

# Contents

Preface .....	7
<b>Chapter 1. Introduction .....</b>	<b>11</b>
1.1. What is statistics?.....	11
1.2. What is statistical thinking? .....	21
1.3. Key statistical concepts .....	30
1.4. Types of data .....	34
1.5. Sources of data collection .....	47
1.6. Forms of data presentation .....	52
1.7. Statistics, models and computer's packages.....	53
1.8. Examples and exercises.....	56
Appendixes .....	81
Appendix 1. Statistical Thinking: From “Small data” to “Big data” .....	81
Appendix 2. Links and glossaries .....	83
<b>Chapter 2. Descriptive statistics.....</b>	<b>95</b>
2.1. Introduction .....	95
2.2. Measures of central location .....	106
2.3. Measures of variability.....	115
2.4. Measures of asymmetry and kurtosis .....	121
2.5. Measures of concentration.....	127
2.6. Examples and exercises.....	130
<b>Chapter 3. Probability, Probability Distribution .....</b>	<b>185</b>
3.1. Probability .....	185
3.2. Discrete random variable and probability distributions.....	190
3.3. Continue random variable and probability distributions.....	198
3.4. Bivariate discrete and continue random variable distribution .....	212
3.4.1. General information.....	212
3.4.2. Two-dimensional discrete and continue random variable distribution	213
3.4.3. Marginal distributions and their characteristics .....	214
3.4.4. Conditional distribution and their characteristics.....	216
3.4.5. Independence of random variables.....	218
3.5. Examples and exercises.....	219

<b>Chapter 4. Statistical Inferences .....</b>	245
4.1. Introduction – Classical Statistical Inference.....	245
4.2. Population, sample, limit theorem and sampling distribution.....	246
4.2.1. Sample.....	246
4.2.2. Selected limit theorem .....	248
4.2.3. Sample statistics and their distributions .....	252
4.3. Point and interval estimation .....	263
4.3.1. Introduction .....	263
4.3.2. Basic properties of the estimator .....	264
4.3.3. Method of estimation.....	266
4.3.4. Point and interval estimation .....	268
4.3.5. Confidence intervals for mean, variance and a population proportion .....	270
4.4. Hypothesis testing.....	274
4.4.1. Parametric Hypotheses Testing.....	278
4.4.2. Nonparametric Hypotheses Testing .....	286
4.5. Examples and Exercises.....	289
<b>Chapter 5. Analysis of Variance .....</b>	349
5.1. Introduction .....	349
5.2. One-Way ANOVA.....	551
5.3. Two-Way ANOVA .....	558
5.4. Examples and exercises.....	361
<b>Chapter 6. Correlation and Regression.....</b>	395
6.1. Introduction - bivariate correlation and regression .....	395
6.2. Correlation .....	399
6.2.1. Correlation Coefficient Rho.....	400
6.2.2. Spearman's rank correlation coefficient.....	405
6.2.3. Kendall's tau ( $\tau$ ) coefficient.....	407
6.3. Regression Model .....	409
6.3.1. Simple Linear Regression Model.....	410
6.3.2. Least – Squares Estimators.....	415
6.3.3. Decomposition of Variance of Y .....	418
6.3.4. Confidence intervals and hypotheses testing for slope and intercept and regression equation .....	420
6.3.5. Prediction based on the regression model .....	423

6.3.6. Checking Assumptions .....	424
6.3.7. Comparing two linear regression equations and two linear coefficients.....	426
6.4. Multiple Regression.....	429
6.5. Multiple Linear Regression versus Simple Linear Regression.....	433
6.6. Diagnostic based on the regression model and other more advanced topics .....	435
6.7. Examples and exercises.....	440
<b>Chapter 7. Indexes and Time Series Analysis.....</b>	<b>509</b>
7.1. Introduction .....	509
7.2. Indexes .....	511
7.2.1. Individual indexes and annual growth rate .....	512
7.2.2. Aggregate indexes for absolute values .....	513
7.3. Time series components and smoothing techniques .....	517
7.4. Seasonality and trend analysis .....	520
7.4.1. Seasonality analysis.....	520
7.4.2. Seasonal indices for time series with trend .....	521
7.4.3. Seasonal indices for time series with trend .....	522
7.5. Trend .....	522
7.6. Forecasting - short view.....	525
7.7. Statistical inferences in time series analysis .....	526
7.8 Examples and exercises.....	530
<b>References.....</b>	<b>579</b>
<b>Appendices.....</b>	<b>593</b>
Appendix 1. Selected Statistical Tables.....	595
Appendix 2. Sampling Distributions and the Central Limit Theorem ( $n \rightarrow \infty$ ).....	617
Appendix 3. Estimation and Statistical hypothesis testing /formulas / .....	618