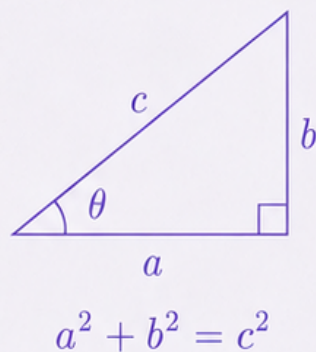




$$i\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \psi + V\psi$$

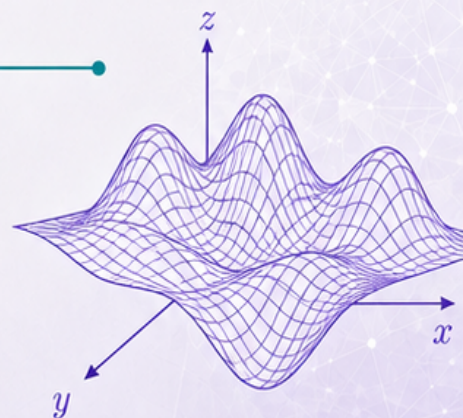
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



MINI-SYMPOSIUM

— 2026 —

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The Department of Mathematics
in collaboration with

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of
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January 14, 2026

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Faculty of Science
University of Ruhuna
Matara 81000
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Message from the Dean, Faculty of Science

It is with great pleasure that I extend my greetings to all contributors and participants of the 5th Mini Symposium of the Department of Mathematics.

Mathematics stands at the heart of scientific inquiry, technological advancement, and informed decision-making. For undergraduate students, it provides not only theoretical knowledge but also a strong foundation in logical reasoning, analytical thinking, and problem solving skills that are essential across all disciplines.

This symposium serves as an important platform for young scholars to share ideas, explore emerging concepts, and appreciate the relevance of mathematics in addressing real-world challenges. As today's undergraduates and tomorrow's graduates, you carry the responsibility of applying mathematical knowledge with integrity, creativity, and innovation for the betterment of society.

I commend the organizers and contributors for their dedication in making this event a success and wish the symposium every success in fostering academic excellence and intellectual growth.



Senior Prof. D.H.N. Munasinghe

Dean of the Faculty,
Faculty of Science,
University of Ruhuna.



Message from the Head, Department of Mathematics

It is my great pleasure to extend a warm and heart-felt welcome to all of you to the 5th Mini Symposium organized by the Department of Mathematics. In today's rapidly evolving world, we are witnessing continuous transformation across various sectors, driven by advancements in knowledge, technology, and innovation. Such transformation requires continuous efforts in research, collaboration, knowledge sharing, and skill development. However, meaningful progress does not take place in isolation; rather, it is achieved through teamwork, effective communication, and the development of strong interpersonal skills.



This Mini Symposium provides an excellent platform for our students pursuing Industrial Mathematics, Financial Mathematics, and Industrial Statistics to present their research findings, exchange ideas, and enhance these essential skills. Through this academic engagement, students gain valuable experience in scientific communication, critical thinking, and applying mathematical concepts to address real-world challenges.

Furthermore, this symposium aims to encourage meaningful discussions that strengthen academic knowledge while creating a bridge between theoretical mathematics and its practical applications in various fields. We hope that all participants will gain maximum benefit from this event and be inspired to explore new dimensions of mathematics and its impact on society.

I would like to express my sincere appreciation to the organizing committee, presenters, sponsors, and everyone who has contributed their valuable time, effort, and support towards the successful organization of the 5th Mini Symposium. Your dedication and commitment are highly commendable.

I wish all participants an enjoyable, inspiring, and fruitful experience throughout the symposium.

Prof. B.G.S.A. Pradeep
Head of the Department,
Department of Mathematics,
University of Ruhuna, Matara



Message from the Keynote Speaker

It is a great honour to serve as the Keynote Speaker at the Mini-Symposium 2026 organized by the Department of Mathematics, University of Ruhuna, in collaboration with the Ruhuna University Mathematics and Statistics Society (RUMSS) and the Actuarial and Data Science Society (ADSS). As an alumnus of the University of Ruhuna, I am particularly pleased to be associated with this important academic event. The strong foundation I received in Mathematics and Physics during my undergraduate studies here has greatly influenced my professional journey in operational meteorology and weather forecasting.



Today, mathematics, statistics, and data science play a vital role in addressing many global challenges, including weather forecasting, climate analysis, and disaster risk reduction. Modern forecasting systems rely heavily on mathematical models, satellite data, and advanced data analysis, highlighting the importance of interdisciplinary collaboration.

I commend the Department of Mathematics, the organizing committee, RUMSS, and ADSS for their efforts in organizing this valuable symposium. Such initiatives provide excellent opportunities for researchers and students to share knowledge, exchange ideas, and explore new research directions.

I wish the Mini-Symposium 2026 every success.

Mr. M.M.P. Mendis

Director of Forecasting,
Department of Meteorology, Sri Lanka



Message from the Chairperson Mini-Symposium 2026

It is a great pleasure to share this message for the 5th Mini Symposium organized by the Department of Mathematics, Faculty of Science, University of Ruhuna, in collaboration with the Ruhuna University Mathematics and Statistics Society (RUMSS) and the Actuarial and Data Science Society (ADSS). The event was successfully held on 14 January 2026 in celebration of International Mathematics Day 2026.

Since its inception in 2022, the Mini Symposium has provided undergraduate students with a valuable platform to present their research findings, encouraging engagement in research and fostering the development of future researchers and scientists.



On behalf of the organizing committee, I sincerely thank the Vice Chancellor, the Dean of the Faculty of Science, the Head of the Department of Mathematics, the academic staff, and the keynote speaker, Mr. Meril Mendis, for their guidance and support. I also extend my appreciation to all members of RUMSS and ADSS, the non-academic staff, sponsors, past graduates, and students whose contributions helped make this event a success.

Finally, I congratulate the organizing committee, all presenters, winners, participants, and their supervisors, and wish them continued success in their future research and academic endeavors.

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Session I

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level I

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An Efficient System for Managing Examination Supervisors and Invigilators.

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Background

Traditionally, universities assign supervisors and invigilators manually, usually resulting in scheduling clashes, overlooked duties, and unnecessary paperwork. Long printed timetables are often unwieldy and difficult to navigate, further increasing the likelihood that supervisors will miss their sessions. These limitations do point out the need for an automated system that is efficient and reliable to assist in examination management.

Objectives

To develop an efficient system that assigns supervisors and invigilators to examination sessions, manages staff profiles and session data, and uses a database-driven process to ensure accurate and timely allocations.

Methods

The system was developed using a hybrid approach combining C for the user interface and Python for core logic, data processing, and validation, while MySQL served as the database backend. The allocation model utilizes a logic-based algorithm to assign invigilators efficiently. The key variables defined in the study include staff availability, examination dates, and hall requirements. It is assumed that the provided staff information is accurate and up-to-date. However, the study is limited by the system's inability to handle last-minute schedule changes automatically without administrative intervention, despite the inclusion of a Python-based automated email notification system.

Results

The system was designed to automate invigilator and supervisor allocation by taking into account availability, qualifications, and the requirements of the exam sessions. The database ensured that accurate data retrieval was achieved while minimizing user errors. It reduced reliance on printed timetables by performing automated updates and email notifications, thus enhancing administrative efficiency.

Conclusions

The system developed here provides a practical and reliable solution for the management of examination staff. Its usage of C significantly enhances the accurateness and reduces manual workload. This framework is scalable and can be expanded further, including the addition of an improved graphical interface or more advanced optimization methods.

Keywords

Examination Management, Supervisor Allocation, Invigilator Scheduling, Administrative Efficiency, Staff Assignment System.



Minimalization of Functions using the Nelder-Mead Simplex Optimization Method

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Background

Optimization is an important part of solving problems in mathematics, engineering, and many applied fields. Many real-world problems use nonlinear functions that do not have simple or smooth shapes. In such cases, gradient-based methods are difficult to use. The Nelder-Mead simplex method is a derivative-free optimization technique that works well for these types of functions. This study focuses on understanding how the method works in two-dimensional space and how constraints can be included using penalty terms.

