



Biostatistics 112 – Chapter 1 Summary

Introduction to Biostatistics

Learning Outcomes

After completing this chapter, you should be able to:

1. Understand the key concepts and terminology of biostatistics.
 2. Classify different types of samples taken from a population.
 3. Recognize the definition of a research study and an experiment.
 4. Appreciate the role of computers in statistical data analysis.
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1.1 Introduction & Basic Concepts

- **Statistics:** The science of collecting, organizing, summarizing, analyzing, and drawing conclusions from data.
 - **Data:** The raw material of statistics, obtained either by **counting** (e.g., number of patients) or **measuring** (e.g., blood pressure).
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1.2 Descriptive vs. Inferential Statistics

- **Descriptive Statistics:** Methods for organizing, presenting, and summarizing data.
Example: Frequency tables, graphs, averages.
 - **Inferential Statistics:** Methods for making conclusions about a population based on information from a sample.
Example: Testing whether a new drug is effective using a sample of patients.
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Sources of Data

- **Records:** Routine organizational logs (e.g., hospital records).
 - **Surveys:** Questionnaires, interviews.
 - **Experiments:** Testing medical strategies or treatments.
 - **External Sources:** Published reports, scientific literature, or databases.
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Statistics vs. Biostatistics

- **Statistics:** General tools and methods for analyzing data.
 - **Biostatistics:** Application of these tools specifically to biological and medical sciences.
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Data and Variables

- **Variable:** A characteristic that can take different values among individuals (e.g., age, gender).
 - **Qualitative Variables (Categorical):**
 - Nominal: Categories without order (e.g., blood type).
 - Ordinal: Categories with order (e.g., pain level: mild, moderate, severe).
 - **Quantitative Variables (Numerical):**
 - Discrete: Whole numbers (e.g., number of patients).
 - Continuous: Can take any value (e.g., weight, height).
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Random Variables

- **Random Variable:** A variable whose values occur by chance.
 - **Discrete:** Number of daily hospital admissions.
 - **Continuous:** Weight of newborn babies.
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Population vs. Sample

- **Population:** The entire group of interest (all patients in a hospital).
 - **Sample:** A subset of the population (50 patients chosen from the hospital).
 - **Why Samples?** Less costly, less time-consuming, sometimes population is infinite, or measurement may destroy units (e.g., blood samples).
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Measurement Scales

- **Nominal:** Categories only (e.g., gender, blood type).
 - **Ordinal:** Categories with order (e.g., satisfaction level).
 - **Interval:** Meaningful differences, but no true zero (e.g., temperature, IQ).
 - **Ratio:** Meaningful differences with a true zero (e.g., weight, height, dosage).
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Sampling Methods

- **Simple Random Sampling:** Every unit has equal chance of selection.
 - **Systematic Random Sampling:** Select every k -th unit.
 - **Stratified Random Sampling:** Divide population into strata (groups) and sample proportionally.
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Statistical Inference

- **Definition:** Drawing conclusions about a population based on sample data.
 - **Research Study:** Collecting and analyzing data systematically.
 - **Experiment:** Manipulating conditions and observing outcomes (e.g., treatment vs. control group).
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Scientific Method & Experiments

- **Accuracy/Validity:** Correctness of measurement.
 - **Precision/Reliability:** Consistency of measurement.
 - **Treatment Group:** Receives the treatment.
 - **Control Group:** Does not receive the treatment (placebo).
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Computers in Biostatistics

- Computers perform statistical analysis faster and more accurately.
 - Software like **MS Excel/MegaStat** will be used for data analysis in this course.
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Biostatistics 112 – Chapter 1 Practice Questions

Part A – Basic Concepts (Q1–10)

1. **Statistics is the science of:**

- A) Collecting data
- B) Organizing data
- C) Analyzing data
- D) All of the above

 **Answer: D** – Statistics covers all these steps.

2. **Data can be defined as:**

- A) Raw material of statistics
- B) Results of counting or measurement
- C) Both A and B
- D) None

 **Answer: C** – Data are numbers obtained by counting or measuring.

3. Which of the following is **not** a source of data?

- A) Surveys
- B) Hospital records
- C) Experiments
- D) Astrology books

 **Answer: D** – Astrology is not a scientific source.

4. **Biostatistics** is mainly applied in:

- A) Banking
- B) Biological & medical sciences
- C) Engineering
- D) Astronomy

 **Answer: B.**

5. **Descriptive statistics** deals with:

- A) Summarizing data
- B) Making decisions about populations
- C) Conducting experiments
- D) None

✓ **Answer: A.**

6. **Inferential statistics** is used when:

- A) Studying a whole population
- B) Studying a sample to generalize to the population
- C) Organizing graphs
- D) Describing medical records only

✓ **Answer: B.**

7. Which one is **qualitative data**?

- A) Weight
- B) Height
- C) Blood group
- D) Age

✓ **Answer: C** – Blood group is categorical.

