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B.COM HONOURS	SEMESTER 4	CALICUT UNIVERSITY	COURSE CODE: COM4CJ205

BUSINESS STATISTICS

EXAM REVISION NOTES

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MODULE I

INTRODUCTION TO BUSINESS STATISTICS

Conceptual Evolution and Definitions of Business Statistics: The term "Statistics" is etymologically rooted in the Latin word "status", the Italian word "statista", or the German term "Statistik", each historically denoting a political state or sovereign council.

- **Business Statistics:** With the advent of the Industrial Revolution, the expansion of joint-stock corporations, and the explosion of digital commerce, statistics transcended state demographic records to become an indispensable quantitative science.

Limitations and Distrust of Statistics: " This distrust arises not from defects in the science itself, but from its misuse by unscrupulous practitioners.

- **Does Not Study Qualitative Phenomena Directly:** Statistics deals exclusively with quantifiable numerical data.
- **Does Not Deal with Isolated Individuals:** Statistical laws apply to aggregate groups and populations; statistics has no meaning when applied to a single isolated observation.
- **Statistical Laws are True Only on Average:** Unlike the immutable laws of natural sciences (physics or chemistry), statistical conclusions represent probabilistic tendencies that hold true in the aggregate over the long run, not exact certainties.
- **Susceptible to Manipulation and Misuse:** Untrained or biased analysts can selectively present figures, manipulate chart scales, or draw misleading conclusions from unrepresentative samples to advance preconceived corporate or political agendas.

A. Measures of Central Tendency (Statistical Averages): Central tendency refers to the central or typical value around which numerical data tends to cluster:

- **Arithmetic Mean (X^-):** The Sum of of all observations divided by the total number of observations:$X^-=N\sum X$(Individual Series);$X^-=N\sum fX$ (Discrete / Continuous Series) Mathematical Property: The algebraic Sum of of deviations of all values from their arithmetic mean is always zero: (Sum of $X-X^-$ = 0).
- **Mode (Z):** Mode (Z): The value that occurs with the greatest frequency in a distribution.
- **Empirical Relationship for Moderately Asymmetrical Distributions:** $Mode=3,Median-2,MeaniffZ=3M-2X^-$

Skewness (Asymmetry of Distribution)

Comprehensive Numerical Illustrations

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Executive Synthesis, Governance Policy, and Continuing Professional Mastery: To conclude, mastery of the concepts examined throughout this module empowers students and commerce executives to evaluate complex fiscal data with precision, independence, and analytical clarity.

Comparative Regulatory and Practical Implementation Standards: A rigorous examination of corporate commercial practice highlights the indispensable role of standardized accounting principles.

Empirical Casework: Forensic Analysis, Audit Trail Verification, and Internal Controls: Empirical accounting investigations across modern industrial enterprises illustrate that financial distortion, fraud, and misstatement rarely occur as isolated incidents; rather, they stem from structural vulnerabilities within accounting workflows, segregation-of-duties lapses, or inadequate internal audit scrutiny.

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MODULE II

CORRELATION AND REGRESSION ANALYSIS

FOUNDATIONAL CONCEPTS OF BIVARIATE RELATIONSHIPS: In corporate and economic systems, variables rarely operate in isolation. Managerial decisions depend critically upon understanding how alterations in one market factor correspond with variations in another.

Taxonomy of Correlation: Statistical theory categorizes correlation across three distinct dimensions based on direction, linearity, and number of variables under examination:

- **1. Direction of Change:** Positive (Direct) Negative (Inverse); • Positive: Both variables move in the identical direction (Change in X > 0 implies Change in Y > 0).
- **2. Ratio of Variation:** Linear Correlation Curvilinear (Non-linear); • Linear: The amount of change in one variable bears a strictly constant ratio to the change in the other variable.
- **3. Number of Variables:** Simple Correlation Partial Correlation Multiple Correlation; • Simple: Studies mutual co-variation between exactly two variables ((X) and (Y)).

Perfect Negative Correlation (r = -1.0)

Alternative Operational Formulas for Computation: In applied business statistics, direct computation from actual arithmetic means becomes cumbersome when X^- or Y^- results in fractional values.

Property 2: Invariance to Origin and Scale

Rules for Interpreting Correlation via Probable Error

- **Condition 1 (Absence of Significance):** _r), the correlation is not significant.
- **Condition 2 (Definite Significance):** r, the correlation is definitely significant.
- **Condition 3 (Inconclusive Zone):** r, the relationship is weak or inconclusive; no definitive decision can be drawn without increasing sample size.
- **Confidence Band:** 73% confidence)

Handling Tied / Repeated Ranks (Correction Factor): When two or more items possess identical numerical values, they cannot be awarded distinct integer ranks. Under the bracket rank procedure, each tied observation is assigned the arithmetic mean of the ranks they would have occupied if they were distinct.