Objectives

The main objectives of this study are to apply the Nelder-Mead algorithm to minimize a nonlinear function, understand how constraints can be added using the penalty method, and observe how initial points and iteration counts affect the optimization results.

Methods

The Nelder-Mead algorithm was implemented using C programming to minimize a nonlinear function of two variables. The objective function was tested with an equality constraint of the form $x^2 - y = 0$. A penalty term was added to the objective function when the constraint was violated. The simplex of three points was updated using reflection, expansion, contraction, and shrinkage.

Results

The results showed that the Nelder-Mead method is sensitive to the initial points. As the number of iterations increased, the solution converged toward $[2,1]$ and the objective value approached 5.0000. With 1000 iterations, the algorithm reached $[2.0000,1.0000]$ with an objective value of 5.0000, confirming convergence to the minimum. The penalty method helped the algorithm satisfy the constraint.

Conclusion

The Nelder-Mead simplex method is easy to use and works well for optimizing nonlinear functions without using derivatives. However, to obtain accurate and reliable results, it is important to choose suitable initial points, penalty values, and the number of iterations.

Keywords

Constraints, Nelder-Mead, Optimization, Penalty Method.



A Simple Mathematical Model for Predicting Chemical Toxicity in Aquatic Fish Species

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Background

Chemical pollution in aquatic environments can result in the accumulation of toxic substances in fish, posing risks to aquatic ecosystems and human health. Although toxicity assessments are widely used to evaluate these effects, they are often costly, time-consuming, and ethically constrained. As an alternative, compartment-based toxicokinetic models offer a systematic framework for describing toxicant uptake and elimination in aquatic organisms, however, existing models are often limited in their ability to capture variability in exposure conditions and organism responses, highlighting the need for further model development.

Objectives

The objective of this study is to develop a simple one-compartment mathematical model to predict toxicant accumulation in fish and to quantify how uptake and elimination processes govern internal toxicity levels. The model is intended to support bioaccumulation prediction and provide quantitative insight relevant to environmental monitoring and risk assessment.

Methods

Toxicant accumulation in fish was modeled using a one-compartment, represented by a first-order ordinary differential equation for uptake and elimination. An analytical solution was derived for constant water contamination, while time-dependent contamination was addressed using the Forward Euler numerical method to obtain a practical solution. Future work will explore higher-order methods, such as the fourth-order Runge-Kutta scheme, for more accurate results.

Results

Under constant water contamination, the model predicts a rapid initial increase in fish toxicant concentration followed by convergence to a steady-state value determined by the uptake and elimination rate constants. Numerical solutions obtained using the Forward Euler method closely followed the analytical solution for sufficiently small time steps. When water contamination varied seasonally, fish toxicant concentrations exhibited periodic fluctuations with reduced amplitude and a delayed response relative to environmental variations, reflecting biological elimination processes.

Conclusion

The results indicate that toxicant bioaccumulation in fish is strongly influenced by both environmental exposure patterns and physiological rate parameters. Seasonal variations in water contamination lead to predictable, lagged internal toxicity responses. This model can help with preliminary environmental risk assessment and can be extended to identify key factors to manage contamination risks from toxicant accumulation in fish.

Keywords

Bioaccumulation, Compartment Model, Euler's Method, Fish Toxicity, Ordinary Differential Equation (ODE).



Estimate the Survival Probabilities of Leukemia Patients using Exponential Parametric Approaches

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Background

Leukemia is a type of cancer which causes harmful effects to the brain and bone marrow. The survival times of Leukemia patients vary considerably due to several factors.

Objectives

Estimating and visualizing the survival probabilities of Leukemia patients through survival analysis approaches.

Methods

The data was taken from Kaggle consisting of 21 data points with uncensored observations over a period of 25 years. The times to event follows an exponential distribution, the rate parameter was estimated using the Maximum Likelihood Estimator (MLE). A C program was built to calculate the estimate of the rate parameter. The survival probabilities were calculated using survival function that has been obtained using parametric approach of survival analysis. In order to get a deeper understanding on the survival dynamics and risk profiles corresponding to Leukemia, the survival function was visualized and the measures such as mean and median survival times were estimated.

Results

The estimated mean and median survival times of patients are 10.62 and 7.36 years respectively. The graphical outcomes of Survivorship function shows that the surviving probability of Leukemia patients has the highest value at the beginning of the study and it falls gradually with the time. The survival probabilities vary in between one and zero during the 25 years of study period.

Conclusion

The estimated mean and median survival times indicate that, Leukemia patients are expected to survive for about 10.6 years after diagnosis and there is a 50% chance to live more than 7.36 years after diagnosis of Leukemia. The lifetimes of Leukemia patients gradually decrease over time as they have a risk of death over time. The survival graph shows how the probability of surviving after 25 years converges to zero. Therefore these informations will be very useful for long-term patient treatment strategies.

Keywords

Leukemia, Exponential Distribution, MLE, Survival Analysis.



Session II

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level II

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Predicting Boston Housing Prices Using A Multiple Linear Regression Analysis

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Background

Urban housing markets are influenced by complex socioeconomic, geographic, and structural factors. The Boston Housing dataset provides a framework for statistically analyzing these relationships, crucial for urban planning and real estate investment.

Objectives

This study aims to build a Multiple Linear Regression (MLR) model to identify key predictors of median home values and interpret their effects, focusing on model diagnostics and validation.

Methods

Using the Boston Housing dataset, an MLR model was developed with median home value (medv) as dependent variable. Key predictors included crime rate, rooms per dwelling, and lower status population percentage. Outliers were removed using IQR method. Homoscedasticity was confirmed via the Breusch-Pagan test ($p > 0.05$), and multicollinearity was assessed using Variance Inflation Factor (VIF), with all retained predictors showing VIF values below 5.

Results

Percentage of lower status population (negative effect) and average rooms per dwelling (positive effect) were the most significant predictors. The model effectively explained housing price variance, providing approximately 70% accuracy.

Conclusion

Socioeconomic status and structural characteristics are paramount in determining Boston housing prices. The findings offer valuable insights for policymakers and demonstrate the effectiveness of MLR for analyzing complex housing market trends.

Keywords

Boston Housing Dataset, Housing Prices, Multiple Linear Regression, Real Estate Investment, Socio-economic Factors.



Modeling the S&P 500 Index Price Based on U.S. Economic Indicators

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Background

The S&P 500 Index reflects the U.S. equity market, tracking 500 leading companies. Its fluctuations are influenced by inflation, industrial output, Unemployment, and household income, as stock prices mirror expected future cash flows. While past studies link stock returns to GDP, CPI, and unemployment, issues like multicollinearity, autocorrelation, and major shocks, including the 2008 crisis and COVID-19 recession, limit their reliability, highlighting the need for updated analysis using recent data and robust methods.

Objectives

To identify how key U.S. macroeconomic indicators influence the S&P 500 Index and determine the direction and strength of these relationships.

Methods

This study used multiple linear regression to examine selected U.S. macroeconomic indicators on the S&P 500 from December 1993 to January 2023 with monthly FRED and Kaggle data with a sample size of 364. GDP was log-transformed, outliers addressed, and variables selected via exploratory analysis. The model was refined through backward elimination after VIF checks, and assumptions of linearity, normality, homoscedasticity, and autocorrelation were tested.

Results

GDP was removed due to multicollinearity. The final model, including five predictors, explained 89% of the variation in the S&P 500. Industrial production, CPI, and producer prices had positive effects, whereas Unemployment and personal income were negative. The model exhibited heteroscedasticity and strong positive autocorrelation.

Conclusion

The study shows U.S. macroeconomic conditions strongly influence the S&P 500. While the model explains index variation, assumption violations indicate future research should use time-series or robust regression for better predictions.

Keywords

S&P 500, CPI, Industrial Production, Multicollinearity, Autocorrelation



Predicting House Prices in Melbourne Using Multiple Linear Regression

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Background

Accurately forecasting house prices is crucial for buyers, sellers, investors, and policymakers in rapidly growing markets such as Melbourne. Understanding how structural property attributes influence price variation enables evidence-based decision-making in real estate valuation.

