QUANTITATIVE ANALYSIS

CPA
CCP
CIFA

PART II

Section 4

STUDY TEXT

KASNEB JULY 2018 SYLLABUS

Revised on: January 2019
CONTENT

1. Basic mathematical techniques
   Functions
   - Functions, equations and graphs: Linear, quadratic, cubic, exponential and logarithmic
   - Application of mathematical functions in solving business problems

   Matrix algebra
   - Types and operations (addition, subtraction, multiplication, transposition, and inversion)
   - Application of matrices: statistical modelling, Markov analysis, input-output analysis and general applications

   Calculus
   - Differentiation
     • Rules of differentiation (general rule, chain, product, quotient)
     • Differentiation of exponential and logarithmic functions
     • Higher order derivatives: Turning points (maxima and minima)
     • Ordinary derivatives and their applications
     • Partial derivatives and their applications
     • Constrained Optimisation; lagrangian multiplier
   - Integration
     • Rules of integration
     • Applications of integration to business problems

2. Probability
   Set theory
   - Types of sets
   - Set description: Enumeration and descriptive properties of sets
   - Operations of sets: Union, intersection, complement and difference
   - Venn diagram

   Probability theory and distribution
   - Definitions: Event, outcome, experiment, sample space
   - Types of events: Elementary, compound, dependent, independent, mutually exclusive, exhaustive, mutually inclusive
   - Laws of probability: Additive and multiplicative rules - Baye's Theorem
   - Probability trees
   - Expected value, variance, standard deviation and coefficient of variation using frequency and probability

   Probability distributions
   - Discrete and continuous probability distributions (uniform, normal, binomial, poisson and exponential)
   - Application of probability to business problems
3. Hypothesis testing and estimation
   - Hypothesis tests on the mean (when population standard deviation is unknown)
   - Hypothesis tests on proportions
   - Hypothesis tests on the difference between means (independent samples)
   - Hypothesis tests on the difference between means (matched pairs)
   - Hypothesis tests on the difference between two proportions

4. Correlation and regression analysis
   **Correlation analysis**
   - Scatter diagrams
   - Measures of correlation - product moment and rank correlation coefficients (Pearson and Spearman)

   **Regression analysis**
   - Assumptions of linear regression analysis
   - Coefficient of determination, standard error of the estimate, standard error of the slope, t and F statistics
   - Computer output of linear regression
   - T-ratios and confidence interval of the coefficients
   - Analysis of Variances (ANOVA)
   - Simple and multiple linear regression analysis

5. Time series
   - Definition of time series
   - Components of time series (circular, seasonal, cyclical, irregular/random, trend)
   - Application of time series
   - Methods of fitting trend: free hand, semi-averages, moving averages, least squares methods
   - Models- additive and multiplicative models
   - Measurement of seasonal variation using additive and multiplicative models
   - Forecasting time series value using moving averages, ordinary least squares method and exponential smoothing
   - Comparison and application of forecasts for different techniques

6. Linear programming
   - Definition of decision variables, objective function and constraints
   - Assumptions of linear programming
   - Solving linear programming using graphical method
   - Solving linear programming using simplex method
   - Sensitivity analysis and economic meaning of shadow prices in business situations
   - Interpretation of computer assisted solutions
   - Transportation and assignment problems

7. Decision theory
   - Decision process
- Decision making environment - deterministic situation (certainty), analytical hierarchical approach (AHA), risk and uncertainty, stochastic situations (risk), situations of uncertainty
- Decision making under uncertainty - maximin, maximax, minimax regret, Hurwicz decision rule, Laplace decision rule
- Decision making under risk - expected monetary value, expected opportunity loss, minimising risk using coefficient of variation, expected value of perfect information
- Decision trees - sequential decision, expected value of sample information
- Limitations of expected monetary value criteria

8. Game theory
   - Assumptions of game theory
   - Zero sum games
   - Pure strategy games (saddle point)
   - Mixed strategy games (joint probability approach)
   - Dominance, graphical reduction of a game
   - Value of the game.
   - Non zero sum games
   - Limitations of game theory

9. Network planning and analysis
   - Basic concepts - network, activity, event
   - Activity sequencing and network diagram
   - Critical path analysis (CPA)
   - Float and its importance
   - Crashing of activity/project completion time
   - Project evaluation and review technique (PERT)
   - Resource scheduling (levelling) and Gantt charts
   - Limitations and advantages of CPA and PERT

10. Queuing theory
    - Components/elements of a queue: arrival rate, service rate, departure, customer behaviour, service discipline, 'finite and infinite queues, traffic intensity
    - Elementary single server queuing systems
    - Finite capacity queuing systems
    - Multiple server queues

11. Simulation
    - Types of simulation
    - Variables in a simulation model
    - Construction of a simulation model
    - Monte Carlo simulation
    - Random numbers selection
    - Simple queuing simulation: Single server, single channel "first come first served" (FCFS) model
    - Application of simulation models
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