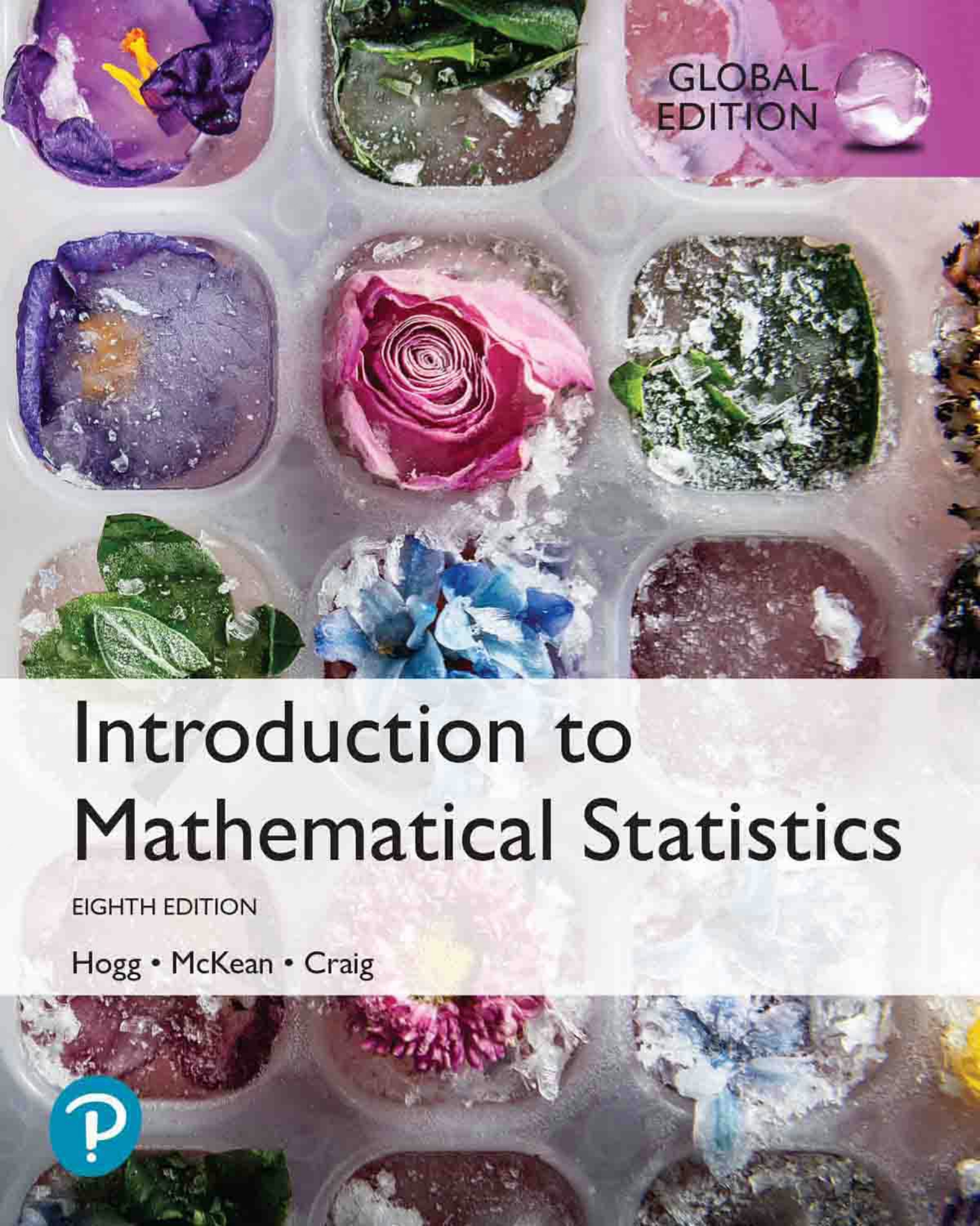




GLOBAL
EDITION



Introduction to Mathematical Statistics

EIGHTH EDITION

Hogg • McKean • Craig



Introduction to Mathematical Statistics

Eighth Edition
Global Edition

Robert V. Hogg
University of Iowa

Joseph W. McKean
Western Michigan University

Allen T. Craig
Late Professor of Statistics
University of Iowa

Introduction to Mathematical Statistics, Global Edition

Table of Contents

Front Cover

Title Page

Copyright Page

Dedication Page

Contents

Preface

1 Probability and Distributions

1.1 Introduction

1.2 Sets

1.2.1 Review of Set Theory

1.2.2 Set Functions

1.3 The Probability Set Function

1.3.1 Counting Rules

1.3.2 Additional Properties of Probability

1.4 Conditional Probability and Independence

1.4.1 Independence

1.4.2 Simulations

1.5 Random Variables

1.6 Discrete Random Variables

1.6.1 Transformations

1.7 Continuous Random Variables

1.7.1 Quantiles

1.7.2 Transformations

1.7.3 Mixtures of Discrete and Continuous Type Distributions

1.8 Expectation of a Random Variable

Table of Contents

1.8.1 R Computation for an Estimation of the Expected Gain

1.9 Some Special Expectations

1.10 Important Inequalities

2 Multivariate Distributions

2.1 Distributions of Two Random Variables

2.1.1 Marginal Distributions

2.1.2 Expectation

2.2 Transformations: Bivariate Random Variables

2.3 Conditional Distributions and Expectations

2.4 Independent Random Variables

2.5 The Correlation Coefficient

2.6 Extension to Several Random Variables

2.6.1 *Multivariate Variance-Covariance Matrix

2.7 Transformations for Several Random Variables

2.8 Linear Combinations of Random Variables

3 Some Special Distributions

3.1 The Binomial and Related Distributions

3.1.1 Negative Binomial and Geometric Distributions

3.1.2 Multinomial Distribution

3.1.3 Hypergeometric Distribution

3.2 The Poisson Distribution

3.3 The χ^2 , t , and F Distributions

3.3.1 The χ^2 -Distribution

3.3.2 The t -Distribution

3.4 The Normal Distribution

3.4.1 *Contaminated Normals

3.5 The Multivariate Normal Distribution

3.5.1 Bivariate Normal Distribution

3.5.2 *Multivariate Normal Distribution, General Case

3.5.3 *Applications

t - and F -Distributions

