficient of Variation indicates less relative variability and greater consistency.
3. A — Computing variance/SD requires constructing a column of squared deviations $((x - \bar{X})^2)$.
4. A — A smaller (CV) (15% vs 25%) signifies lower relative dispersion and greater stability.

Lesson 52: Appropriate Usage of the Measures of Dispersion

1. Why is measuring the spread of data values important regarding measures of central tendency?

- A) It indicates how well a central measure (like the mean) represents the dataset
- B) It proves whether data was gathered from primary or secondary sources
- C) It converts qualitative ordinal ranks into interval scale temperatures
- D) It eliminates the requirement for representative sampling

2. What does a large spread of data values signify regarding individual scores?

- A) There are probably large differences between individual scores, making the mean less representative
- B) Individual scores are virtually identical
- C) The sample size (n) is equal to population size (N)
- D) The distribution is perfectly symmetrical with zero variance

3. In scientific research, why is little variation within a data group generally viewed positively?

- A) It indicates that subjects in the group are similar to one another
- B) It proves that the experiment had zero measurement cost
- C) It guarantees that the dataset is non-randomly selected
- D) It means the mean is completely unrepresentative

4. If data values are tightly clustered around the mean (small spread), what can be inferred about the mean?

- A) The mean is highly representative of the dataset
- B) The mean is misleading and unusable
- C) The mean equals the population size $\sqrt{N}$
- D) The mean cannot be calculated

Answer Key

1. A — A measure of spread shows how well a central tendency metric represents the data.
2. A — Large spread indicates substantial individual score differences, reducing mean representativeness.
3. A — Little variation indicates that group subjects are similar, which strengthens research conclusions.
4. A — Small spread means data points lie close to the average, making the mean highly representative.

Lesson 53: Calculating Skewness and Making Decisions Using Numerical Measures

1. What does Skewness measure in a frequency distribution?

- A) The asymmetry or lack of symmetry of a distribution
- B) The heaviness of distribution tails
- C) The total number of sample observations
- D) The ratio of variance to standard error

2. In a dataset where $\text{Mean} = 2.2$, $S = 1.0408$, and $\frac{\sum(x - \bar{X})^3}{[(n-1)S^3]} = +0.0443$, how is the distribution classified?

- A) Slightly positively skewed (nearly symmetric)
- B) Heavily negatively skewed
- C) Symmetrical with zero variance
- D) U-shaped continuous curve

3. What relationship between Mean, Median, and Mode holds for a positively skewed distribution?

- A) $\text{Mean} > \text{Median} > \text{Mode}$
- B) $\text{Mean} < \text{Median} < \text{Mode}$
- C) $\text{Mean} = \text{Median} = \text{Mode}$
- D) $\text{Mode} > \text{Mean} > \text{Median}$

4. If Pearson's modified coefficient of skewness is calculated as $Sk = \frac{3(\bar{X} - \text{Median})}{S}$, what result indicates a negatively skewed distribution?

- A) A negative numerical value ($Sk < 0$)
- B) A value of zero ($Sk = 0$)
- C) A positive numerical value ($Sk > 0$)
- D) An undefined infinite value

Answer Key

1. A — Skewness essentially measures the symmetry or asymmetry of a distribution.
2. A — A skewness value of $+0.0443$ indicates slight positive skewness.

3. A — In positively skewed distributions, the mean is pulled right towards the tail ($\text{Mean} > \text{Median} > \text{Mode}$).
4. A — A negative skewness coefficient ($Sk < 0$) indicates a left-skewed (negatively skewed) distribution.

Lesson 54: Calculating Kurtosis and Making Decisions Using Numerical Measures

1. How is Kurtosis defined in Topic 54?

- A) A statistical measure that defines how heavily the tails of a distribution differ from the tails of a normal distribution
- B) A measure of central tendency locating the middle score
- C) The difference between Q_3 and Q_1 divided by 2
- D) The count of favorable outcomes divided by total outcomes

2. What key distinction separates Skewness from Kurtosis?

- A) Skewness measures symmetry, while kurtosis determines tail heaviness (presence of extreme values)
- B) Skewness applies to sample statistics, while kurtosis applies only to parameters
- C) Skewness is measured in inches, while kurtosis is measured in kilograms
- D) Skewness uses Greek letters, while kurtosis uses Arabic numerals

3. How is Excess Kurtosis mathematically calculated?

- A) $\text{Excess Kurtosis} = \text{Kurtosis} - 3$
- B) $\text{Excess Kurtosis} = \text{Kurtosis} + 3$
- C) $\text{Excess Kurtosis} = \text{Kurtosis} \times 3$
- D) $\text{Excess Kurtosis} = \frac{\text{Kurtosis}}{3}$

4. In the numerical example provided in Topic 54, if sample kurtosis is calculated as 2.4057, what is the corresponding excess kurtosis?

