

QUANTITATIVE ANALYSIS

**CPA
CCP
CIFA**

PART II

Section 4

STUDY TEXT

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*SomeaKenya - Sample notes
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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 Probability theory

- 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

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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

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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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