Chapter – 9
STATISTICS

Statistics deals with the collection, classification, presentation, analysis and interpretation of numeric data (quantitative data).

The simplest form of numerical data is a series of values of a certain variable. Such values can be given as individual numbers. Therefore, such data is called an individual series of raw data.

In such a series, some numbers could occur repeatedly. In such cases, it would be convenient to group these numbers. This grouping can be done in two ways. The numbers can be arranged in ascending (or descending) order and the number of times each number occurs (its frequency) can be specified. This results in a discrete series. Alternately, we may choose to ignore the actual number and record only the fact that it lies between certain limits. Such grouping results in a continuous series. The values between the limits are called intervals. For example, consider the marks obtained by the students of a class. This data has been represented in each of the ways below.

Individual series
60, 55, 70, 60, 70
65, 75, 65, 70, 55
58, 74, 67, 68, 73

Discrete series

Frequency	2	1	2	2	1	1	3	1	1	1
Number	55	58	60	65	67	68	70	73	74	75

Continuous series
We denote the marks obtained by the students as

Intervals	Frequency
$x \leq 55$	2
$55 < x \leq 60$	3
$60 < x \leq 65$	2
$65 < x \leq 70$	5
$70 < x \leq 75$	3

Collection of data, especially on a large scale, is typically an expensive process and requires big teams of field workers. Therefore it needs careful planning. The primary consideration is the purpose for which the collected data will be used

After data has been collected, classified and presented, it has to be analysed and interpreted. To analyse data, the important features of the data have to be identified and relations between quantities (variables) have to be studied. Two important features of any data are the central tendency and dispersion. Instead of thinking of all the numbers in a set, we would like to think of a typical number, the 'central' value. Two sets of numbers, which may have the same 'central' value, may differ in terms of the variation of all the numbers in the set, i.e. the extent to which the numbers 'disperse' from this central value.

Various quantitative measures can be defined to measure these two properties, ie central tendency and dispersion.

In this chapter, we shall limit ourselves to an individual series and study such properties.

I. Measures of Central Tendencies

The measures we discuss here are
(A) Arithmetic Mean,
(B) Geometric Mean,
(C) Harmonic Mean,
(D) Median and
(5) Mode.

1. Arithmetic Mean (A.M.) ($\bar{x}$)

Given $x_1, x_2, \ldots\ldots, x_n$ (n individual items)

$$A.M. = \bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

or $\bar{x} = \dfrac{\text{Sum of the observations}}{\text{The number of observations}}$

Examples

(i) The arithmetic mean of (5, 8, 9, 14, −16) is
$= \dfrac{5 + 8 + 9 + 14 - 16}{5} = \dfrac{20}{5} = 4$

(ii) The arithmetic mean of (3, 4, 5, 6, 7, 8, 9, 10) is
$= \dfrac{3 + 4 + 5 + 6 + 7 + 8 + 9 + 10}{8} = \dfrac{52}{10} = 5.2$

Note:
(a) The algebraic sum of deviations about the mean is 0 or $\Sigma(x - \bar{x}) = 0$.
(b) The arithmetic mean of two numbers a, b is $\dfrac{a + b}{2}$.
(c) If b = AM of (a, c), then a, b and c are in arithmetic progression.

2. Geometric Mean (G.M.)

Given $x_1, x_2, \ldots\ldots, x_n$ (n individual items all being positive)

$$G.M. = (x_1 \cdot x_2 \cdot \ldots\ldots, x_n)^{1/n}$$

or G.M. = n^{th} root of the product of the numbers.

Examples

(i) The geometric mean of (10, 30, 90) is
$= (10 \times 30 \times 90)^{1/3}$
$= (10 \times 30 \times 3 \times 30)^{1/3}$
$= (30 \times 30 \times 30)^{1/3} = 30$

(ii) The geometric mean of (24, 20, 15, 45, 75) is
$= (8 \times 3 \times 5 \times 4 \times 3 \times 5 \times 3^2 \times 5 \times 3 \times 5^2)^{1/5}$
$= (2^9 \times 3^5 \times 5^5)^{1/5}$
$= 2 \times 3 \times 5 = 30$

Mathematics Course 3 Chapter 9 Statistics And Matrices

Fletcher Dunn,Ian Parberry

Mathematics Course 3 Chapter 9 Statistics And Matrices:

