MINI-SYMPOSIUM 2024

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Proceedings
of
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Department of Mathematics
Faculty of Science
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Sri Lanka

Panel

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Message from the Deputy Vice-Chancellor

Mathematics stands as a cornerstone of human understanding, influencing every aspect of our lives, from the simplest calculations to the most complex theories. Your dedication to exploring its depths and sharing your insights with the community is truly commendable. Throughout this symposium, I do not doubt that minds are sparked, perspectives are broadened, and collaborations are forged. Such gatherings serve not only to advance the field but also to foster a sense of unity and friendship among mathematicians of the Faculty of Science. As we continue our journey of discovery and innovation, let us carry forward the inspiration and knowledge gained from this event.

May your future endeavors be filled with success and fulfillment, and may the bonds formed here endure, serving as a foundation for future collaborations. Once again, thank you for your invaluable contributions to the mini-symposium on mathematics. Your passion and commitment are the driving forces behind progress in our field, and I am grateful for the opportunity to be a part of this vibrant community.

Let me take this opportunity to extend my heartfelt gratitude to the organizing committee of this mini-symposium and all the staff members of the Department of Mathematics for taking pains to organize this wonderful event. I am honored and privileged to write a message to this important event.

Prof. E. P. Saman Chandana

Message from the Dean, Faculty of Science

It is with great pleasure that I send this message for the 3rd Mini Symposium organized by the Department of Mathematics of the Faculty of Science. The Symposium plays a crucial role in nurturing the next generation of mathematicians and provides undergraduate students with a unique opportunity to showcase their research projects and findings.

Participating in the symposium helps students refine essential professional skills such as public speaking, writing abstracts, and preparing professional posters or presentations. These skills are invaluable for future academic pursuits, research endeavors, and career opportunities in academia, industry, or government. On behalf of the faculty of science, I extend my sincerest thanks to the organizing committee for their hard work, dedication, and unwavering commitment to advancing the field of mathematics.

I believe that the symposium will foster a sense of motivation and curiosity that encourages students to pursue further studies or careers in the field of mathematics and to become professional mathematicians to serve the country.

Best wishes and warm regards.

Prof. D.H.N. Munasinghe

Message from the Head, Department of Mathematics

It is with great pleasure that I extend a warm welcome to all of you as we gather for the 3 rd Mathematics mini-symposium 2024. Specially, the key-note speaker, Prof. Janak R. Wedagedara who has rendered an exceptional service to the Department of Mathematics. And also he has made a significant impact on my life as one of my teachers. As the head of the Department of Mathematics, I am happy to see so many esteemed mathematicians, researchers, students those who following Industrial Mathematics and Financial Mathematics and Industrial Statistics, and enthusiasts come together to share knowledge, exchange ideas, and explore the latest developments in field of mathematics.

As a student, what is the significant importance of participating and presenting at this mini symposium. It supports you to have very good networking opportunities, exposure to current research, feedback and critique, presentation skills, building confidence, inspiration and motivation and publication opportunities which are the extremely important recently rather than knowledge. By summarizing, this mini symposium offers our students a valuable opportunity to grow academically, professionally, and personally. I would like extend my gratitude to the organizing committee, presenters, sponsors, and all those who have contributed to making this mathematics mini-symposium a possible one. All of your dedication and support are highly appreciated.

I wish each and every one a most pleasant experience at the 3 rd Mathematics mini-symposium 2024.

Prof. B.G.S.A. Pradeep

Message from the Coordinator Mini-Symposium 2024

As the coordinator of the 3rd Mini-Symposium, it is a great honour for me to provide a message which is scheduled to be held on the 21st of February 2024 at the Department of Mathematics, Faculty of Science, University of Ruhuna. This symposium marks a significant milestone as it represents the first physical gathering at the Department of Mathematics, offering a platform for scholarly exchange and collaboration. MINI SYMPOSIUM was initiated in 2022 to create a platform for presenting the valuable research findings of projects conducted by undergraduate students who are following the Industrial Mathematics course at the Department of Mathematics, University of Ruhuna. It inspired undergraduates in research activities. Therefore, the 2nd Mini-symposium was open for all the undergraduate research findings of projects attached to the Department of Mathematics in 2023. Building upon the success of its predecessors, the 3rd Mini Symposium continues this tradition, seamlessly overcoming various challenges. I am delighted to announce that the MINI-SYMPOSIUM 2024 will feature a keynote address by Dr. J.R. Wedagedara, a distinguished former professor of Mathematics at the University of Ruhuna. Dr. Wedagedara holds a special significance to this event, being the pioneering figure behind the introduction of the Industrial Mathematics course unit to our department, which has significantly contributed to its development. On behalf of the organizing committee, I greatly appreciate the support and guidance from the Vice Chancellor and Deputy Vice-Chancellor. I express our sincere gratitude to the Dean/Faculty of Science for her support and encouragement throughout the planning of MINI SYMPOSIUM 2024. I highly appreciated the head and the academic staff members in the Department of Mathematics contributed to the success of this event by actively participating in the mini-symposium. Furthermore, I extend my thanks to the members of the Mathematics and Statistics Society, as well as the non-academic staff members of the department, for their valuable contributions to various aspects. As well as I greatly appreciate students in the faculty of science, who supported in numerous ways to succeed this event. My special thanks go to Dr. P.L.J.S.S. Liyanage and Dr. M.K. Mahinda who are graduates of the B.Sc. (Special) Degree in Mathematics, University of Ruhuna, for his financial contribution to MINI SYMPOSIUM 2024. Finally, I would like to express my sincere gratitude to adversary board member Dr. N. Yapage, and reviewer chair prof. P. A. Jayantha for guiding me in all aspect. I greatly appreciate the organizing committee of this mini-symposium for their dedication to make this event a success. At the end, I convey my wishes to presenters, participating students and their supervisors for their research activities and future endeavors.