Objectives

This study aims to identify the key determinants of house prices in Melbourne and to develop a statistically robust multiple linear regression (MLR) model that explains price variation using property attributes.

Methods

Data preprocessing involved removing records with missing values and treating outliers using the interquartile range (IQR) method. A cleaned dataset of 1,329 observations from the Melbourne Housing Snapshot (2000-2018) was analyzed. Data preprocessing included handling missing values, removing outliers using the interquartile range method, and applying a log transformation to the price variable to correct skewness. Model assumptions—linearity, homoscedasticity, multicollinearity, and normality—were evaluated using diagnostic plots and variance inflation factors. Variable selection techniques (backward elimination, forward selection, and best subsets) were used to identify the most significant predictors.

Results

Rooms, bathrooms, car spaces, and land size emerged as significant predictors of log-transformed house prices, while building area was excluded due to insignificance. The final MLR model achieved an R^2 of 0.943, indicating that 94.3% of the variation in log-price was explained. The estimated model was: $\ln(\text{Price}) = 12.46 + 0.029(\text{Rooms}) + 0.023(\text{Car}) + 0.018(\text{Bath}) - 0.00002(\text{Land})$. F-tests ($F = 0.81$, $p = 0.858$) confirmed that the reduced model provided an adequate fit.

Conclusion

The findings highlight the strong influence of internal structural features and parking availability on house prices in Melbourne. The study emphasizes the importance of rigorous assumption checking and variable selection in building reliable property valuation models. These insights support more informed decision-making for real estate practitioners and policymakers.

Keywords

House Prices, Log Transformation, Melbourne Housing Market, Multiple Linear Regression, Property Attributes, Variable Selection.



Predicting Laptop Prices in Satna, India Using Multiple Linear Regression Analysis

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Background

Laptop market of Satna in India is growing rapidly with rising digital adoption. With many brands and features, it can be difficult to determine which specifications drive price. Factors like RAM, SSD, PPI, weight, and brand reputation all play a role. This study uses multiple regression to identify the key predictors of laptop prices in Satna, India.

Objectives

To develop a multiple linear regression model to predict laptop prices in Satna, India, and to quantify the impact of key independent variables: Company, RAM, Weight, PPI, and SSD on the log-transformed price.

Methods

A Kaggle dataset of 1,088 laptops was analyzed. The dataset was examined for missing values, and none were found. Outliers in numerical variables were detected via boxplots and retained as valid configurations. Exploratory Data Analysis (EDA) assessed variable distributions and relationships with laptop prices. Multiple Linear Regression assumptions were checked using Normal Q-Q plots (normality), scatter plots (linearity), Variance Inflation Factors (multicollinearity), and residuals versus fitted plots (homoscedasticity), all of which were satisfied. A Multiple Linear Regression model was fitted, and ANOVA and significance tests identified key factors affecting laptop prices.

Results

The model explains approximately 71% of the variation in laptop prices. The ANOVA results confirmed that the overall regression model was highly significant ($F = 178.53$, $p < 0.001$). Key predictors showed strong positive effects on laptop prices, including RAM (e.g., RAM-8GB: $\beta = 0.94$, $p < 0.001$), SSD capacity (e.g., SSD-256GB: $\beta = 0.25$, $p < 0.001$), and screen quality measured by PPI ($\beta = 0.0068$, $p < 0.001$). Weight also had a statistically significant but comparatively smaller positive effect ($\beta = 0.078$, $p = 0.003$), while differences between brands significantly influenced laptop prices. All model assumptions were satisfied. Overall, the results indicate that both laptop specifications and brand significantly influence laptop prices in the Indian market.

Conclusion

The study confirms that laptop prices in Satna, India are strongly driven by technical specifications and brand effects. The model offers useful insights for consumers, retailers, and policy-makers in understanding price formation.

Keywords

Brand Effect, Laptop Prices, Multiple Linear Regression, RAM, SSD, Screen Quality (PPI)



A Principal Component Analysis (PCA)-Based Approach for Ranking Honours Degree Applicants in the Statistics Stream

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Background

Selection of students for Honours Degree programmes in Sri Lankan universities is mainly based on Grade Point Average (GPA). While GPA reflects academic performance, it does not capture other important qualities such as participation in sports and involvement in student societies. As a result, students with balanced academic and extracurricular profiles may be overlooked. Therefore, a more comprehensive and fair ranking method is required for selecting Statistics Honours Degree applicants.

Objectives

The aim of this study is to develop a fair and simple ranking method that considers both academic performance and extracurricular activities of students.

Methods

The study used actual undergraduate data from 52 Level III students of the Faculty of Science, University of Ruhuna, who applied for the Honours Degree programme in Statistics after completing their first two academic years. Three variables were considered: GPA, participation in sports, and involvement in university societies. PCA was then applied, and the selected principal components were used to compute a composite score for ranking students.

Results

The first two principal components together explained over 76 percentage of the total variation in the data. The PCA-based ranking showed noticeable differences compared to GPA-only ranking. Several students with moderate GPAs but strong extracurricular involvement moved up in rank, while some students with higher GPAs but low extracurricular participation moved down.

Conclusion

The PCA-based ranking approach provides a more balanced and objective method for evaluating Honours Degree applicants. This method can support university admission committees in making fairer selection decisions by considering both academic performance and extracurricular engagement.

Keywords

Principal Component Analysis (PCA), Student Ranking, Multivariate Analysis



Estimating Survival Probabilities of Liver Cirrhosis Patients Using Kaplan-Meier Estimator

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Background

Liver cirrhosis is a late stage of liver disease, characterized by scarring in liver tissue. Survival analysis is a type of statistical methods that can be used to analyze the expected duration of time until a certain event occurs, such as death, failure etc. Due to the increasing incidence of Liver Cirrhosis in today's society, it is important to identify this disease early, understanding patients' survival probabilities, and supporting suitable treatment decisions have become essential.

Objectives

The objectives are to estimate the survival probabilities of liver cirrhosis patients and understand survival patterns.

Methods

The data used in this study were sourced from a clinical trial and only the 50 patient records were used, including right-censored observations. The follow-up time range from 51 days to 4509 days. The survival probabilities were estimated using the Kaplan-Meier estimator. Kaplan-Meier estimator is a non-parametric estimator that is used to estimate the survival probabilities. MATLAB program was developed to calculate the estimates. The estimated probabilities were visualized for better understanding. The probability density function and the hazard function were estimated.

Results

Using the estimated survival probabilities and the visualization, results show that the initial survival probability was 1 and after 51 days, survival probability dropped to 0.98. At 131 days, the survival probability decreases up to 0.94. By 1832 days, it had decreased to 0.66 and by 4509 days, it dropped to 0.30594. According to data, by 4509 days, the survival probability drops from 1 to 0.30594. The survival curve indicates that there is a 30th than 4500 days of recognizing that the patient is with Liver Cirrhosis.

Conclusion

This project offers understanding into the survival patterns of liver cirrhosis patients after they have been identified with the disease and supports decision-making in treatment planning.

Keywords

Hazard Function, Kaplan-Meier Estimator, Liver Cirrhosis Patients, Survival Curve, Survival Probabilities.



A Study of Soil-Air Temperature Dynamics in Greenhouse through Analytical and Numerical Methods

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Background

A Greenhouse is a designed structure to regulate the temperature and humidity of the environment inside. Greenhouses provide plants with a secure place to grow and reach their full potential. Accurate analytical and numerical models are required to describe and predict soil-air temperature interactions to improve greenhouse management and resource efficiency.

Objectives

The aim of this study is to analyze the thermal behavior of the greenhouse by considering soil and air temperature.

