



Introduction to STATISTICS

**DR.M. AFZAL BEG
MIRAJ DIN MIRZA**



THE CARAVAN BOOK HOUSE

2 KACHEHRI ROAD, LAHORE Phone:

CONTENTS

	Page
<i>Syllabus</i>	(iii)
<i>Preface to Fifth Edition</i>	(v)
<i>Preface to Third Edition</i>	(vi)
<i>Preface to First Edition</i>	(vii)
<i>Contents</i>	(viii)
Introduction	1
1.1 History	4
1.2 Meanings of Statistics	6
1.3 Descriptive and Inferential Statistics	5
1.4 Characteristics of Statistics	7
1.5 Limitations of Statistics	7
1.6 Functions or Uses of Statistics	8
1.7 Importance of Statistics in Different Fields	12
1.8 Collection of Data	13
1.9 Primary and Secondary Data	13
1.9.1 Methods for Collection of Primary Data	14
1.9.2 Methods for Collection of Secondary Data	15
1.10 Variable and Constant	15
1.10.1 Continuous and Discrete Variables	16
1.10.2 Qualitative and Quantitative Variables	16
1.11 Accuracy of Measurements	16
1.11.1 Errors of Measurement	17
1.11.2 Compensating Errors	17
1.11.3 Biased Errors	17
1.12 Significant Digits	17
1.13 Scientific Notation	20
1.14 Rounding off Numbers	2
1.15 Summation Notation	2
<i>Exercises</i>	
2. Presentation of Data	3
2.1 Classification	3
2.2 Types of Classification	3
2.3 Tabulation	3
2.4 Statistical Table	3
2.5 Frequency Distribution	3

2.6.	Formation of a Frequency Distribution	43
2.6.1.	Frequency Distribution of Discrete Data	47
2.7.	Cumulative Frequency Distribution	48
2.8.	Relative Frequency Distribution	49
2.8.1.	Relative Cumulative Frequency Distribution	50
2.9.	Bivariate Frequency Distribution	51
2.10.	Graphs	53
2.10.1.	Graphs of Frequency Distributions	54
2.10.2.	Histogram	54
2.10.3.	Frequency Polygon	56
2.10.4.	Relative Frequency Histogram and Relative Frequency Polygon	58
2.10.5.	Cumulative Frequency Polygon or Ogive	58
2.10.6.	Frequency Curve and Smoothed Ogive	59
2.11.	Common Types of Frequency Distributions and Curves	60
2.12.	Charts	65
2.12.1.	Simple Bar chart	65
2.12.2.	Multiple Bar Chart	67
2.12.3.	Component Bar chart	67
2.12.4.	Percentage Component Bar Chart	70
2.12.5.	Pie Chart	71
	<i>Exercises</i>	75
3.	Measures of Location	
3.1.	Introduction	87
3.2.	Types of Averages	87
3.3.	The Arithmetic Mean	87
3.3.1.	Arithmetic Mean for grouped Data	89
3.3.2.	Short Formulae for Computing Mean	92
3.3.3.	Weighted Mean	98
3.3.4.	Properties of Arithmetic Mean	101
3.3.5.	Charlier's Check in Checking the Accuracy of Computations in Mean.	102
3.4.	The Geometric Mean	103
3.4.1.	The Geometric Mean for Grouped Data	104

	The Harmonic Mean	
3.5.	The Harmonic Mean for Grouped Data	106
3.5.1.	The Median	106
3.6.	The Median for Grouped Data	109
3.6.1.	Median for Discrete Data	110
3.6.2.	Graphic Location of Median	112
3.6.3.	Qualities, Deciles, Percentiles, etc.	112
3.6.4.	Quantiles for Grouped Data	113
3.6.5.	Quantiles for Discrete Data	117
3.6.6.	Graphic Location of Quantiles	118
3.6.7.	The Mode	123
3.7.	The Mode from Grouped Data	124
3.7.1.	The Mode from Discrete Data	124
3.7.2.	Empirical Relation between the Mean, Median and the Mode	125
3.8.	Desirable Qualities of a Good Average	126
3.9.	Advantages and Disadvantages of Arithmetic Mean	128
3.9.1.	Advantages and Disadvantages of Geometric mean	129
3.9.2.	Advantages and Disadvantages of Median	130
3.9.3.	Advantages and Disadvantages of Mode	131
3.9.4.	<i>Exercises</i>	132
		133
4.	Measures of Dispersion	
4.1.	Introduction	155
4.2.	The Range	156
4.3.	The Range for Grouped Data	156
4.4.	The Semi-interquartile Range or Quartile Deviation	157
4.5.	The Mean Deviation or Average Deviation	159
4.5.1.	Mean Deviation for Grouped Data	161
4.6.	The Standard Deviation	162
4.6.1.	The Standard Deviation for Grouped Data	164
4.6.2.	Short Methods for Computing Standard Deviation	166