Dr. E.J.K.P. Nandani

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Keynote Speech

Beyond the Equations: Mathematics in Action for Real-World Challenges

Dr. Janak R. Wedagedera,
A.Menarini Farmaceutica Internazionale SRL United Kingdom
Former professor in Department of Mathemtics, University of Ruhuna, Sri Lanka.

The origins of Mathematics are indeed rooted in human efforts to comprehend the natural world and celestial objects. From tallying herds, deciphering the motion of celestial bodies, to precise calculations without the aid of computers or similar tools for constructing irrigation systems, as well as for religious and cultural endeavours, humanity has evolved in attempting to replicate the intricacies of the human brain within semiconductor or biological molecule-based artificial systems. These advancements are all underpinned by the vast, rich, and robust foundations laid by pure mathematical and statistical theories.

Thus, there is no need to emphasize how Mathematics and Statistics have played a crucial role throughout human evolution in surmounting real-world challenges. The primary focus of this symposium is to explore how, as a small academic community in a university with minimal government support and limited established links with local or international industries, you facilitate job-oriented research activities in mathematics and statistics. These activities empower graduates to confidently apply the knowledge and training acquired through the degree programs you offer, whether in a direct or translational manner.

The quality and standard of the research you conduct are beyond question. Looking at this year's project list, the diversity and tremendous potential of these projects to make an impact in their targeted areas are evident. While these endeavours may not always follow a straightforward path, they all rest on the solid foundation necessary for success in international-level research.

Furthermore, we will delve into discussions on a couple of examples on using Mathematics and Statistics in todayâĂŹs cutting-edge applications in Drug development. We will also discuss the essential skills you should equip yourselves with as graduates to confront real-world challenges and secure your careers.

Session I
BSc (General) Degree - Level I

Mathematical Model for Motor Insurance Claim using Decision Tree

H.M.C.K. Madhuwanthi*, P.K.S. Sadunika, A.M.B. Thilakshana, K.A.D. Nethmini and D.M.W.W. Dasanayake
Supervisor: Dr. E.J.K.P. Nandani

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The vehicle insurance will provide a financial protection to the vehicle in an accident. The most crucial aspect of insurance is the requesting a claim in the event of accident of vehicle. The lack of knowledge of the claim procedure may cause to worry about the vehicle insurance when they urgently need assistance. Therefore, the objective of this study is to build a model to determine whether a motor insurance claim is eligible or not in an accident, and calculate the insurance claim amount. Data for this study were collected through a survey that was based on some factors such as having insurance for the vehicle, type of insurance, driving license to the driver, use of private and commercial vehicle and age of the vehicle giving to the people who had requested claim for their motor vehicle. There were 60 complete records, and randomly selected 50 records used to build up the model and the rest of them were used for measured the performance accuracy of the model. The decision tree technique was used to classify the claim eligibility and the order of the nodes in the decision tree was selected by calculating the Entropy and Information gain. If the model classified the claim request as eligible for the claim, then the developed formula was used to calculate the claim amount. According to the collected data records, the model was able to classify the claim eligibility perfectly and calculate the claim amount by developing a formula under the assumed depreciation rates of vehicles. So, this study will help to get some knowledge about the insurance process and claim amount.