- A) -0.5943 ($2.4057 - 3 = -0.5943$)
- B) +5.4057
- C) +0.4057
- D) +7.2171

Answer Key

1. A — Kurtosis identifies whether distribution tails contain extreme values relative to a normal curve.
2. A — Skewness measures distribution symmetry; kurtosis determines tail heaviness.
3. A — Excess Kurtosis is defined as $\text{Kurtosis} - 3$.
4. A — With kurtosis (= 2.4057), excess kurtosis is $2.4057 - 3 = -0.5943$.

Lesson 55: Counting Rules

1. According to the Multiplicative Rule of counting, if you have j sets of elements with $n_1, n_2, \dots, n_j$ elements respectively, how many possible sample sets can be formed by taking one element from each set?

- A) $n_1 \times n_2 \times \dots \times n_j$
- B) $n_1 + n_2 + \dots + n_j$
- C) $\frac{n_1 + n_2}{j}$

D) $\binom{n-1}{n-j}$

2. On what do the number of possible outcomes depend when selecting elements of a set?

- A) The conditions under which the selection has taken place
- B) The standard deviation of the population
- C) The level of significance ($\alpha = 0.05$)
- D) The mean deviation of the central scores

3. How many primary counting rules for determining possible outcomes are explicitly highlighted in Topic 55?

- A) At least 4 rules
- B) Exactly 100 rules
- C) Only 1 rule
- D) Zero rules

4. If Set 1 contains 3 elements and Set 2 contains 4 elements, how many unique pairs can be formed by the multiplicative rule?

- A) 12 ($3 \times 4 = 12$)
- B) 7 ($3 + 4 = 7$)
- C) 1 ($4 - 3 = 1$)
- D) 64 ($4^3 = 64$)

Answer Key

1. A — The multiplicative rule defines total possible sample sets as $n_1 \times n_2 \times \dots \times n_j$.
2. A — The number of outcomes depends directly on selection conditions.
3. A — Topic 55 explicitly notes that there are at least 4 rules to count possible outcomes.
4. A — By the multiplicative rule, $3 \times 4 = 12$ unique pairs can be formed.

Lesson 56: Permutations

1. How is a permutation defined in probability and counting rules?

- A) Any subset of r objects selected without regard to their order
- B) Any ordered subset selected from a set of n distinct objects
- C) A collection of continuous random variables with zero variance
- D) A non-probability sample drawn from an infinite population

2. What mathematical formula calculates the number of permutations (${}_nP_r$) of r objects selected in definite order from n distinct objects?

- A) ${}_nP_r = \frac{n!}{(n-r)!}$
- B) ${}_nP_r = \frac{n!}{r!(n-r)!}$
- C) ${}_nP_r = n \times r!$
- D) ${}_nP_r = \frac{r!}{(n-r)!}$

3. When calculating permutations for a set containing repeated or identical elements, what formula determines the total number of distinct arrangements?

- A) $P = \frac{n!}{n_1! n_2! \dots n_k!}$
- B) $P = n! \times (n_1! + n_2!)$
- C) $P = \frac{(n-1)!}{r!}$
- D) $P = n^k$

4. According to the example in Topic 56, how many distinct permutations can be formed from the 9-letter word "committee" (which contains 1 c, 1 o, 2 m's, 1 i, 2 t's, and 2 e's)?

- A) 45,360
- B) 362,880
- C) 15,120
- D) 5,040

Answer Key

1. B — A permutation is defined as any ordered subset selected from a set of (n) distinct objects.
2. A — The number of permutations of (r) objects selected from (n) distinct objects is given by $(nP_r = \frac{n!}{(n-r)!})$.
3. A — For sets with identical groups of items, the permutation formula is $(P = \frac{n!}{n_1! n_2! \dots n_k!})$.
4. A — For the word "committee", evaluating $(\frac{9!}{1!1!2!1!2!2!})$ yields exactly $(45,360)$ distinct permutations.