Table of Contents

3.6.1 The t-distribution

3.6.2 The F-distribution

3.6.3 Students Theorem

3.7 *Mixture Distributions

4 Some Elementary Statistical Inferences

4.1 Sampling and Statistics

4.1.1 Point Estimators

4.1.2 Histogram Estimates of Pmfs and Pdfs

4.2 Confidence Intervals

4.2.1 Confidence Intervals for Difference in Means

4.2.2 Confidence Interval for Difference in Proportions

4.3 *Confidence Intervals for Parameters of Discrete Distributions

4.4 Order Statistics

4.4.1 Quantiles

4.4.2 Confidence Intervals for Quantiles

4.5 Introduction to Hypothesis Testing

4.6 Additional Comments About Statistical Tests

4.6.1 Observed Significance Level, p-value

4.7 Chi-Square Tests

4.8 The Method of Monte Carlo

4.8.1 AcceptReject Generation Algorithm

4.9 Bootstrap Procedures

4.9.1 Percentile Bootstrap Confidence Intervals

4.9.2 Bootstrap Testing Procedures

4.10 *Tolerance Limits for Distributions

5 Consistency and Limiting Distributions

5.1 Convergence in Probability

5.1.1 Sampling and Statistics

5.2 Convergence in Distribution

5.2.1 Bounded in Probability

5.2.2 -Method

Table of Contents

5.2.3 Moment Generating Function Technique

5.3 Central Limit Theorem

5.4 *Extensions to Multivariate Distributions

6 Maximum Likelihood Methods

6.1 Maximum Likelihood Estimation

6.2 RaoCram er Lower Bound and Efficiency

6.3 Maximum Likelihood Tests

6.4 Multiparameter Case: Estimation

6.5 Multiparameter Case: Testing

6.6 The EM Algorithm

7 Sufficiency

7.1 Measures of Quality of Estimators

7.2 A Sufficient Statistic for a Parameter

7.3 Properties of a Sufficient Statistic

7.4 Completeness and Uniqueness

7.5 The Exponential Class of Distributions

7.6 Functions of a Parameter

7.6.1 Bootstrap Standard Errors

7.7 The Case of Several Parameters

7.8 Minimal Sufficiency and Ancillary Statistics

7.9 Sufficiency, Completeness, and Independence

8 Optimal Tests of Hypotheses

8.1 Most Powerful Tests

8.2 Uniformly Most Powerful Tests

8.3 Likelihood Ratio Tests

8.3.1 Likelihood Ratio Tests for Testing Means of Normal Distributions

8.3.2 Likelihood Ratio Tests for Testing Variances of Normal Distributions

8.4 *The Sequential Probability Ratio Test