Keywords: Decision tree, Entropy, Information gain, Insurance claim.
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Numerical Integration Methods to Find the Water Plane Area of a Ship

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Supervisor: Mrs. K.C.N. Shanthidevi

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Numerical Integration is a concept of using numerical approximation algorithms to approximate answers for integration problems specially when finding the analytical solution is not feasible. It is a heavily used concept in many practical problems in various industries due to that reason. Even though many methods are available to use under numerical integration, it is very important to find the most suitable method which gives the most approximately closer value to the analytical answer. Hence, the objective of this study was to find the most suitable method of numerical integration which gives the most approximately closer value. Mainly six methods of Numerical integration were considered throughout this study which are Trapezodial Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule and their Composite Rules. The answers of each method were calculated separately and simultaneously, using separate C code functions for each method. By comparing the results for known functions with the analytical solution, the error of each method was able to calculate. When reviewing the results of each method, it was observed that Composite Simpson's 1/3 and 3/8 Rules give the most accurate answers while sometimes giving the exact answer. Other methods also give closer values but the difference between the analytical values was a bit higher than the the above methods. To observe the practical industrial application of these methods, this study considered finding the Waterplane area of a ship which is used to calculate the Tonnes Per Centimeter value which is very much crucial for a shipŚs stability and safety.

Keywords: Numerical integration, Simpson's rule, TPC value, Trapezodial rule, Water plane area

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Population Modeling with Exponential and Logistic Growth Model

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Mathematics can be used to model population dynamics and study the patterns of future populations. Population growth models are used to predict how population changes over time. This study investigated the best fit for modelling population among exponential growth model and logistic growth model. Accordingly, available secondary data on population in Matara from 1950 to 2023 was used. The general solution of the two models were obtained after going through a comprehensive study for the both models. Then real population values were plotted with respect to time and then growth rate, and carrying capacity values were calculated using the data values. As per the analysis, exponential growth was increased over time without any limitation, but logistic growth model increased and then decreased to the carrying capacity value. For the model interpretation, C programming language was used. Throughout this study, other than the main objective of identifying the best models among two main population models, the benefits of using such programming language like availability of tools for scientific computing and analysis, possibility of handling large data sets with minimal overhead and memory usage were identified. As per the analysis it was found that the logistic growth is more realistic compared to the exponential model to model population data when resources are limited. The results of this study will be useful for predicting future population values of Matara district. By including immigration/emigration and disasters by changing growth rates in population models to constraints his study can also be extended to model the population of a country and even the world population, to make useful decisions on future requirements of people by identifying the possible future population growth.

Keywords: Population growth model, Exponential growth model, Logistic growth model, Carrying capacity

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Applications of Monte Carlo Method

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A Monte Carlo simulation takes the variable that has uncertainty and assigns it a random value. The model is then run and a result is provided. This process is repeated again and again while assigning many different values to the variable in question. Once the simulation is complete, the results are averaged to arrive at an estimate. The purpose of our research was to learn how to use the Monte Carlo Method for real-world problems, especially in Finance applications. The Monte Carlo simulation has numerous applications in finance and other fields. Monte Carlo is used in corporate finance to model components of project cash flow, which are impacted by uncertainty. The result is a range of net present values (NPVs) along with observations on the average NPV of the investment under analysis and its volatility. In this research we created a C program to compute Net Present Value (NPV) for an imaginary project to decide whether the project is profitable or not.

Keywords: Monte Carlo method, Net present value
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Session II
BSc (General) Degree - Level II

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The Ordinary Kriging Method for Forecasting Infected COVID-19 Patients in the Galle District

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Supervisor: Dr. E.J.K.P. Nandani

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One of the most widespread outbreaks is the COVID-19 pandemic, which has been carried out to debilitate the entire global system. All the people in the world were very keen on the daily updated situation, and try to manage it in best. Therefore, this study tried to predict the infected COVID-19 patients in necessary areas by using the Ordinary Kriging model which is a geostatistical technique. Kriging uses the spatial correlation between sampled points to interpolate the values in the spatial field. Kriging is a technique for interpolating the value of a random field at an unobserved location by observing its value at surrounding locations. The main idea of ordinary kriging is that near-sample points should get more weight in the prediction to improve the estimate. This study was limited to the Galle district in Sri Lanka and, relevant data was collected from the Ministry of Health (MOH) offices in the Galle District. There were 20 data points and each point represents the corresponding MOH office area. So, we collected the total number of COVID-19 infected patients with latitude and longitude of a place in each area. Then, the variogram cloud of the data was clustered by the K-means clustering method. The most suitable number of clusters was selected as 7 according to the elbow method. The experimental semivariogram plot was selected as the exponential model under the minimum sum of square error. Upon deriving the Exponential model which has range, sill, and nugget as 0.4714, 3631792.7519, and 0 respectively and kriging weights were calculated by the covariance matrix. Ordinary Kriging model used for forecasting average number of infected COVID-19 patients in necessary areas. Overall, this project demonstrates a sophisticated approach to spatially analyzing and modeling the spread of COVID-19, providing valuable insights for public health planning and intervention strategies in the study area.

