

Mathematics for Business I

Assignment Guidelines:

This project evaluates the application of fundamental linear algebra, matrix operations, systems of linear equations, and quantitative modelling to analyse and solve business-related problems in tourism and hospitality. Students are expected to translate real-world operational scenarios into formal mathematical models, execute accurate computational methods (leveraging tools such as Excel), and interpret quantitative findings to guide strategic decision-making.

Submission Format:

- Type: Practical Analytical & Quantitative Report
- Font/Spacing: Times New Roman, Size 12, Double Spaced
- Word Count: 1500 – 2500 words (excluding mathematical proofs, matrix calculations, and spreadsheet output appendices)
- Submission Deadline: To be announced by the respective professors

Assessment Criteria:

- Application of linear algebra concepts and matrix formulations – 20%
- Critical interpretation of mathematical results in economic and business contexts – 25%
- Accuracy of computational modelling, spreadsheet implementation, and formal structure – 20%
- Strategic business insight and quantitative recommendations – 25%
- Structure, technical reporting clarity, presentation, and APA referencing – 10%

Mandatory Sections:

- Title Page
- Table of Contents
- Executive Summary
- Introduction
- Mathematical Modelling & Problem Formulation
- Matrix Analysis & Computational Results
- Economic & Business Interpretation
- Managerial Implications & Recommendations
- Conclusion
- References
- Appendices (Mathematical Proofs & Spreadsheet Outputs)

Assignment Task – Choose ONE of the following practical research projects:

Option 1: Linear Matrix Algebra and Resource Allocation in Hotel Operations

Analyse how hotel operations optimise room allocation, housekeeping labour, and resource constraints using systems of linear equations and matrix inversion. Your paper should:

- Develop a set of linear equations expressing the resource constraints (for example, labour hours, types of rooms, maintenance budgets) for a hotel chain with multiple properties.

- Apply matrix manipulations to determine optimal allocation of resources in the operational departments.
- Use shadow prices and sensitivities in the linear program to determine how changes in resource availability affect total operating cost.
- Present a quantitative decision model for hotel line managers to apply in the distribution of operating resources in peak vs. nonpeak seasons.

Option 2: Input-Output Matrix Modelling for Regional Tourism Economics

Investigate inter-sectoral economic dependencies and tourist spending multipliers across regional destination economies using Leontief Input-Output models. Your paper should:

- Develop a simplified Leontief input-output matrix for interrelations between tourism sub-sectors (e.g., accommodation, transport, food & beverage, recreation).
- Determine the technical coefficient matrices and the identity-minus-A inverse matrix to simulate the direct and indirect economic effects of a variation in tourists' expenditure.
- Contrast the traditional linear economic assumptions with the economic volatility and supply chain disruptions experienced in real life in regional destinations.
- Propose a data-driven policy system for Destination Management Organisations (DMOs) to maximise their economic yields based on input-output findings.

Option 3: Linear Programming and Dynamic Yield Optimisation in Airline and Travel Pricing

Evaluate linear programming models and system equations to solve revenue management and inventory allocation problems in travel service operations. Your paper should:

- Describe the objectives and the linear constraints for the ticket or room inventory pricing classes under capacity limit constraints.
- Construct and solve a linear programming model with spreadsheet tools to maximise total booking revenue.
- Test model sensitivity to dynamic demand changes, seasonality, and competitor prices.
- Create a best-in-class inventory allocation solution that generates maximum capacity utilisation and yield performance for mid-sized travel operators.