Methods

This paper provides a mathematical model with a system of coupled first-order ordinary differential equations. The model assumes uniform temperatures in both the greenhouse air and soil. It describes the temperature relationships of soil and air over time, with solar radiation. Homogeneous part of the model was solved using eigenvalue and eigenvector method. Further simulations were conducted using Runge-Kutta 4th order method numerically. Simulations were done using MATLAB. Several parameters of interest, such as rates of heat transfer and loss and intensity of solar input, were manipulated to evaluate the model's response to changing thermal conditions. Stability and equilibrium were studied using phase plane diagrams of the homogeneous part.

Results

The results show that the greenhouse thermal response is highly sensitive to these parameters. Moreover, the study found that the greenhouse temperature dynamics converge to a stable node, demonstrating asymptotic stability of the system.

Conclusions

The model provides useful insights for the design and operation of greenhouses to suit different climate conditions and crop requirements.

Keywords

Greenhouse, Ordinary Differential Equations, Runge-Kutta 4th Order Method, Thermal Behavior.



Session III

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level II

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Modelling the Export Revenue of Sri Lanka's Garment Industry in USD Using Multiple Linear Regression

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Background

Sri Lanka's garment industry is a vital source of export revenue and employment in the Sri Lankan Economy. However, its financial performance is subject to volatile macroeconomic factors. This study aims to develop a precise, quantitative model to identify the most influential factors among exchange rate, wage index, raw material prices, apparel export value, and energy cost that impact the industry's stability and growth in Sri Lanka.

Objectives

This research aimed to develop a parsimonious multiple linear regression model to identify the most significant macroeconomic predictors of the garment industry's export revenue in USD, providing a reliable tool for forecasting and planning.

Methods

Using monthly data (2010-2023) sourced from the Central Bank of Sri Lanka (<http://www.cbsl.gov.lk>), we developed a multiple linear regression model to analyse key export determinants. An iterative stepwise procedure combining forward selection, backward elimination, and best subset criteria was employed to identify the optimal predictors from an initial set comprising the Exchange Rate (USD/LKR), Wage Index (growth rate), Raw Material Prices (millions in USD), Apparel Export Value (millions in USD), and Energy Cost (USD per kWh). The final parsimonious model was then subjected to rigorous diagnostic testing for standard econometric assumptions.

Results

The analysis yielded a highly significant model ($R^2 = 0.919$) with three key predictors: the global Apparel Export Value (0.87923), the Exchange Rate (USD/LKR)(-0.04893), and Raw Material Prices (0.03717). In particular, domestic cost variables like Wage Index and Energy Cost were statistically insignificant and excluded from the final robust model.

Conclusion

This study provides a validated, data-driven model that highlights the primary influence of global demand and internationally-traded cost factors on Sri Lanka's garment export revenue. It offers industry stakeholders and policy makers a powerful tool to navigate economic fluctuations, optimize strategies, and secure the long-term competitiveness of this critical sector.

Keywords

Export Revenue, Garment Industry, Multiple Linear Regression, Exchange Rate, Sri Lanka.



Hotel Rating Prediction Using Multiple Linear Regression

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Background

The hotel industry is an important part of Sri Lanka's economy and customer ratings help tourists choose where to stay. Good ratings also help hotels stay competitive. Many hotels do not use statistical methods to understand what factors mainly influence their ratings.

Objective

The aim of this study is to identify the main factors that impact hotel ratings and to build a strong prediction model using multiple linear regression.

Methods

Data were collected from 50 randomly selected hotels in Sri Lanka via the TripAdvisor website. To evaluate the model's predictive power, the dataset was partitioned into a training set of 40 hotels and a validation set of 10 hotels using a web based random number generator. The independent variables are location, value for money and cleanliness. The dependent variable is hotel rating. The model was written using MATLAB. The assumptions of linearity, independence, homoscedasticity, normality and non-multicollinearity were checked further.

Results

The MLR model accounted for approximately 90% of the variation in hotel ratings ($R^2 \approx 0.90$). Cleanliness was identified as the most significant predictor with a coefficient of 0.47, followed by value for money (0.41) and location (0.25). The model demonstrated high predictive accuracy during validation, yielding a Root Mean Square Error of 0.1207 and a Mean Absolute Percentage Error of 2.10%.

Conclusion

These results demonstrate that maintaining high cleanliness standards significantly improves customer satisfaction. This model provides hotel managers with a reliable tool for predicting ratings and making data driven decisions to enhance competitive advantage.

Keywords

Cleanliness, Location, Multiple Linear Regression, Hotel Rating, Value for Money.



The Impact of Socioeconomic Indicators on GDP per Capita Across Countries

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Background

GDP per capita is a widely used indicator of a nation's economic health. This study examines the relationship between GDP per capita and selected socioeconomic factors including exports, imports, net income, child mortality, health expenditure, inflation, life expectancy and total fertility rate.

Objective

The objective of the study is to identify which factors have the greatest effects on GDP per capita by modeling these relationships using multiple linear regression.

Methods

Initial data exploration includes summary statistics, box plots, and correlation matrices to assess variable distributions and relationships. Multiple linear regression was employed to investigate the relationships between variables, with the Backward Elimination method used to identify the best model.

Results

The final model was identified based on R-Squared values. It achieved an R-squared of 92.7%, indicating that approximately 92.7% of the variance in GDP per capita is explained by the model, reflecting a very strong fit. F-test confirmed the statistical significance of the model compared to nested models.

Conclusion

This reduced model indicates that countries with higher incomes, lower child mortality, and lower fertility rates tend to have higher GDP per capita. The findings will highlight the importance of socioeconomic indicators in shaping national economic performance.

Keywords

GDP Per Capita, Child Mortality, Income, Inflation, Health, Import, Export.



Factors Affecting Housing Prices In Ames, Iowa, USA

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Background

Housing prices are a fundamental measure of both local and economic well-being. The price of these properties mainly depends on log lot area, overall quality, year built, total basement area, ground living area, total rooms above ground and garage area. This study investigates the effect of these on housing prices in Ames, Iowa, USA.

Objective

The main objective of the study is to provide a reliable predictive model for housing prices.

Methods

A quantitative research design was applied to the secondary data derived from Ames Housing Dataset from 2006 to 2010. The initial dataset underwent a data cleaning process. Log transformation and centering were applied to satisfy key assumptions of the regression model for some variables. The data was analyzed using descriptive statistics and multiple linear regression. Dummy variables were created for categorical variables. The backward elimination method was used to determine best model.

Results

The final regression model achieved an R-squared value of 0.82574, indicating that approximately 82.5 percent of the variation in sales price can be explained by the selected predictors. Year built, total basement surface, ground living area and garage area were eliminated based on hypothesis testing. The F test and model selection criteria confirmed that the full model provides the best fit.

Conclusion

The final model confirmed that overall quality is strong positive predictor of house values, highlighting its crucial influence on price. The result provide valuable insights for various stakeholders including prospective home owners, real estate agents and property developers, enabling them to make more inform decisions by focusing on the most influential characteristics of a property.

Keywords

Backward Elimination, Multiple Linear Regression, Sales Price.



Impact of Vehicle Attributes on the Resale Prices of Used Toyota Corolla Cars

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Background

The used car market has grown significantly in Sri Lanka, creating a need for transparent and data-driven pricing methods. Resale prices of used vehicles are influenced by several attributes, including age, mileage, color, engine size, and weight.

Objectives

This study aims to identify the relationships between key vehicle attributes and the resale prices of used Toyota Corolla cars.

Methods

A secondary dataset consisting of 248 observations, obtained from an online vehicle marketplace dataset available on Kaggle, was analysed using descriptive statistics, exploratory data analysis, and Multiple Linear Regression techniques. Dummy variables were created for categorical attributes. A full regression model including all predictors was initially estimated, followed by forward selection and reduced model comparison to determine the most suitable regression model.

Results

The final full regression model achieved an R-squared value of 0.8929, indicating that approximately 89% of the variation in resale prices can be explained by the selected predictors. Age and mileage showed significant negative effects on resale price, while weight exhibited a significant positive effect. Several color categories were statistically significant, whereas engine size did not show a significant influence. The F-test and model selection criteria confirmed that the full model provides the best fit.

Conclusion

The study concludes that age, mileage, weight, and specific color categories substantially influence the resale prices of used Toyota Corolla cars. The findings confirm that older cars with higher mileage depreciate considerably, while heavier vehicles tend to retain higher value.