3.5.	The Harmonic Mean	
3.5.1.	The Harmonic Mean for Grouped Data	106
3.6.	The Median	106
3.6.1.	The Median for Grouped Data	109
3.6.2.	Median for Discrete Data	110
3.6.3.	Graphic Location of Median	112
3.6.4.	Qualities, Deciles, Percentiles, etc.	112
3.6.5.	Quantiles for Grouped Data	113
3.6.6.	Quantiles for Discrete Data	117
3.6.7.	Graphic Location of Quantiles	118
3.7.	The Mode	123
3.7.1.	The Mode from Grouped Data	124
3.7.2.	The Mode from Discrete Data	124
3.8.	Empirical Relation between the Mean, Median and the Mode	125
3.9.	Desirable Qualities of a Good Average	126
3.9.1.	Advantages and Disadvantages of Arithmetic Mean	128
3.9.2.	Advantages and Disadvantages of Geometric mean	129
3.9.3.	Advantages and Disadvantages of Median	130
3.9.4.	Advantages and Disadvantages of Mode	131
	<i>Exercises</i>	132
4.	Measures of Dispersion	
4.1.	Introduction	155
4.2.	The Range	156
4.3.	The Range for Grouped Data	156
4.4.	The Semi-interquartile Range or Quartile Deviation	157
4.5.	The Mean Deviation or Average Deviation	159
4.5.1.	Mean Deviation for Grouped Data	161
4.6.	The Standard Deviation	162
4.6.1.	The Standard Deviation for Grouped Data	164
4.6.2.	Short Methods for Computing Standard Deviation	166

	(x)	173
4.7.	The Variance	
4.7.1.	Properties of the Standard Deviation and Variances	174
4.8.	Charlier's Check for Checking Accuracy of Computations	181
4.9.	Sheppard's Correction for Grouping Error	181
4.10.	Empirical Relation between Measures of Dispersion	182
4.11.	Characteristics of Measures of Dispersion	182
4.12.	Absolute and Relative Dispersion	184
4.13.	Measures of Relative Dispersion	184
4.13.1.	Coefficient of Variation	184
4.13.2.	Coefficient of Dispersion	184
4.13.3.	Coefficient of Quartile Deviation	184
4.13.4.	Mean Coefficient of Dispersion	19
4.14.	Moments	19
4.14.1.	Moments for Grouped data	19
4.14.2.	Relation between Moments	20
4.14.3.	Checking Accuracy of Computations	20
4.15.	Sheppard's Correction for Grouping	20
4.16.	Moment Ratios	20
4.17.	Symmetry and Skewness	20
4.17.1.	Measures of Skewness	2
4.18.	Kurtosis	2
	Exercises	
5.	Index Numbers	2
5.1.	Introduction	2
5.2.	Types of Index Numbers	2
5.3.	Uses of Index Numbers	2
5.4.	Steps in the Construction of Index Numbers of Prices	2
5.5.	Notations	2
5.6.	Construction of Price Index Numbers	2
5.6.1.	Simple Relatives or Simple Index Numbers	2
5.6.2.	Unweighted Index Numbers	2

5.6.3.	Weighted Index Numbers	153
5.7.	Quantity or Volume Index Numbers	154
5.8.	Value Index Number	155
5.9.	Theoretical Tests for Index Numbers	156
5.10.	Wholesale Price Index Numbers	157
5.11.	Consumer Price Index	158
5.12.	Construction of Wholesale and Consumer Price Index Numbers in Pakistan	159
	Exercise	160
6.	Rules of Counting	163
6.1.	Factorials	164
6.2.	Fundamental Principle	165
6.3.	Permutations	166
6.4.	Combinations	167
6.5.	Binomial Expansion	168
6.6.	Set Theory	169
6.6.1.	Set	170
6.6.2.	Null Set	171
6.6.3.	Subsets	172
6.6.4.	Universal Set	173
6.6.5.	Disjoint Sets	174
6.6.6.	Overlapping Sets	175
6.7.	Venn Diagram	176
6.8.	Set Operations	177
6.8.1.	Union of Sets	178
6.8.2.	Intersection of Sets	179
6.8.3.	Difference of Sets	180
6.8.4.	Complement of a Set	181
6.8.5.	Ordered Pairs	182
6.8.6.	Product Set	183
6.8.7.	Class of Sets	184
	Exercises	185
7.	Probability	186
7.1.	Introduction	187
7.2.	Random Experiment	188

7.3.	Sample Space	288
7.4.	Events	288
7.5.	Equally Likely, Mutually Exclusive and Exhaustive Outcomes	290
7.6.	Definitions of Probability	290
7.7.	Assignment of Probabilities	295
7.7.1.	Probability of an Event	295
7.8.	Union and Intersection of Events	298
7.9.	Mutually Exclusive Events	298
7.9.1.	Complementary Events	299
7.10.	Addition Law of Probability	299
7.10.1.	Addition Theorem for Mutually Exclusive Events	301
7.11.	Complementary Events Rule	303
7.12.	Independent and Dependent Events	303
7.13.	Conditional Probability	304
7.14.	Multiplication Theorem of Probability	307
7.14.1.	Multiplication Theorem for Independent Events	308
7.15.	Repeated Independent Events	314
	<i>Exercises</i>	319
8.	Random Variable and Probability Distribution	
8.1.	Random Numbers	329
8.1.1.	Generation of Random Numbers	329
8.1.2.	Applications of Random Numbers	331
8.2.	Random Variable	331
8.2.1.	Discrete and Continuous Random Variables	331
8.3.	Discrete Probability Distribution	332
8.4.	Continuous Probability Distribution	336
8.6.	Distribution Function	341
8.7.	Mathematical Expectation	342
8.7.1.	Laws of Expectation	346
8.8.	The Variance and Standard Deviation	348
8.8.1.	Properties of Variance	349
	<i>Exercises</i>	349
	<i>Answers</i>	353