8. Which of the following is **quantitative discrete**?

- A) Weight of a baby
- B) Number of patients in a ward
- C) Blood pressure
- D) Temperature

✓ **Answer: B.**

9. A **random variable** is:

- A) Always predictable
- B) Cannot be measured
- C) Value determined by chance
- D) Not useful in biostatistics

✓ **Answer: C.**

10. A **continuous random variable** example:

- A) Number of students
- B) Shoe size
- C) Birth weight
- D) Number of pills taken

✓ **Answer: C.**

Part B – Population, Samples, & Measurement (Q11–20)

11. A **population** in statistics refers to:

- A) The largest collection of values or entities of interest

- B) A small sample of patients
- C) The study tool used
- D) A group of doctors

✓ **Answer: A.**

12. A **sample** is:

- A) The whole population
- B) A subset of the population
- C) Always infinite
- D) Not related to population

✓ **Answer: B.**

13. One reason to use a sample instead of a population is:

- A) It is cheaper and faster
- B) Populations are always infinite
- C) Populations cannot be studied
- D) Samples give less valid results

✓ **Answer: A.**

14. Which is an **ordinal scale** variable?

- A) Gender
- B) Blood type
- C) Pain severity (mild, moderate, severe)
- D) Temperature

✓ **Answer: C.**

15. Which is **nominal scale**?

- A) Blood type
- B) Weight
- C) Age
- D) Height

✓ **Answer: A.**

16. Interval scale does **not** have:

- A) Ordered values
- B) Equal intervals
- C) True zero
- D) Numerical meaning

✓ **Answer: C** – Interval scale zero is arbitrary (e.g., temperature).

17. Ratio scale has:

- A) True zero
- B) No meaning of zero
- C) No order

D) Only qualitative data

✓ **Answer: A.**

18. Example of interval scale:

A) Blood group

B) Temperature (°C)

C) Weight

D) Height

✓ **Answer: B.**

19. Example of ratio scale:

A) IQ score

B) Temperature

C) Weight

D) Blood group

✓ **Answer: C.**

20. Likert scale responses (e.g., agree–disagree) are treated as:

A) Nominal

B) Ordinal

C) Interval

D) Ratio

✓ **Answer: B.**

Part C – Sampling Methods & Studies (Q21–30)

21. **Simple random sampling** means:

A) Each member has equal chance of selection

B) Selecting only healthy subjects

C) Selecting groups instead of individuals

D) Choosing every 10th unit

✓ **Answer: A.**

22. **Systematic random sampling** is:

A) Every k-th element selected

B) Divide into strata then sample

C) Everyone included

D) Always biased

✓ **Answer: A.**

23. **Stratified random sampling** is useful when:

- A) Population is homogeneous
- B) Population has clear subgroups
- C) Only one variable exists
- D) Randomness is not required

✓ **Answer: B.**

24. An **experiment** differs from a research study because:

- A) It uses interviews
- B) It manipulates variables
- C) It avoids randomization
- D) It ignores treatment groups

✓ **Answer: B.**

25. A **research study** example:

- A) Giving one group placebo and another group drug
- B) Observing tea consumption habits and sleep times
- C) Assigning random doses to groups
- D) None of the above

✓ **Answer: B.**

26. A **treatment group** is:

- A) Group that gets placebo
- B) Group that gets the actual treatment
- C) Always the control group
- D) Not randomly assigned

✓ **Answer: B.**

27. A **control group** is:

- A) Group not exposed to treatment
- B) Group exposed to maximum dose
- C) Group that is always larger
- D) Irrelevant to experiments

✓ **Answer: A.**

28. **Precision** refers to:

- A) Correctness of measurement
- B) Consistency of measurement
- C) Random error
- D) Validity

✓ **Answer: B.**

29. **Accuracy** refers to:

- A) Correctness of measurement

- B) Consistency of measurement
- C) Reliability only
- D) None

✓ **Answer: A.**

30. Which is an example of **sampling without replacement**?

- A) Choosing a student, recording his name, then putting it back
- B) Drawing blood and using the same sample again
- C) Selecting patients from a hospital and not repeating them
- D) Random number generation

✓ **Answer: C.**

Part D – Computers & Applications (Q31–40)

31. Which software is suggested in the course for analysis?

- A) SPSS
- B) R
- C) Excel/MegaStat
- D) Stata

✓ **Answer: C.**

32. Computers are useful in biostatistics because:

- A) Faster than humans
- B) More accurate
- C) Can generate random numbers
- D) All of the above

✓ **Answer: D.**

33. Which of the following is **not** a role of computers in statistics?

- A) Performing calculations
- B) Data visualization
- C) Collecting blood samples
- D) Generating random samples

✓ **Answer: C.**

34. Which term indicates “correctness of measurement”?

- A) Reliability
- B) Precision
- C) Validity
- D) Randomness

✓ **Answer: C.**

35. Which term indicates “consistency of measurement”?

- A) Reliability
- B) Accuracy
- C) Validity
- D) Randomization

✓ **Answer: A.**

36. In medical research, biostatistics is most useful for:

- A) Making assumptions without data
- B) Analyzing experimental results
- C) Avoiding data collection
- D) None

✓ **Answer: B.**

37. An **infinite population** example is:

- A) All students in a classroom
- B) All humans alive today
- C) Possible blood pressure values
- D) Patients in a hospital ward

✓ **Answer: C.**

38. A **finite population** example is:

- A) All bacteria in the world
- B) Students enrolled in a university
- C) Possible IQ values
- D) All numbers between 0 and 1

✓ **Answer: B.**

39. If researchers divide patients into smokers and non-smokers, then sample from each group, they are using:

- A) Simple random sampling
- B) Stratified sampling
- C) Systematic sampling
- D) Convenience sampling

✓ **Answer: B.**

40. In a hospital, if researchers select every 5th patient from a list, they are using:

- A) Stratified sampling
- B) Simple random sampling
- C) Systematic sampling
- D) Cluster sampling

✓ **Answer: C.**

✓ That's **40 MCQs with answers and short reasoning** based directly on **Chapter 1**.

Do you want me to also **prepare them in an exam-style PDF** (with space for student answers, then a separate answer key at the end)?