Lesson 57: Combinations

1. What is the defining characteristic of a combination compared to a permutation?

- A) Combinations select subsets without regard to the order of objects
- B) Combinations require objects to be arranged in a strict linear sequence
- C) Combinations apply exclusively to continuous ratio variables
- D) Combinations always yield a larger numerical result than permutations

2. What formula computes the total number of combinations (nC_r) or $(\binom{n}{r})$ of (r) objects chosen from (n) distinct objects?

- A) $(\binom{n}{r} = \frac{n!}{r!(n-r)!})$
- B) $(\binom{n}{r} = \frac{n!}{(n-r)!})$
- C) $(\binom{n}{r} = \frac{r!}{n!(n-r)!})$
- D) $(\binom{n}{r} = n! \times r!)$

3. How is a combination (nC_r) mathematically related to a permutation (nP_r) ?

- A) $(nP_r = r! \times nC_r)$
- B) $(nC_r = r! \times nP_r)$
- C) $(nP_r = nC_r + r!)$
- D) $(nC_r = \frac{nP_r}{n!})$

4. In the card hand example in Topic 57, how many distinct 5-card hands can be chosen from a standard deck of 52 cards?

- A) 2,598,960
- B) 311,875,200
- C) 120
- D) 52,000

Answer Key

1. A — A combination is defined as any subset of (r) objects selected without regard to their order from (n) distinct objects.
2. A — The combination formula is $(\binom{n}{r} = \frac{n!}{r!(n-r)!})$.
3. A — The source specifies that $(nP_r = r! \times \binom{n}{r})$ or $(\binom{n}{r} = \frac{nP_r}{r!})$.

4. A — Choosing 5 cards from 52 yields $\binom{52}{5} = \frac{52 \times 51 \times 50 \times 49 \times 48}{5 \times 4 \times 3 \times 2 \times 1} = 2,598,960$ ways.

Lesson 58: Bernoulli Distribution

1. What is a Bernoulli Distribution?

- A) A discrete probability distribution for a random experiment with only two possible outcomes ("Success" or "Failure")
- B) A continuous probability distribution used for bell-shaped height curves
- C) A distribution that divides sample observations into four equal quartiles
- D) A non-parametric ranking procedure for ordinal survey data

2. In a Bernoulli trial with success probability (p) , how is the probability of failure (q) expressed?

- A) $(1 - p)$
- B) (p^2)
- C) $(\frac{1}{p})$
- D) $(1 + p)$

3. How does a Bernoulli distribution relate to a Binomial distribution?

- A) It is a special case of the binomial distribution for a single trial $(n = 1)$
- B) It is a limiting form of the binomial distribution when (n) approaches infinity
- C) It requires sampling without replacement from a finite population
- D) It measures continuous time intervals between rare Poisson events

4. What is the probability function $(P(n))$ for a Bernoulli random variable where $(n = 1)$ denotes success and $(n = 0)$ denotes failure?

- A) $(P(1) = p)$ and $(P(0) = 1 - p)$
- B) $(P(1) = 0.5)$ and $(P(0) = 0.5)$ for all trials
- C) $(P(n) = \frac{p}{1 - p})$
- D) $(P(n) = e^{-p} p^n)$

Answer Key

1. A — A Bernoulli distribution is a discrete probability distribution for a random trial with only two outcomes (Success/Failure).
2. A — The probability of failure is defined as $(1 - P)$ (where (P) is success probability).
3. A — The Bernoulli distribution is a binomial distribution with $(n = 1)$ single trial.
4. A — The probability mass function assigns (p) to $(n = 1)$ (success) and $(1 - p)$ to $(n = 0)$ (failure).