Keywords

Multiple Linear Regression, Resale Value, Toyota Corolla, Used Car Pricing, Vehicle Attributes.



Modeling the Adjusted Closing Price of Gold Exchange Traded Funds Using Multiple Linear Regression

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Background

Gold remains a critical safe-haven asset and an inflation hedge. Although numerous macroeconomic and commodity variables have been proposed as drivers of gold prices, empirical evidence on their short-term predictive power for daily gold adjusted closing prices remains fragmented and often contradictory.

Objectives

This study aims to identify the most powerful predictors of the daily adjusted closing price of the Gold Exchange Traded Funds (ETF) and to develop a parsimonious, robust, and highly accurate linear regression forecasting model using key commodity and financial market variables.

Methods

Daily data consisting of 1,718 observations from November 2011 to January 2019, sourced from the "Gold Price Prediction Dataset" on Kaggle.com, were analyzed using multiple linear regression in R. Five predictor variables, Gold ETF Low, Silver Low, Platinum Open, Gold Miners ETF Adjusted Close (GDX) and US Oil Fund Volume (USO) were examined after reviewing highly correlated and low variance features for potential exclusion. Classical assumptions (normality, linearity, no multicollinearity, homoscedasticity) were rigorously tested and satisfied. Variable selection was performed using backward elimination, forward selection, and best-subsets regression.

Results

All methods consistently identified Gold ETF Low as the dominant predictor and excluded the USO volume variable, which showed no statistically significant contribution and minimal improvement in model fit. The final reduced model, containing only variables Gold ETF Low(0.982), Silver Low(0.000016), Platinum Open(0.0002) and Gold Miners ETF Adjusted Close(0.062) achieved an exceptional Adjusted R^2 of 0.9949, indicating that over 99.49% of the daily variation in gold adjusted closing price is explained. Diagnostic tests confirmed the absence of residual autocorrelation, heteroscedasticity, and multicollinearity (VIF values<5).

Conclusion

This highly accurate and parsimonious model provides investors, hedge funds, and policymakers with a reliable tool for short-term gold price forecasting in volatile market conditions. However, its applicability for long-term forecasting may be limited due to its reliance on daily intraday price dynamics.

Keywords

Commodity Markets, Gold ETF, Multiple Linear Regression, Price Forecasting, Variable Selection.



Predicting Average Temperature Through Multiple Linear Regression Modeling

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Background

Predicting average temperature of the environment accurately is crucial for monitoring weather, assessing climate, and environmental planning. Multiple Linear Regression is a powerful method to quantify how key atmospheric variables affect average temperature, and to build a predictive model.

Objectives

The main objective of this study is to develop a MATLAB program capable of performing multiple linear regression while verifying its underlying assumptions and to develop a multiple linear regression model which can predict average temperature based on dew point, humidity, sea-level pressure, and wind speed.

Methods

Multiple linear regression was performed the publicly available Austin weather dataset. The dataset was cleaned and checked for normality, independence, and multicollinearity before performing multiple linear regression.

Results

The R^2 value is 0.9999, emphasizing that almost all variability in average temperature is explained by the predictors. Dew point shows a positive effect (+1.037) on average temperature, while humidity (-0.5098), pressure (-0.6032), and wind speed (-0.0706) show a negative relationship. Specifically, as dew point increases, temperature rises. Conversely, higher humidity, sea level pressure, or wind speed leads to a decrease in average temperature.

Conclusion

This study emphasizes that multiple linear regression can be used to predict average temperature. This modeling framework can be applied to other environmental datasets that need clear and assumption-based statistical forecasting.

Keywords

Atmospheric Variables, Environmental Modeling, Multiple Linear Regression, Statistical Modeling, Temperature Prediction.



Session IV

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level II

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Modeling Population Dynamics of Monkeys Using Logistic Growth Equation

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Background

Monkeys have been identified as a rapidly growing primate species in Sri Lanka. With monkey population increase, human-monkey conflicts are currently increasing rapidly. To better understand this issue, it is important to analyze how monkey populations grow and whether they have reached maximum sustainable levels.

Objectives

The aim of this study was to apply logistic growth models to examine the growth of overall monkey population in Sri Lanka and in selected areas, and predict future trends.

Methods

Two modeling approaches were tested. First, parameters of the logistic growth model were estimated using the monkey population data from 1977 to 2025. The logistic growth model with estimated parameters was used to determine long-term monkey population growth behavior. Second, a logistic growth model was developed to quantify how monkey populations change with the impact of human food sources on monkey population stability.

Results

The first experiment estimated the carrying capacity of the monkey population at 5,170,000. According to the supply growth model derived from this data, the monkey population in Sri Lanka will have reached this maximum carrying capacity by 2025. Therefore, there will be no further natural growth. The second model, which considers the impact of human-provided food on the monkey population, shows that the monkey population has not yet reached its carrying capacity. However, by 2025, the growth rate of the monkey population had slowed down rapidly.

Conclusion

In conclusion, these findings suggest that the monkey population in Sri Lanka is no longer increasing significantly and is close to reaching a stable state. However, this situation may change as various environmental changes and monkeys move closer to human habitats. This study is important for wildlife authorities in formulating future policies.

Keywords

Carrying Capacity, Logistic Growth Model, Monkey, Monkey Population, MATLAB.



Analizing the key factors affecting Sri Lankan Tourism Ddevelopment using Topsis method

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Background

The tourism industry plays a vital role in the Sri Lankan economy by generating foreign exchange income, creating employment opportunities, and supporting local enterprises. Sri Lanka has experienced significant challenges in recent years, notably the COVID-19 pandemic followed by a severe political and economic crisis. Despite ongoing efforts to revive and develop the tourism industry, a comprehensive and effective mechanism to systematically guide tourism development initiatives remains absent.

Objective

This study aims to analyze the factors that have influenced Sri Lankan tourism in the past and to propose recommendations for its future development. Accordingly, five key factors affecting tourism management were selected, namely, natural attractions, cultural attractions, infrastructure, the accommodation sector, and tourist support services.

Methods

The relevant data for this study were extracted from the Sri Lanka Tourism Development Authority annual reports and prosperity index reports over the period from 2010 to 2020. By considering the data in three year clusters from 2010 onwards, each cluster was organized into a decision matrix in which the columns and rows represent the years and the affecting factors, respectively. Following min-max normalization, the weights for each year were calculated using the entropy method. Finally, the affecting factors were ranked using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

Results

The findings indicate that a peaceful national environment and the "Wonder of Asia" campaign enhanced natural attractions during the period 2010–2012. Major initiatives such as CHOGM and the Port City project significantly boosted infrastructure development during 2013–2015. However, political instability during 2016–2018 critically reduced foreign investment in infrastructure projects. Furthermore, the Easter Sunday attacks and the COVID-19 pandemic during 2018–2020 highlighted the importance of tourism support services and the accommodation sector. Overall, the results demonstrate that the priority of each factor varies in response to changing national conditions and trends.

Conclusion

The promotion of natural and cultural attractions appears to be the most appropriate strategy for enhancing Sri Lanka's tourism industry in the present context.

Keywords

Rank, TOPSIS Analysis, Tourism Management



Modeling and Simulation of the Motion of Volleyball with Spin (Effect of Magnus and Drag)

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Background

The projectile motion of a volleyball in flight is influenced by aerodynamic forces, especially when spin is applied. The top-spin serve gives the ball more control, speed, and a sharper downward trajectory.

Objectives

This study aims to model and simulate the motion of a volleyball subjected to a top-spin serve, focusing on the aerodynamic forces that cause the ball to swerve during flight.

Methods

By applying Newton's second law and incorporating the effects of drag, lift, and Magnus forces, a system of second order differential equations is obtained. This simulation assumes that all forces act in the same vertical plane. Finally, the second order differential equations, which are the key equations in this study, are solved by using MATLAB and then the trajectory of the ball under varying initial conditions is predicted. Also, the simulation checks whether the ball clears the net and lands within the opponent's court.