8.5 *Minimax and Classification Procedures

8.5.1 Minimax Procedures

Table of Contents

8.5.2 Classification

9 Inferences About Normal Linear Models

9.1 Introduction

9.2 One-Way ANOVA

9.3 Noncentral 2 and F-Distributions

9.4 Multiple Comparisons

9.5 Two-Way ANOVA

9.5.1 Interaction Between Factors

9.6 A Regression Problem

9.6.1 Maximum Likelihood Estimates

9.6.2 *Geometry of the Least Squares Fit

9.7 A Test of Independence

9.8 The Distributions of Certain Quadratic Forms

9.9 The Independence of Certain Quadratic Forms

10 Nonparametric and Robust Statistics

10.1 Location Models

10.2 Sample Median and the Sign Test

10.2.1 Asymptotic Relative Efficiency

10.2.2 Estimating Equations Based on the Sign Test

10.2.3 Confidence Interval for the Median

10.3 Signed-Rank Wilcoxon

10.3.1 Asymptotic Relative Efficiency

10.3.2 Estimating Equations Based on Signed-Rank Wilcoxon

10.3.3 Confidence Interval for the Median

10.3.4 Monte Carlo Investigation

10.4 MannWhitneyWilcoxon Procedure

10.4.1 Asymptotic Relative Efficiency

10.4.2 Estimating Equations Based on the MannWhitney Wilcoxon

10.4.3 Confidence Interval for the Shift Parameter

10.4.4 Monte Carlo Investigation of Power

10.5 *General Rank Scores

Table of Contents

10.5.1 Efficacy

10.5.2 Estimating Equations Based on General Scores

10.5.3 Optimization: Best Estimates

10.6 *Adaptive Procedures

10.7 Simple Linear Model

10.8 Measures of Association

10.8.1 Kendall's

10.8.2 Spearmans Rho

10.9 Robust Concepts

10.9.1 Location Model

10.9.2 Linear Model

11 Bayesian Statistics

11.1 Bayesian Procedures

11.1.1 Prior and Posterior Distributions

11.1.2 Bayesian Point Estimation

11.1.3 Bayesian Interval Estimation

11.1.4 Bayesian Testing Procedures

11.1.5 Bayesian Sequential Procedures

11.2 More Bayesian Terminology and Ideas

11.3 Gibbs Sampler

11.4 Modern Bayesian Methods

11.4.1 Empirical Bayes

A Mathematical Comments

A.1 Regularity Conditions

A.2 Sequences

B R Primer

B.1 Basics

B.2 Probability Distributions

B.3 R Functions

B.4 Loops

B.5 Input and Output

Table of Contents

B.6 Packages
C Lists of Common Distributions
D Tables of Distributions
E References
F Answers to Selected Exercises
Index
Back Cover