Lesson 59: Bernoulli Trials and Bernoulli Distribution

1. What defines a Bernoulli Trial?

- A) An experiment where you can have one of two possible outcomes (e.g., "Yes/No", "Heads/Tails")
- B) An experiment resulting in a continuous range of temperature measurements
- C) A survey method where participants refer their acquaintances
- D) A calculation of the median and interquartile range from grouped data

2. Which of the following is explicitly listed in Topic 59 as a real-world example of a Bernoulli trial?

- A) Coin tosses recording heads vs. tails, or recording boy vs. girl births
- B) Measuring the exact mileage rating of 30 test cars
- C) Tabulating five-number summaries on box plots
- D) Computing Pearson's coefficient of skewness for manual workers

3. What fundamental assumption must hold when conducting repeated Bernoulli trials?

- A) Each trial must be independent with a constant probability of success
- B) Trials must be conducted without replacement from a small population
- C) The sample size $\sqrt{n}$ must equal the total population size $\sqrt{N}$
- D) The outcomes must follow a U-shaped frequency curve

4. In a Bernoulli trial represented graphically, what do the two discrete bars on the horizontal axis ($\sqrt{n = 0}$) and ($\sqrt{n = 1}$) represent?

- A) $\sqrt{0}$ represents Failure ($\sqrt{1 - p}$) and $\sqrt{1}$ represents Success ($\sqrt{p}$)
- B) $\sqrt{0}$ represents the population mean and $\sqrt{1}$ represents the sample variance
- C) $\sqrt{0}$ represents the lower quartile and $\sqrt{1}$ represents the upper quartile
- D) $\sqrt{0}$ represents primary data and $\sqrt{1}$ represents secondary data

Answer Key

1. A — A Bernoulli trial is a simple experiment with one of two possible outcomes.
2. A — Topic 59 explicitly lists coin tosses (heads/tails) and births (boy/girl) as Bernoulli trials.
3. A — Repeated Bernoulli trials require independent outcomes with constant success probability across trials.
4. A — On the Bernoulli probability bar chart, $\sqrt{n = 0}$ corresponds to failure ($\sqrt{1 - p}$) and $\sqrt{n = 1}$ corresponds to success ($\sqrt{p}$).

Lesson 60: Standard Error

1. What is the Standard Error (SE) in statistics?

- A) The standard deviation of the sampling distribution of a statistic or parameter estimate
- B) The difference between the maximum and minimum values in a sample
- C) The probability of making a Type I error in a t-test
- D) The ratio of the upper quartile to the lower quartile

2. What formula computes the Standard Error of the Sample Mean ($\sqrt{SE_{\bar{x}}}$) or SEM)?

- A) $\sqrt{SE_{\bar{x}}} = \frac{S}{\sqrt{n}}$
- B) $\sqrt{SE_{\bar{x}}} = S \times \sqrt{n}$
- C) $\sqrt{SE_{\bar{x}}} = \frac{S^2}{n}$
- D) $\sqrt{SE_{\bar{x}}} = \frac{\bar{x}}{S}$

3. What does the Standard Error measure regarding a sample estimate?

- A) The variability and accuracy with which a sample statistic describes a population parameter
- B) The total percentage of qualitative nominal categories
- C) The exact census count of all observation units
- D) The skewness direction of a histogram peak

4. How does increasing the sample size ($\sqrt{n}$) affect the Standard Error of the mean?

- A) Standard Error decreases as sample size increases
- B) Standard Error increases proportionally with sample size
- C) Standard Error remains completely unchanged

D) Standard Error becomes equal to the population variance

Answer Key

1. A — Standard error is defined as the standard deviation of a statistic's sampling distribution.
2. A — The standard error of the sample mean formula is $(SE_{\{\bar{x}\}} = \frac{S}{\sqrt{n}})$.
3. A — The SE formula identifies the accuracy and deviation of a sample statistic relative to the population.
4. A — Because (n) is in the denominator $(\sqrt{n})$, increasing sample size reduces the standard error.

Lesson 61: Sampling Distribution of the Sample Mean

1. What is the Sampling Distribution of the Sample Mean?

- A) The probability distribution of all possible sample means obtained from repeated random samples of size (n) drawn from a population
- B) A single frequency table of raw primary survey scores
- C) The percentage distribution of qualitative nominal categories
- D) The ratio of population size (N) to sample size (n)

2. In the rowing team example (4 rowers weighing 152, 156, 160, and 164 lbs), how many total samples of size $(n = 2)$ can be drawn WITH REPLACEMENT?