Results

For any given initial data set, the results show how the effect of Magnus and drag changes the path of the volleyball. Tests with different speeds and angles showed that only certain combinations allow a successful serve. A serve at 14 ms^{-1} and 45° cleared the net and landed in the opponent's court, while low angles as 2° or low speeds as 4 ms^{-1} failed.

Conclusions

According to this study, by adjusting the initial velocity and the angle, the most suitable angle and launch velocity can be found to make the ball land at the correct spot.

Keywords

Drag Force, Magnus Effect, Projectile Motion.



Optimizing Bus Timetables for Safe and Reliable Operations Using Linear Programming

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Background

When multiple bus routes share common stops, overcrowding, long passenger waiting times, and unsafe competition between buses can occur. In the absence of a well-structured timetable, buses from different routes may arrive at the same stop simultaneously, reducing service reliability and passenger comfort.

Objectives

The main objective of this study is to optimize bus timetables for overlapping routes in order to reduce competition at shared stops. The specific objectives are to minimize passenger waiting time, maintain a safe time gap between buses, and develop a reliable and practical bus schedule.

Methods

A linear programming model was developed to determine optimal arrival times for two bus routes sharing several common stops. The model considers fixed travel times, known passenger demand at each stop, and a minimum safe time gap between buses as constraints. MATLAB was used to solve the optimization problem and generate the final bus timetable.

Results

The optimized timetable ensures a minimum safe time gap of 10 minutes between buses from different routes at all shared stops. Bus arrivals are more regularly spaced and better distributed over time, which reduces bus bunching and unsafe competition. As a result, passenger waiting times are significantly reduced compared to an unplanned schedule.

Conclusion

This study shows that an effective and safe bus timetable can be developed using linear programming and MATLAB. The optimized timetable provides a more reliable service, reduces passenger waiting time, and improves safety at shared bus stops. The model can be further improved by incorporating real-time data and adjusting passenger demand, making it more suitable for practical public transport systems.

Keywords

Linear Programming, Bus Scheduling, Overlapping Routes, Passenger Waiting Time.



Factors Affecting Academic Performance of Science Undergraduates

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Background

Identifying the factors that affect the study performance of undergraduates is highly valuable for modern educational systems. The study included Level II and III undergraduates in the Faculty of Science, University of Ruhuna. Data from 200 participants were collected over a five-month period using a structured questionnaire, employing a simple random sampling method. The research investigated several variables, including study behavior, sleep patterns, preferred study environments, physical activity, part-time work, university involvement, social media usage, and economic background.

Objectives

To determine the relationship between students' GPAs and specific behaviors and habits, analyze the variables influencing GPA in students from various academic fields and provide recommendations on how advisors, instructors, and learners may raise time management, reduce distractions and adopt beneficial study methods.

Methods

A Q-Q plot was used to check the normality. Independent sample t-tests and one-way ANOVA tests were used to assess the effect of variables on GPA. All statistical analyses, visualizations, and data processing were conducted using MATLAB.

Results

Statistical analysis revealed that study hours ($p = 1.3015e-06$) and regular review of lecture materials ($p = 0.0002$) were the only factors with a statistically significant effect on GPA ($p < 0.05$). Students who maintained consistent study hours and revisited lecture content tended to achieve higher GPAs. Conversely, other factors including gender, social media usage, study environment, sleep patterns, club involvement, physical activity, living situation, monthly income, and economic background did not show a statistically significant effect on academic performance ($p > 0.05$).

Conclusion

The research determines that study techniques, rather than lifestyle or demographic elements are the primary determinants of academic performance.

Keywords

Academic Performance, ANOVA Test, Grade Point Average (GPA), Study Habits, T-test.



Session V

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level III

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Linear Regression Approach To Modeling Sri Lanka's Tea Export Revenue Based On Global Tea Market Drivers And Macroeconomic Variables

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Background

Sri Lanka is the third largest tea exporter. For more than a century, Sri Lanka's tea industry, was the main source of the government economy. Vital source of foreign exchange, has experienced fluctuating export performance due to changing global market dynamics and domestic economic challenges.

Objective

To analyze the impact of global and domestic economic factors and which variables are the mostly significant to the Sri Lanka's tea export revenue and also to provide policy relevant insights and strategic recommendations that can support decision making in the tea export sector.

Methods

This study applies a Multiple Linear Regression approach to evaluate the impact of global tea prices, exchange rates, tea production, Brent crude oil prices, inflation rate, global tea consumption, china tea export as main competitor and Russia GDP growth rate on Sri Lanka's tea export revenue from 2014 to 2024 Forbes and Walker Tea Brokers, Sri Lanka Tea Export Statistics. using monthly data, by using R software the analysis was refined through the Forward Selection method to identify the most significant predictors and also thier contribution.

Results

The resulting reduced model explains approximately 86.1% of the variance in tea export revenue. The equation explains that global tea prices ($+1.636 \times 10^9$), exchange rates ($+1.076 \times 10^8$), tea production ($+1.260 \times 10^2$), and oil prices have ($+3.036 \times 10^7$) effects on export revenue, whereas inflation (-4.732×10^7) shows a negative relationship.

Conclusion

This study has highlighted the key variables global tea prices, exchange rates, domestic tea production, brent crude oil prices, and inflation as the most significant determinants of export revenue. At the same time, other variables such as Russia's GDP growth, china's tea export revenue, and global tea consumption were found to have no significant influence within the studied period. Although the model is not flawless, the insights gained are valuable for policymakers and exporters, as they reveal which macroeconomic factors should be prioritized in strategic planning. However, given its limitations, this model should be used as a supportive analytical tool rather than as a precise forecasting mechanism for future decision making.

Keywords

Sri Lanka Tea Export, Multiple Regression Analysis, Tea Market Drivers, Macroeconomic.



Modeling U.S. Energy Production Using Economic and Environmental Indicators (1990–2024)

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Background

Energy production in the United States is influenced by a combination of economic, environmental, and industrial factors. Although many studies have examined these factors individually, limited research has evaluated their combined impact on total energy production over a long time horizon. Understanding these relationships is essential for accurate energy forecasting and effective policy formulation.

Objectives

The primary objective of this study is to develop a multiple linear regression model to identify significant economic and environmental indicators affecting U.S. energy production from 1990 to 2024 and to determine the most influential predictors among them.

Methods

Monthly data consisting of 396 observations were analyzed using exploratory data analysis and multiple linear regression techniques. The independent variables included crude oil production, liquid fuel consumption, electricity consumption, total energy consumption, crude oil prices, GDP implicit price deflator (year-over-year percentage change), and Manufacturing Production Index (year-over-year percentage change). Regression assumptions were tested using diagnostic plots and statistical measures, and stepwise variable selection was employed to obtain an optimal predictive model.

Results

The results indicate that crude oil production has a strong positive relationship with total energy production and is the most influential predictor. Liquid fuel consumption, total energy consumption, crude oil prices, and manufacturing activity also exhibit significant positive effects, while GDP inflation shows a negative impact. Electricity consumption was found to be statistically insignificant and was excluded in the reduced model. The final model explains approximately 93% of the variation in U.S. energy production, demonstrating high predictive accuracy.

Conclusion

This study highlights the dominant role of oil-related variables and industrial activity in determining U.S. energy production. The developed regression model provides reliable insights for forecasting energy output and can support policymakers and energy planners in making informed decisions regarding energy management and economic stability.

Keywords

Crude Oil Production, Liquid Fuel Consumption, GDP Implicit Price Deflator, Manufacturing Production Index, U.S. Energy Production.



Macroeconomic and Supply Determinants of WTI Crude Oil Prices

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Background

Crude oil remains a central global commodity, whose price dynamics significantly influence economic stability, financial markets, and policy decisions worldwide. West Texas Intermediate (WTI) crude oil serves as a major benchmark in global energy markets. Although numerous macroeconomic and supply-side variables have been identified as potential determinants of crude oil prices, empirical evidence on their combined explanatory power for monthly WTI price movements remains limited, particularly when long-term data are considered.

