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BBA	SEMESTER 2	CALICUT UNIVERSITY	COURSE CODE: BBA2FM101

FOUNDATION IN BUSINESS ANALYTICS

EXAM REVISION NOTES

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MODULE I

FOUNDATIONS OF BUSINESS ANALYTICS & DESCRIPTIVE STATISTICS

The Business Analytics Paradigm: Business analytics is universally structured across three evolutionary analytical tiers:

- **Descriptive Analytics:** , quarterly sales reports, customer churn rates).
- **Predictive Analytics:** , credit scoring models, demand projections).
- **Prescriptive Analytics:** , algorithmic airline pricing, supply chain network optimization).

Taxonomy of Business Data and Scales of Measurement: Data analysis requires strict identification of the underlying scale of measurement, which dictates the permissible mathematical and statistical operations:

- **Nominal:** ; Customer gender, payment mode (UPI, Card, Cash), product category.
- **Ordinal:** ; Customer satisfaction ratings (Likert scale 1–5), bond credit ratings (AAA to D).
- **Interval:** ; Temperature Fahrenheit/Celsius, credit bureau risk score indices.
- **Ratio:** ; Sales revenue ($), inventory turnover, operational cycle days, production units.

Measures of Central Tendency: Measures of central tendency locate the single representative value around which a distribution clusters:

- **Arithmetic Mean ($\bar{X}$):** The Sum of of all observations divided by the total number of observations.
- **Mode (Z):** The observation that appears with the greatest frequency.

Measures of Dispersion and Relative Variation: Central tendency alone is inadequate; two distributions can share an identical mean of 50 while one has observations clustered tightly between 48 and 52 and the other ranges wildly from 0 to 100.

Skewness, Kurtosis, and Exploratory Data Visualization: The shape of an empirical frequency distribution is analyzed through third and fourth statistical moments:

- **Skewness:** Measures the asymmetry of the distribution around its mean.
- **Kurtosis:** Measures the peakedness and tail heaviness of a distribution relative to a standard normal curve.

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MODULE II

PROBABILITY THEORY & THEORETICAL PROBABILITY DISTRIBUTIONS

Fundamental Concepts and Probability Axioms: In probabilistic modeling, an Experiment represents any process generating well-defined outcomes. The Sample Space (S) constitutes the universal set of all mutually exclusive elementary outcomes.

- **Non-negativity:** $0 \leq P(A) \leq 1$.
- **Certainty of the Sample Space:** $P(S)=1$.
- **Additivity for Mutually Exclusive Events:** If AcapB=emptyset, then P(AcupB)=P(A)+P(B).

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Rules of Probability & Bayes' Theorem: When events are not mutually exclusive (they can occur simultaneously):

Discrete Probability Distributions: The Binomial distribution models the number of successes (r) across n independent Bernoulli trials, where each trial yields only two possible outcomes (success or failure) with constant success probability p:

Continuous Probability Distributions: The Normal Distribution: The Normal (Gaussian) Distribution is the single most vital distribution in statistical inference and business analytics.

- **Standard Normal Variable (Z):** To evaluate probabilities for any normally distributed random variable X, it is transformed into the , which has a mean of 0 and a standard deviation of 1:
- **mu±1sigma:** 0; Baseline central operating zone.
- **mu±2sigma:** 0; Statistical control limits in process charts.
- **mu±1.96sigma:** 96; Standard 95% Confidence Interval critical threshold.

The Central Limit Theorem (CLT): The Central Limit Theorem (CLT) is the theoretical foundation of inferential statistics. It states that as sample size n increases (n≥30), the sampling distribution of the sample mean (X^{-}) approaches a normal distribution, regardless of the underlying shape of the parent population distribution.