- A) 16 samples $(4^2 = 16)$
- B) 6 samples
- C) 8 samples
- D) 4 samples

3. How are the individual entries of a sampling distribution of the sample mean constructed?

- A) By listing all possible samples of size (n) , calculating the mean $(\bar{x})$ for each, and determining their probabilities
- B) By calculating the range between maximum and minimum population scores
- C) By taking a 100% census count of the population
- D) By arranging qualitative labels in alphabetical order

4. If all possible samples of size (n) are drawn with replacement from a population, what shape does the sampling distribution of the sample mean tend toward as sample size grows?

- A) A symmetrical bell-shaped distribution centered at the population mean
- B) A heavily negatively skewed step function
- C) A completely flat uniform line with zero height
- D) A U-shaped distribution with extreme peaks at the ends

Answer Key

1. A — The sampling distribution of the sample mean is the probability distribution of sample means from all possible samples of size (n) .
2. A — Drawing samples of size $(n = 2)$ with replacement from $(N = 4)$ yields $(4 \times 4 = 16)$ possible sample pairs.
3. A — Topic 61 demonstrates finding every sample pair, computing its sample mean $(\bar{x})$, and constructing its probability table.
4. A — The distribution of sample means clusters symmetrically around the population mean.

Lesson 62: Expected Value and Variance of the Sampling Distribution of the Sample Mean

- What is the expected value of the sample mean ($\mu_{\bar{x}}$) or $(E(\bar{x}))$ equal to?
 - It is always equal to the population mean (μ) ($\mu_{\bar{x}} = \mu$)
 - It is equal to the sample standard deviation divided by (n)
 - It is always equal to zero
 - It is equal to the sample size (n) multiplied by population variance (σ^2)
- For sampling WITH REPLACEMENT, what formula gives the variance of the sampling distribution of the sample mean ($\sigma_{\bar{x}}^2$)?
 - $\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$
 - $\sigma_{\bar{x}}^2 = \sigma^2 \times n$
 - $\sigma_{\bar{x}}^2 = \frac{\sigma}{\sqrt{n}}$
 - $\sigma_{\bar{x}}^2 = \sigma^2 - n$
- In the rowing team example ($N = 4, n = 2$), weights 152, 156, 160, 164 lbs), what was the calculated mean ($\mu_{\bar{x}}$) and standard deviation ($\sigma_{\bar{x}}$) of the sample mean?
 - $\mu_{\bar{x}} = 158$ and $\sigma_{\bar{x}} = \sqrt{10} \approx 3.16$
 - $\mu_{\bar{x}} = 160$ and $\sigma_{\bar{x}} = 5.00$
 - $\mu_{\bar{x}} = 152$ and $\sigma_{\bar{x}} = 10.00$
 - $\mu_{\bar{x}} = 158$ and $\sigma_{\bar{x}} = 1.00$
- What term is given to the standard deviation of the sampling distribution of the sample mean ($\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$)?
 - Standard Error of the Mean
 - Mean Absolute Deviation
 - Coefficient of Variation
 - Interquartile Range

Answer Key

- A — The expected value of the sampling distribution of the sample mean ($\mu_{\bar{x}}$) equals the population mean (μ).
- A — For sampling with replacement, the variance of the sample mean is $\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$.
- A — In the worked example, $\mu_{\bar{x}} = 158$ and standard deviation $\sigma_{\bar{x}} = \sqrt{10} \approx 3.16$.
- A — The standard deviation of the sample mean distribution is called the Standard Error.

Lesson 63: Estimation

- How is statistical estimation defined in Topic 63?
 - The process by which one makes inferences about a population based on information obtained from a sample
 - The manual tallying of frequency counts in a categorical survey
 - The exact measurement of all entities in a national census
 - The plotting of scatter diagrams to check linearity

2. Into which two primary categories is statistical estimation divided?

- A) Point Estimation and Interval Estimation
- B) Primary Estimation and Secondary Estimation
- C) Discrete Estimation and Continuous Estimation
- D) Symmetrical Estimation and Skewed Estimation

3. What role does a sample statistic play in the estimation process?

- A) It serves as the point estimator used to infer the unknown population parameter
- B) It replaces the need for collecting any sample data
- C) It guarantees 100% certainty with zero margin of error
- D) It converts ratio scales into nominal categories

4. What is an estimator?

- A) A rule or formula used to calculate an estimate of a population parameter based on sample data
- B) The total number of sampling units in a population
- C) The upper boundary of a grouped frequency class
- D) A non-probability snowball referral contact

Answer Key

1. A — Estimation refers to making statistical inferences about a population using sample information.
2. A — Estimation is broadly divided into Point Estimation and Interval Estimation.
3. A — Sample statistics serve as estimators to infer unknown population parameters.
4. A — An estimator is a rule/function applied to sample observations to estimate a parameter.