Objectives

The primary objective of this study is to identify the most influential macroeconomic and supply-related factors affecting monthly WTI crude oil prices over the period from 1997 to 2024. The study also aims to develop a statistically robust and highly predictive multiple linear regression model to explain WTI price fluctuations.

Methods

Monthly data comprising 278 observations were obtained from the U.S. Energy Information Administration (EIA) and the Federal Reserve Economic Data (FRED), including WTI Futures prices. Multiple linear regression analysis was employed, supported by exploratory data analysis and regression diagnostics. A square-root transformation of the dependent variable was applied to satisfy classical regression assumptions. Multicollinearity was assessed using Variance Inflation Factors (VIF), and best subset selection was used to identify a parsimonious and stable predictive model.

Results

The results indicate that the Consumer Price Index (CPI) and Manufacturing Production Index (MPI) exert statistically significant positive effects on WTI crude oil prices, reflecting the influence of inflation and industrial activity. In contrast, the U.S. Dollar Index and Federal Funds Rate show significant negative impacts. Among all predictors, WTI Futures emerged as the most influential positive predictor. Although OPEC crude oil production and U.S. crude oil inventories exhibited weaker statistical effects, they were retained due to their theoretical relevance. The final model is highly significant ($F = 1254.9$, $p < 0.001$) and explains 98.26% of the variation in WTI prices.

Conclusion

The findings suggest that WTI crude oil prices are predominantly driven by macroeconomic and financial factors rather than physical supply variables. The proposed model provides valuable insights for policymakers, investors, and analysts in forecasting oil price movements, conducting scenario analysis, and evaluating the effects of economic shocks on energy markets.

Keywords

Consumer Price Index, Manufacturing Production Index, Multiple Linear Regression, WTI Crude Oil Price, WTI Futures.



A Comparative Time Series Analysis of Sri Lankan GDP Growth Rate using ARIMA and Holt's Exponential Smoothing

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Background

The GDP (Gross Domestic Product) growth rate is considered in this study, as it plays a crucial role in Sri Lanka's economy. The GDP is the market value of total goods and services produced within the period measured. Over recent years, the country has faced fluctuations in its GDP growth, reflecting the impacts of economic crisis, net exports of goods and services, foreign debt, and external shocks such as COVID-19 pandemic.

Objective

This research aims to identify best fitted time series model for forecasting GDP growth rate in Sri Lanka which can be used in future decision-making process.

Methods

The data comprise quarterly basis from 2004 to 2024, obtained from Central Bank of Sri Lanka. The statistical tests called Augmented Dickey-Fuller (ADF) and Kwiatkowski Phillips-Schmidt-Shin (KPSS) were used to check the stationarity of the time series data. R statistical software was used to develop Autoregressive Integrated Moving Average (ARIMA) and Exponential Smoothing models for GDP growth rate. Model selection was performed based on the Akaike information criterion (AIC) and the Bayesian information criterion (BIC).

Results

Several ARIMA models were fitted and the ARIMA(0,1,1) model was identified as a best-fitted model, based on the AIC and BIC values. Holt's Exponential Smoothing model was identified as the best model among the Exponential Smoothing models.

Conclusion

The results concluded that ARIMA(0,1,1) was the best-performing model with the lowest forecast errors Root Mean Squared Error (RMSE) of 2.5230 and a Mean Absolute Error (MAE) of 1.8274, compared to Holt's Exponential Smoothing, which produced an RMSE of 2.7068 and an MAE of 2.0482.

Keywords

ARIMA, Forecasting, GDP Growth Rate, Holt's Exponential Smoothing.



Factors Affecting Real Estate Housing Prices in Chennai, India

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Background

The real estate (RE) market in Chennai, India, has seen rapid growth and expansion due to urban sprawl and economic development, resulting in significant price variations between locations. It is important for buyers, investors, developers, and policymakers to understand the impact of the most significant factors that affect the RE prices in Chennai.

Objective

The objectives of this study are to identify the primary determinants of residential housing prices in Chennai and to measure the relative effects of these factors.

Methods

A quantitative research design was utilized to analyze an existing dataset of residential properties from a publicly accessible RE portal. After removing missing values and outliers, 400 observations remained. The dependent variable was housing price; the independent variables were area, location, property status, number of bedrooms (BHK), number of bathrooms and age of the house. Categorical variables were converted to numerical form. Multiple linear regression (MLR) using backward elimination was applied. Regression assumptions (linearity, independence, homoscedasticity, multicollinearity, and normality of residuals) were examined and found to be reasonably acceptable.

Results

The final reduced model explained 86.47% of the variance in housing prices. Area and BHK had a strong positive influence on prices. Location also indicated major price differences between zones. The bathroom count had a negative association with price. Age and property status were statistically nonsignificant and excluded from the final model as non-influential factors.

Conclusions

Area, BHK, number of bathrooms, and location are the most influential factors affecting housing prices based on the analyzed residential property dataset from Chennai. The age of the house and property status do not significantly affect pricing within the studied sample. These results assist market participants and provide insight into pricing behavior in similar rapidly urbanizing areas, subject to data scope.

Keywords

Backward Elimination, Chennai, Housing Prices, Multiple Linear Regression, Real Estate.



Identifying Optimal Tourist Travelling Routes in Sri Lanka Using Graph Theory

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Background

Sri Lanka has many popular tourist destinations, but tourists often face difficulties in planning the best travel routes. Poor planning can result in longer travel times and a less enjoyable experience. Identifying the shortest paths between cities can help tourists save time and travel more comfortably.

Objective

The aim of the study is to identify the shortest travel paths between selected tourist destinations in Sri Lanka using Dijkstra's Algorithm.

Methods

Firstly, twenty-two popular destinations were picked from the Sri Lanka Tourism Development Authority annual report 2024. Then road distances between cities were collected using Google maps and organized into a distance matrix in Microsoft Excel sheet. Each city was treated as a node, and distances were used as edge weights using graph theory. Finally, shortest routes were calculated by using Dijkstra's Algorithm and implemented in MATLAB.

Results

The program effectively determined the shortest routes. For instance, for the itinerary beginning in Colombo and stopping at Bandarawela, Badulla, and Ella, the optimal route identified was Colombo, Bandarawela, Ella, and Badulla, with a shortest travel distance of 230 km. The algorithm offered effective route recommendations in every scenario examined.

Conclusion

This study demonstrates that Dijkstra's Algorithm is a simple and efficient method for identifying the shortest routes between cities in a travel itinerary in Sri Lanka. It can enhance route planning and act as a valuable resource for travel apps and tourism strategies.

Keywords

Dijkstra's Algorithm, Distance Matrix, Route Planning, Shortest Path.



Session VI

BSc (General) Degree / BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics - Level III & IV

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Relationship Between Employee Motivation and Job Performance

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Background

Employee motivation is a critical factor influencing job performance and overall organizational success. Although many studies have examined the relationship between employee motivation and job performance, findings remain inconclusive, particularly within the Sri Lankan telecommunication sector. Sri Lanka Telecom Mobitel (Pvt) Ltd operates in a highly competitive environment where employee performance is essential for service quality and organizational sustainability.

Objectives

The primary objective of this study is to examine the relationship between employee motivation and job performance among employees of Sri Lanka Telecom Mobitel (Pvt) Ltd, Matara Branch. Specifically, the study investigates the influence of intrinsic and extrinsic motivational factors on employee job performance.

Methods

A quantitative research design was adopted. Primary data were collected using a structured questionnaire administered via Google Forms. A simple random sampling technique was used to select 100 employees, of whom 79 valid responses were analyzed. The questionnaire consisted of closed-ended items measured on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Employee motivation was measured using intrinsic and extrinsic motivational factors, while job performance was operationalized using productivity, quality of work, efficiency, punctuality, initiative, and work attitude. Data were analyzed using SPSS, employing descriptive statistics, reliability analysis, factor analysis, and Pearson correlation analysis at a 5% significance level ($\alpha = 0.05$).