Matrix Mathematics Dennis S. Bernstein,2009-07-06 When first published in 2005 Matrix Mathematics quickly became the essential reference book for users of matrices in all branches of engineering science and applied mathematics In this fully updated and expanded edition the author brings together the latest results on matrix theory to make this the most complete current and easy to use book on matrices Each chapter describes relevant background theory followed by specialized results Hundreds of identities inequalities and matrix facts are stated clearly and rigorously with cross references citations to the literature and illuminating remarks Beginning with preliminaries on sets functions and relations Matrix Mathematics covers all of the major topics in matrix theory including matrix transformations polynomial matrices matrix decompositions generalized inverses Kronecker and Schur algebra positive semidefinite matrices vector and matrix norms the matrix exponential and stability theory and linear systems and control theory Also included are a detailed list of symbols a summary of notation and conventions an extensive bibliography and author index with page references and an exhaustive subject index This significantly expanded edition of Matrix Mathematics features a wealth of new material on graphs scalar identities and inequalities alternative partial orderings matrix pencils finite groups zeros of multivariable transfer functions roots of polynomials convex functions and matrix norms Covers hundreds of important and useful results on matrix theory many never before available in any book Provides a list of symbols and a summary of conventions for easy use Includes an extensive collection of scalar identities and inequalities Features a detailed bibliography and author index with page references Includes an exhaustive subject index with cross referencing *Research in Education* ,1971 *Resources in Education* ,1992 **Unified Modern Mathematics, Course 1-3** Secondary School Mathematics Curriculum Improvement Study,1968 Mathematics Michael Sullivan,Abe Mizrahi,2004-06-01 Looking for a textbook to help you motivate your students Sullivan Mizrahi s Mathematics An Applied Approach 8 e continues its rich tradition of engaging students and demonstrating how mathematics applies to various fields of study The text is packed with real data and real life applications to business economics social and life sciences The new Eighth Edition also features a new full color design and improved goal oriented pedagogy to further help student understanding **Statistics of Directional Data** K. V. Mardia,2014-07-03 Probability and Mathematical Statistics A Series of Monographs and Textbooks Statistics of Directional Data aims to provide a systematic account of statistical theory and methodology for observations which are directions The publication first elaborates on angular data and frequency distributions descriptive measures and basic concepts and theoretical models Discussions focus on moments and measures of location and dispersion distribution function corrections for grouping calculation of the mean direction and the circular variance interrelations between different units of angular measurement and diagrammatical representation The book then examines fundamental theorems and distribution theory point estimation and tests for samples from von Mises populations The text takes a look at non parametric tests distributions on spheres and

inference problems on the sphere Topics include tests for axial data point estimation distribution theory moments and limiting distributions and tests of goodness of fit and tests of uniformity The publication is a dependable reference for researchers interested in probability and mathematical statistics   *Numerical Linear Algebra* SUNDARAPANDIAN, V.,2008-04-23 This well organized text provides a clear analysis of the fundamental concepts of numerical linear algebra It presents various numerical methods for the basic topics of linear algebra with a detailed discussion on theory algorithms and MATLAB implementation The book provides a review of matrix algebra and its important results in the opening chapter and examines these results in the subsequent chapters With clear explanations the book analyzes different kinds of numerical algorithms for solving linear algebra such as the elimination and iterative methods for linear systems the condition number of a matrix singular value decomposition SVD of a matrix and linear least squares problem In addition it describes the Householder and Givens matrices and their applications and the basic numerical methods for solving the matrix eigenvalue problem Finally the text reviews the numerical methods for systems and control Key Features Includes numerous worked out examples to help students grasp the concepts easily Provides chapter end exercises to enable students to check their comprehension of the topics discussed Gives answers to exercises with hints at the end of the book Uses MATLAB software for problem solving Primarily designed as a textbook for postgraduate students of Mathematics this book would also serve as a handbook on matrix computations for scientists and engineers   **3D Math Primer for Graphics and Game Development** Fletcher Dunn,Ian Parberry,2002 Presents an introduction to the fundamental concepts of 3D math explaining vectors coordinate spaces matrices Euler angles geometric primitives representation techniques and more   **Math for Deep Learning** Ronald T. Kneusel,2021-12-07 Math for Deep Learning provides the essential math you need to understand deep learning discussions explore more complex implementations and better use the deep learning toolkits With Math for Deep Learning you ll learn the essential mathematics used by and as a background for deep learning You ll work through Python examples to learn key deep learning related topics in probability statistics linear algebra differential calculus and matrix calculus as well as how to implement data flow in a neural network backpropagation and gradient descent You ll also use Python to work through the mathematics that underlies those algorithms and even build a fully functional neural network In addition you ll find coverage of gradient descent including variations commonly used by the deep learning community SGD Adam RMSprop and Adagrad Adadelta   **Symbolic Mathematics for Chemists** Fred Senese,2018-11-05 An essential guide to using Maxima a popular open source symbolic mathematics engine to solve problems build models analyze data and explore fundamental concepts Symbolic Mathematics for Chemists offers students of chemistry a guide to Maxima a popular open source symbolic mathematics engine that can be used to solve problems build models analyze data and explore fundamental chemistry concepts The author a noted expert in the field focuses on the analysis of experimental data obtained in a laboratory setting and the fitting of data and modeling experiments The text contains a wide variety of illustrative

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