Lesson 64: Point Estimation**1. What is Point Estimation?**

- A) Calculating a single numerical value from sample data to serve as the best estimate of a population parameter
- B) Constructing a range of values with an associated confidence percentage
- C) Counting the total number of qualitative categories in a frequency table
- D) Drawing a box and whisker plot to locate outliers

2. What is the distinction between a point estimator and a point estimate?

- A) An estimator is the sample statistic formula (e.g., $\bar{x}$), while an estimate is the specific calculated numerical value
- B) An estimator applies to populations, while an estimate applies only to infinite samples
- C) An estimator is expressed as a percentage, while an estimate is expressed in squared units
- D) An estimator uses Greek letters, while an estimate uses Roman numerals

3. Which sample statistic is commonly used as a point estimator for the population mean (μ)?

- A) Sample mean ($\bar{x}$)
- B) Sample range
- C) Coefficient of variation
- D) Interquartile range (IQR)

4. In the pre-term baby weight example in Topic 64, what estimation method was utilized to estimate average population weight from sample data?

- A) Maximum Likelihood Estimator
- B) Goldfish Bowl Drawing Method
- C) Spearman's rank correlation
- D) Pearson's modified skewness index

Answer Key

1. A — Point estimation assigns a single calculated value to estimate an unknown population parameter.
2. A — The estimator is the general rule/formula, whereas the point estimate is the specific numerical value obtained.
3. A — The sample mean $\bar{x}$ is the standard point estimator for the population mean μ .
4. A — The example specifies using a Maximum Likelihood Estimator on sample data of pre-term baby weights.

Lesson 65: Interval Estimation

1. What is an Interval Estimate?

- A) An estimate that provides a range of values (interval) within which a population parameter is expected to lie
- B) A single numerical value calculated from sample observations
- C) The exact count of all units in a complete census
- D) A qualitative label identifying ordinal survey categories

2. What is the general mathematical structure of a Confidence Interval?

- A) $\text{Sample Statistic} \pm \text{Margin of Error}$
- B) $\text{Sample Statistic} \times \text{Margin of Error}$
- C) $\frac{\text{Sample Statistic}}{\text{Standard Deviation}}$
- D) $\text{Margin of Error} \div \text{Sample Size}$

3. How is the Margin of Error calculated in interval estimation?

- A) $\text{Margin of Error} = M \times \hat{SE}(\text{estimate})$, where multiplier (M) depends on confidence level
- B) $\text{Margin of Error} = \frac{\bar{x}}{n}$
- C) $\text{Margin of Error} = S^2 \times 100\%$
- D) $\text{Margin of Error} = Q_3 - Q_1$

4. According to Topic 65, what is the standard interpretation template for a confidence interval?

- A) "We are [X]% confident that the [population parameter] is between [lower bound] and [upper bound]"
- B) "There is an [X]% chance that the sample mean is equal to zero"
- C) "The population parameter is guaranteed to equal the sample statistic exactly"
- D) "The margin of error contains [X]% of all primary survey observations"

Answer Key

1. A — Interval estimates provide a range/interval of values as the estimate for a population parameter.
2. A — The general form of a confidence interval is $\text{sample statistic} \pm \text{margin of error}$.
3. A — Margin of error is computed as multiplier (M) times the estimated standard error $\hat{SE}(\text{estimate})$.
4. A — Topic 65 provides the template: "We are [level %] confident that [population parameter] is from [lower bound] to [upper bound]".