Results

The findings revealed a moderate and statistically significant positive relationship between intrinsic motivation and job performance ($r = 0.489, p < 0.05$). A similar positive relationship was observed between extrinsic motivation and job performance ($r = 0.462, p < 0.05$). These results indicate that both intrinsic and extrinsic motivational factors significantly influence employee job performance.

Conclusion

The study concludes that employee motivation plays a significant role in enhancing job performance at Sri Lanka Telecom Mobitel (Pvt) Ltd. Both intrinsic and extrinsic motivational factors contribute positively to employee performance. Therefore, organizations should focus on strengthening recognition and appreciation systems, leadership practices, career development opportunities, and balanced reward mechanisms to improve overall employee performance.

Keywords

Extrinsic Motivation, Intrinsic Motivation, Job Performance, Telecommunication Industry.



Determinants of Life Expectancy in South Asia: A Multiple Linear Regression Approach

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Background

Life expectancy in South Asia differs considerably between countries, largely due to disparities in healthcare, economic development, and education. Understanding the drivers of life expectancy is crucial for designing effective health and social policies to improve regional well-being.

Objective

This study aims to identify the main predictors of life expectancy in eight South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) from 2010 to 2020 using multiple linear regression techniques.

Methods

Life expectancy at birth was modeled as the dependent variable using a sample size of 110 observations. Independent variables included adult mortality, alcohol use, vaccination coverage (Hepatitis B, Polio, and Diphtheria), GDP per capita, income composition of resources, and years of schooling. To ensure model reliability, the Shapiro-Wilk test and Breusch-Pagan test were used to verify normality and homoscedasticity, while Variance Inflation Factor (VIF) confirmed the absence of multicollinearity. Best subsets regression and partial F-tests were used for model refinement.

Results

The analysis identified adult mortality, Diphtheria vaccination, and income composition as significant predictors ($p < 0.05$), leading to the rejection of the null hypothesis that these coefficients are zero. Adult mortality showed a negative impact (-0.011), while Diphtheria vaccination (0.152) and income composition (23.664) had strong positive effects. The adjusted R^2 of 0.846 indicates that 84.6% of the total variance in life expectancy is explained by the model, which was confirmed as overall significant by the ANOVA test ($p < 0.001$).

Conclusion

The findings highlight that reducing adult mortality and enhancing vaccination coverage are vital for improving life expectancy in South Asia. Strengthening immunization programs and addressing socioeconomic disparities are essential to reduce regional inequalities, aligning with Sustainable Development Goals 3.

Keywords

Adult Mortality, Income Composition, Life Expectancy, Multiple Linear Regression, Vaccination Coverage.



Predicting Sri Lanka's Gross Domestic Product Using Multiple Linear Regression with Macroeconomic Indicators

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Background

This study addresses the need to understand the determinants of Sri Lanka's Gross Domestic Product (GDP) per capita by analyzing the combined effect of multiple macroeconomic indicators such as population growth, capital formation, domestic credit FDI and trade over a long time series (1970-2023). The volatility in Sri Lanka's economic growth and its recent financial crisis underscore the importance of evidence-based predictive modeling to inform post-crisis recovery and sustainable development policy.

Objectives

The primary objective was to investigate the impact of key macroeconomic indicators on Sri Lanka's GDP per capita and to develop an accurate and statistically significant multiple linear regression model for prediction and policy insights.

Methods

Annual macroeconomic data from 1970 to 2023 were obtained from the World Bank Open Data platform. After handling missing values and detecting outliers using box plots, 51 observations were retained for analysis. A multiple linear regression model was developed using $\ln$ GDP as the dependent variable. The initial model included five predictors: population growth, gross capital formation, domestic credit to the private sector, foreign direct investment (FDI), and trade (% of GDP). Best subset regression was applied to evaluate all possible predictor combinations, and a reduced model was selected using the partial F-test. Model assumptions were assessed using residual plots to examine linearity, Q-Q plots and the Shapiro-Wilk test to assess normality, residual plots and the Breusch-Pagan test to evaluate homoscedasticity, and variance inflation factors (VIF) to detect multicollinearity.

Results

The full model explained 85.02% of the variance in $\ln$ GDP, while the reduced model explained 83.37%. Regression analysis of the reduced model indicated that domestic credit (0.025664), foreign direct investment (FDI) (0.299780), and trade (0.011641) were the only statistically significant predictors of $\ln(\text{GDP})$. Domestic credit exhibited the strongest positive contribution. The negative effect of trade corroborated the correlation findings, suggesting that persistent trade deficits are detrimental to per capita economic growth.

Conclusion

Domestic Credit, FDI, and Trade are the most important determinants of Sri Lanka's GDP per capita over the studied period. The statistically valid and parsimonious reduced model suggests that encouraging financial deepening (credit expansion) and attracting foreign investment are key drivers of growth, while the external sector needs serious reform to make international trade a positive contributor.

Keywords

Domestic Credit, Economic Growth, GDP Per Capita, Macroeconomic Indicators, Multiple Linear Regression, Sri Lanka, Trade.



Developing a Laptop Price Prediction System using Random Forest Model

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Background

Laptops have become essential for education, work, and daily activities. However, in developing countries such as Sri Lanka, many users lack sufficient knowledge of laptop specifications, making it difficult to select a suitable and affordable device. A reliable price prediction system can help users make better buying decisions.

Objective

The aim of this study is to develop a machine learning-based system that predicts laptop price categories using a Random forest model implemented in Java, providing accurate guidance for users with different levels of technical knowledge.

Methods

A publicly available laptop dataset containing approximately 1000 laptop records was obtained from GitHub was preprocessed using Python, including cleaning, handling missing values, and converting continuous variables such as screen size, RAM, weight, and price into categorical groups. A categorical Random Forest model was built using Information Gain and Entropy to determine optimal attribute splits. The model was implemented in Java and integrated into a graphical interface that allows users to enter any combination of features. For each prediction, the system constructs a Random Forest using the relevant attributes and outputs the final price category via majority voting.

Results

The Random Forest model produced stable and accurate predictions that performed better than a single decision tree approximately 85% by reducing variance and overfitting. The system successfully generated predictions even when only a subset of features was provided, offering flexibility to users who may not know all laptop specifications. The Java terminal also displays entropy, information gain, and tree-level predictions for deeper analysis.

Conclusion

This study demonstrates that a Random forest-based approach effectively predicts laptop price categories and provides practical value to users in Sri Lanka. Future improvements may include expanding the dataset, improving user awareness of laptop features, and integrating advanced machine learning techniques.

Keywords

Decision Tree, Information Gain, Laptop Features, Price Prediction, Random Forest.



Economic and Security Shocks in Sri Lanka's Tourism: A Bayesian Approach

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Background

Tourism remains a critical contributor to Sri Lanka's foreign exchange earnings, yet it has been repeatedly disrupted by major economic and security shocks. Understanding how these interventions influence short-term earnings is essential for policy planning and recovery forecasting.

Objectives

This study aims to model and forecast Sri Lanka's monthly tourist earnings using a Bayesian Structural Time Series (BSTS) approach, and to quantify the causal impact of major interventions, including the April 2019 Easter Attacks, the COVID-19 pandemic, and the 2022 economic crisis, on tourism earnings from 2015 to 2025.

Methods

Monthly tourist earnings were analyzed using a BSTS model incorporating trend, seasonal components, and intervention covariates. Counterfactual earnings were estimated to measure the magnitude of each intervention's impact. Model performance was evaluated Weighted Mean Absolute Percentage Error (WMAPE).

Results

The BSTS model successfully captured structural variations and intervention effects. In-sample accuracy metrics showed moderate of WMAPE (19.84% indicated good fit relative to the earnings scale. The interventions produced significant negative impacts, particularly following the Easter attacks and the COVID-19 pandemic, with recovery trends evident in the counterfactual projections.

Conclusions

The BSTS framework demonstrates strong capability for analyzing intervention impacts and forecasting tourism earnings under structural shocks. The findings emphasize the vulnerability of Sri Lanka's tourism sector to disruptive events and provide actionable insights for policymakers regarding resilience and crisis-response planning.

Keywords

Bayesian, Forecasting, Time Series, Tourist Earnings.



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