

Basic Statistics Competency

I. Introduction to Statistics

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Recognize the differences in and give examples of the nominal, ordinal, interval, and the ratio scales of measurement.
2. Recognize the differences in, and give examples of, continuous and discrete data.
3. Specify the variable of interest in a research study.
4. Describe the difference between descriptive and inferential statistics.
5. Perform simple manipulations using Σ notation.
6. Translate a statistical formula into an English sentence.

II. Descriptive Statistics: Tabular and Graphical Presentations

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Define the term frequency distribution.
2. Construct an absolute frequency table and a relative frequency table.
3. Present a frequency table graphically by means of a histogram.
4. Present data by means of bar charts, circle graphs, and frequency polygons.
5. Identify symmetric and skewed distributions of data.

III. Descriptive Statistics: Numeric Summary

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Define and compute measures of central tendency:
 - a. Mean
 - b. Median
 - c. Mode
2. Define and compute measures of variability:
 - a. Range
 - b. Variance
 - c. Standard deviation
3. Choose the appropriate descriptive statistic for summarizing a set of data.
4. Summarize data by means of percents, percentiles, rates, and ratios.

IV. Populations, Samples, and the Normal Distribution

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Define *population* and *sample* and state the relationship between them.
2. Describe the relationship between *parameters* and *statistics* and give examples of each.
3. State the difference between *theoretical* and *empirical* distribution.
4. Describe in words the meaning of *sampling error*.
5. List the properties of the normal distribution.
6. State the standard probabilities associated with the normal curve.

V. Estimating Population Parameters

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Compute and interpret confidence intervals on a single population mean μ for
 - a. Population standard deviation σ known.
 - b. Population standard deviation σ unknown.
2. Compute and interpret confidence intervals on the difference in two population means $\mu_1 - \mu_2$ for
 - a. Population standard deviations known.
 - b. Population standard deviations unknown.
3. Compute and interpret confidence intervals on the true mean difference D in a paired experiment.
4. Compute and interpret confidence intervals on a true population proportion p .
5. Compute and interpret confidence intervals on the true difference in population proportions $p_1 - p_2$.

VI. Statistical Inference: An Overview

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. List the elements of a statistical test and describe in words what is meant by:
 - a. Null hypothesis
 - b. Test statistic
 - c. Level of significance
 - d. Rejection region
 - e. Decision or conclusion
2. Identify the above elements in a given research situation.

VII. Select an Appropriate Statistical Test

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Select an appropriate statistical analysis.

VIII. Making Inferences about Means: The *t*-test

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. State the assumptions and nature of the data necessary for the use of a simple *t*-test.
2. State the assumptions and nature of the data necessary for the use of the pooled *t*-test and the paired *t*-test.
3. Carry out a test of hypothesis about a single mean using a simple *t*-test.
4. Interpret results of a simple *t*-test, pooled *t*-test, and paired *t*-test.
5. Carry out a test of hypothesis using a pooled *t*-test and a paired *t*-test.

IX. Analysis of Variance

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. State when Analysis of Variance procedures are used.
2. Discuss the Completely Randomized Design in terms of the six steps of hypothesis testing.
3. Be familiar with common terms associated with Analysis of Variance procedures.
- †4. Carry out the analysis for a Completely Randomized Design.
5. Discuss the Randomized Complete Block Design in terms of the six steps of hypothesis testing.
- †6. Carry out the analysis for a Randomized Complete Block Design.
- †7. Determine which pairs of means are different using the Bonferroni *t* procedure.

X. Correlation and Regression

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Recognize a positive linear, negative linear, and a curvilinear relationship.
2. Represent a set of data by means of a scatter diagram.
3. Define the term “correlation.”
4. Discuss the interpretation of correlation, i.e., what is meant by range of values -1 to $+1$ and by the squared correlation.
5. Discuss precautions in the interpretation of correlation.
6. Determine the correlation between two variables using Pearson’s Product Moment Correlation Coefficient.
7. Determine the correlation between two variables using Spearman’s Rank Order Correlation Coefficient.

8. Describe in words the use of regression analysis.
- †9. Carry out a simple linear regression analysis.

XI. The Chi-Squared Tests of Proportions

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Describe what is meant by a contingency table.
2. Describe the general situation in which X^2 analysis is appropriate.
3. Describe what is meant by a “significant” X^2 .
- †4. Calculate the X^2 statistic and carry out an X^2 test of hypothesis.

XII. Non-Parametric Methods

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Discuss the general differences in parametric and nonparametric techniques.
2. State briefly the situations in which each test may be applicable.
3. Carry out a test of hypothesis on related samples using the Sign Test and the Wilcoxon Signed Rank Test.
4. Carry out a test of hypothesis on independent samples using the Median Test and the Wilcoxon Rank Sum Test.

XIII. Methods of Sample Selection

OBJECTIVES

Upon completion of this chapter, the student will be able to:

1. Distinguish between probability and nonprobability sampling schemes by discussing the meaning, advantages, and disadvantages of each.
2. Describe and recognize common probability sampling techniques.
3. Describe and recognize common nonprobability sampling techniques.
4. Define and recognize cross-sectional, retrospective, and prospective studies.
5. Define single-blind and double-blind trials.
6. Define the Hawthorne Effect.

† Sections marked by a dagger (†) cover more difficult or theoretical topics.

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