Lesson 66: Correlation

1. How is Correlation defined in statistics?

- A) A measure of association or the extent to which two variables are related
- B) The calculation of the arithmetic average of a single variable
- C) A non-probability sampling technique using volunteer referrals
- D) The square root of the sample variance divided by sample size

2. What are the three possible outcomes of a correlational study?

- A) Positive correlation, Negative correlation, and No correlation
- B) Linear correlation, Quadratic correlation, and Cubic correlation
- C) Primary correlation, Secondary correlation, and Tertiary correlation
- D) Finite correlation, Infinite correlation, and Sample correlation

3. What visual and numerical pattern characterizes a Positive Correlation?

- A) Data points lie close to a straight line with a positive gradient; as one variable increases, the other increases
- B) Data points lie close to a line with a negative gradient; as one variable increases, the other decreases
- C) Data points show no visible pattern across the plot
- D) All data points lie on a horizontal line with zero slope

4. What does a Negative Correlation indicate about two variables?

- A) As one variable increases, the other variable decreases
- B) As one variable increases, the other variable also increases
- C) There is no connection or relationship between the two variables
- D) The variables are measured on nominal scales exclusively

Answer Key

- 1. A — Correlation means association—specifically measuring the extent to which two variables are related.
- 2. A — Correlational studies yield three potential outcomes: positive, negative, or no correlation.
- 3. A — Positive correlation shows points near a line with a positive gradient where both variables increase together.
- 4. A — Negative correlation indicates an inverse relationship: as one variable increases, the other decreases.

Lesson 67: Assumptions used for Correlation

1. What assumptions regarding data level and distribution must be met to use Pearson's correlation coefficient (r)?

- A) Two quantitative (interval or ratio) variables that follow a normal distribution
- B) Two nominal variables with any arbitrary distribution
- C) One ordinal variable and one qualitative name label
- D) Binary dichotomous variables with a U-shaped frequency curve

2. Which correlation test is appropriate when analyzing two ordinal, interval, or ratio variables that have a non-linear relationship and any distribution?

- A) Spearman's rho (or Kendall's tau)
- B) Pearson's r
- C) Point-biserial correlation
- D) Cramér's V

3. What type of variables are required to perform a Point-biserial correlation?

- A) One dichotomous (binary) variable and one quantitative (interval/ratio) variable
- B) Two nominal categorical variables
- C) Two ordinal ranked variables
- D) Three continuous time-series variables

4. Which correlation coefficient is suited for assessing association between two nominal variables with any distribution?

- A) Cramér's V (Cramér's ϕ)
- B) Pearson's r
- C) Spearman's ρ
- D) Point-biserial correlation

Answer Key

1. A — Pearson's r assumes two quantitative (interval/ratio) variables with a linear relationship and normal distribution.
2. A — Spearman's ρ (and Kendall's tau) handles non-linear monotonic relationships for ordinal/interval data across any distribution.
3. A — Point-biserial correlation evaluates relationships between one binary (dichotomous) variable and one quantitative variable.
4. A — Cramér's V is designed for measuring association between two nominal variables.

Lesson 68: Types of Correlation and Their Usage**1. What is the primary usage of Pearson's correlation coefficient (r)?**

- A) Measuring linear relationships between two continuous, normally distributed variables
- B) Ranking qualitative preferences in survey questionnaires
- C) Calculating sample size allocations in stratified sampling
- D) Evaluating stillbirth proportions in census datasets

2. When is Spearman's rank correlation (ρ) used instead of Pearson's r ?

- A) When variables are measured on an ordinal scale or data violates normal distribution assumptions
- B) When both variables are continuous and perfectly normally distributed
- C) When calculating point estimates for population means
- D) When taking 100% complete census counts

3. What range of numerical values can a correlation coefficient assume?

- A) Between -1.0 and $+1.0$ inclusive
- B) Between 0.0 and $+100.0$
- C) Between $-\infty$ and $+\infty$
- D) Between 0.0 and $+1.0$ only

4. If a correlation coefficient between two variables is calculated as $r = 0.00$, what type of relationship exists between them?

- A) No linear correlation / no connection between the variables
- B) Perfect positive linear correlation
- C) Strong inverse negative correlation
- D) Continuous exponential growth

Answer Key

1. A — Pearson's r measures linear association between quantitative interval/ratio variables.
2. A — Spearman's rank correlation is used for ordinal data or non-normally distributed continuous data.
3. A — Correlation coefficients range strictly from -1.0 (perfect negative) to $+1.0$ (perfect positive).
4. A — A coefficient of 0.00 indicates no linear correlation or connection between the variables.

End of Quiz

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