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MODULE III

SAMPLING METHODOLOGIES, STATISTICAL ESTIMATION & HYPOTHESIS TESTING

Scientific Sampling Techniques: Sampling designs are fundamentally classified into probability and non-probability sampling:

- **Probability Sampling:** Every element in the target population has a known, non-zero probability of selection, permitting mathematical computation of sampling error: Simple Random Sampling (SRS): Every member has an equal selection likelihood, executed via random number generators.
- **Stratified Random Sampling:** , income brackets, company sizes), and random samples are drawn proportionally from each stratum.
- **Cluster Sampling:** The population is divided into heterogeneous geographic clusters; entire clusters are randomly selected for enumeration.
- **Systematic Sampling:** Selecting every k-th item from an ordered list (k=N/n) after a random start.
- **Non-Probability Sampling:** Selection relies on subjective researcher judgment or convenience, precluding objective statistical error bounds: Convenience Sampling: Enrolling readily accessible subjects (intercepting shoppers at a mall entrance).

Statistical Estimation and Confidence Intervals: Parameter estimation bridges sample statistics with true population values:

- **Point Estimate:** , sample mean X^{-} estimating population mean mu).
- **Interval Estimate (Confidence Interval):** A range of values constructed around the point estimate that contains the true population parameter with a specified probability (1−alpha): Confidence Interval = barX ± Zalpha/2 · left((sigma) / (√(n)) right)

The Formal Hypothesis Testing Framework: Hypothesis testing is a structured statistical protocol designed to determine whether empirical sample evidence warrants rejecting a stated proposition about a population parameter.

- **Formulate the Hypotheses:** , H0:mu=50).
- **Alternative Hypothesis (H1 or Ha):** , $H1 : mue50foratwo - tailedtest, orH1 : mu > 50$ for a one-tailed directional test).
- **Specify the Level of Significance (alpha):** 01 (1%).
- **Select the Appropriate Test Statistic:** Dictated by sample size (n), knowledge of population variance (sigma2), and data scale (Z-test, t-test, Chi-Square, ANOVA).
- **Establish the Critical Value and Decision Rule:** Determine critical thresholds separating the acceptance region from the rejection region.

Parametric vs. Non-Parametric Hypothesis Tests: Utilized when testing means with large samples or known population variance:

- **Goodness of Fit:** Testing whether sample frequencies conform to a hypothesized theoretical distribution.
- **Test of Independence of Attributes:** , customer brand preference vs.
- **Student's t-Distribution:** 2 Student's t-Test (Small Samples, n<30) When the population variance is unknown and the sample is small, the sampling distribution follows William Sealy Gosset's with n−1 degrees of freedom (df):

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MODULE IV

CORRELATION, REGRESSION MODELING & TIME SERIES FORECASTING

Bivariate Correlation Analysis: Correlation examines the degree of covariation between two numeric variables without asserting causal dependence:

Linear Regression Analysis: While correlation merely quantifies association, Regression Analysis estimates the mathematical function linking an independent predictor variable (X) to a dependent outcome variable (Y):

- **Ordinary Least Squares (OLS):** Under the principle, the parameters a and b are computed to minimize the Sum of of squared vertical residuals (∑ei2=∑(Yi−hatYi)2):
- **Coefficient of Determination (R2):** The measures the proportion of total variation in the dependent variable explained by the regression model:
- **Adjusted R2:** 85 signifies that 85% of the variance in corporate sales is statistically explained by advertising expenditures, while the remaining 15% is attributable to residual stochastic noise.

Time Series Analysis and Business Forecasting: A Time Series is a sequence of quantitative observations recorded across successive, uniform time intervals (daily stock prices, monthly sales revenues, annual GDP).

- **Additive Model:** Assumes components are independent and expressed in original physical units: Yt=Tt+St+Ct+It
- **Multiplicative Model:** Assumes seasonal and cyclical variations operate as percentage proportions of the underlying trend: Yt=Tt×St ×Ct×It
- **Moving Averages:** Smoothes out short-term seasonal and random fluctuations by computing successive rolling averages over a window of length m.
- **Method of Least Squares (Linear Trend Fitting):** Fitting a linear mathematical trend equation (Y=a+bX) where time is indexed symmetrically (∑X=0), simplifying parameter estimation to: a=n∑Y andb=∑X2∑XY

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