Principle of Ordinary Least Squares (OLS): The standard criterion for fitting a line of best fit through scattered bivariate data is the Principle of Least Squares.

Regression Equation of (X) on (Y)

Common Sign Property

Point of Intersection

Standard Error of Estimate ((S(yx)) and (S(xy))): The Standard Error of Estimate measures the dispersion of actual observed values around the fitted regression line, providing an index of forecasting accuracy:

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MODULE III

SET THEORY AND PROBABILITY

SET THEORY: FOUNDATIONS NOTATIONAL ARCHITECTURE: Modern mathematical probability is constructed upon the structural language of Set Theory, originally formulated by Georg Cantor.

Taxonomy of Sets in Quantitative Analysis

- **1. Null / Empty Set (emptyset):** A set containing zero elements: (|emptyset| = 0).
- **2. Universal Set ((U) or (Omega)):** ; The master database containing all active credit cardholders of a financial institution.
- **3. Finite vs. Infinite Set:** • Infinite: The set of real-number exchange rate fluctuations over continuous time.
- **4. Subset Proper Subset:** (A subseteq B) if (forall x in A implies x in B).

Intersection (A ∩ B)

Fundamental Laws of Set Algebra: Set operations conform to precise algebraic identities that mirror probability calculations:

- **1. Idempotent Laws:** (A ∪ A = A); (A ∩ A = A)
- **2. Commutative Laws:** (A ∪ B = B ∪ A); (A ∩ B = B ∩ A)
- **3. Associative Laws:** ((A ∪ B) ∪ C = A ∪ (B ∪ C)); ((A ∩ B) ∩ C = A ∩ (B ∩ C))
- **4. Distributive Laws:** (A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C)); (A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C))

Fundamental Principle of Multiplication

FOUNDATIONAL CONCEPTS TERMINOLOGY OF PROBABILITY: Probability theory formalizes the quantitative measurement of uncertainty. Essential terminology includes:

Events (Simple vs. Compound)

Independent Events

Theorem of Total Probability (Addition Rules)

Mathematical Architecture of Bayes' Theorem: , B(k)) constitute a set of mutually exclusive and exhaustive events (a complete partition of sample space (S)) with known non-zero prior probabilities (P(B(i))).

- **Prior Probability:** Initial assessment of the likelihood of cause or state of nature (B(i)) before observing sample data.
- **Likelihood (Conditional):** (P(A | B(i))); The conditional probability of observing evidence (A) given that cause (B(i)) actually exists.

- **Joint Probability:** (P(B(i) ∩ A) = P(B(i)) · P(A | B(i))); The simultaneous probability of both cause (B(i)) occurring and evidence (A) being observed.
- **Posterior Probability:** (P(B(i) | A)); The revised, updated probability of cause (B(i)) after taking concrete empirical evidence (A) into account.

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MODULE IV

THEORETICAL DISTRIBUTIONS

RANDOM VARIABLES PROBABILITY DISTRIBUTIONS: An empirical frequency distribution is derived through actual experimental observation and tallying. In contrast, a Theoretical Probability Distribution is a mathematical rule or function that assigns a probability to each conceivable numerical value that a random variable can assume under specified theoretical assumptions.

Taxonomy: Discrete vs. Continuous Probability Distributions

- **1. Nature of Variable:** ; The random variable assumes any value within an unbroken continuous interval (a≤X≤b).
- **2. Governing Function:** ; Probability Density Function (PDF): (f(x)).
- **3. Fundamental Conditions:** 1.
- **4. Exact Point Probability:** ; Strictly zero: (P(X = c) = Integral of f(x) dx = 0).

Probability Mass Function of the Binomial Distribution

- (n) = Total number of trials.
- (r) = Number of successful outcomes (0≤r≤n).
- (p) = Probability of success in a single trial.
- (q = 1 - p) = Probability of failure in a single trial.

Universal Inequity: Mean > Variance

THE POISSON DISTRIBUTION (LAW OF RARE EVENTS): Introduced in 1837 by French mathematician Siméon Denis Poisson, the Poisson Distribution is a discrete probability distribution applicable when the probability of occurrence of an event is extremely small, but the total number of opportunities for occurrence is exceedingly large.

Single Parameter (λ)

Additive (Reproductive) Property

Empirical Area Properties Under the Normal Curve (The Empirical Rule)

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