Keywords: Covaraince matrix, COVID-19, Exponential model, Ordinary Kriging
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Analysis of Indoor Air Pollution Model by using LU Decomposition

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In now a days, Indoor air pollution is a serious threat to human health, causing millions of death each year. This study describes an indoor air pollution model to find the concentration of Carbon Monoxide in the each sections of restaurant serving area based on MATLAB programming. The model aims to analyse indoor air pollutant concentration and sources affected to air pollution. By creating the linear algebraic equation system, we convert our real-world problem to mathematical model. Mainly LU factorization and Matrix Inversion techniques are used to solve the resulting linear system, allowing for a comprehensive evaluation of pollutant concentrations and their spatial distribution within indoor environments. In addition, Gauss Elimination is involved to our study for decompose Lower and Upper matrices. LU factorization is the one of the methods to solve linear equation system. There are three versions of LU factorization. In this case study we use Do-little method to decompose Lower and Upper triangular matrices. As well as Matrix Inverse is used to calculate carbon monoxide concentrations. First, we analysed the Carbon Monoxide concentration in each room. Among them, we identified the concentration of Carbon Monoxide in the kid's section was at an intermediate level. Our main purpose is to decrease the Carbon Monoxide concentration in kid's section. We used to decrease the Carbon Monoxide concentration in kid's section by banning the smoking section and fixing the faulty grill. Finally, we analyse how the concentration in kid's area would change. This model contributes to understanding and decreasing indoor air pollution, offering insights into effective control strategies for healthier indoor environment.

Keywords: Decomposition, Do-little Method, Gauss Elimination, LU factorization, Matrix Inversion

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Four Compartment Mathematical Model for Diabetes Population Dynamics.

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According to the International Diabetics Federation reports in 2021, 537 million adults are living with diabetics and 3 in 4 adults are in low- and middle-income countries. Furthermore 6.7 million deaths occur due to diabetes all over the world. Because of this, diabetes is a social menace to the world. Our aim is to study the dynamics of diabetes population considering the compartments, pre-diabetic people through genetic factors (P), pre-diabetics due to the negative impact of socio-environmental factors (E), diabetics without complications (E) and diabetics with complications (C). For that we have considered a mathematical model consisting of the above compartments. We study the analytical properties of the model such as stability of the equilibrium points, positivity of the solutions and invariant regions. The numerical simulations are done by Euler method and Runge-Kutta method implemented in C- programming and parameters values are taken from Abdelfatah Kouidere et al. (2021) research paper. Considering these simulations of our compartments model, we observed that only the number of diabetics with complications increases with time for the considered set of parameters. It seems that this behavior is unacceptable and the reason for this is the unsuitability of chosen model parameters. Therefore, we have to choose suitable parameters. As such our next target is estimating acceptable model parameters considering relevant Sri Lankan scenarios.

Keywords: Equilibrium points, Invariant region, Positivity
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Image Compression of Victoria Crater with Principal Component Analysis

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The Victoria Crater is a well-known geological feature on Mars that the imaging technologies have photographed mostly. However, the images are usually compressed and inherited with minimum storage for speedy transfer to Earth. The Principal Component Analysis (PCA) is a method used to compress an image while keeping all of the important visual information by with predeterminate number of main components. Therefore, lossy image compression using MATLAB is the main focus of this project. We designed a MATLAB function and identified 400 principal components are needed to get a clear picture of Victoria Crater with great accuracy. The designed MATLAB function could be developed further to identify images with complex structures in many fields.

Keywords: Data compression, Dimensionality reduction, Image compression, Principal Component Analysis (PCA)
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Modelling Time Series Data using Exponential Smoothing Methods.

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This project explores data forecasting, with a focus on predicting future data through the application of exponential smoothing techniques. Exponential smoothing is a popular statistical method in time series forecasting. Exponential smoothing is a broadly accurate forecasting method for short-term forecasts. The technique assigns larger weights to more recent observations while assigning exponentially decreasing weights for past observations. This is a highly effective forecasting method due to its flexibility and simplicity. Other forecasting methods assume that seasonality and trends are constant but exponential smoothing can manage data with irregular and unpredictable behavior. The choice of the smoothing constant/s is important in determining the operating characteristics of exponential smoothing. The main objective of this research is to determine the exponential smoothing parameter(s) using MATLAB codes instead of the trial and error method. We have designed the corresponding MATLAB codes and graphical simulations related to four methods in Exponential smoothing which are single exponential smoothing, double exponential smoothing, triple exponential smoothing for additive and triple exponential smoothing for multiplicative. These methods are implemented to capture different aspects of the underlying trends and seasonality in the data. The Mean Square Error (MSE), Root Mean Square Error (RMSE), or Mean Absolute Percentage Error (MAPE) can be used as the criterion for selecting an appropriate smoothing constant/s. MSE penalizes larger errors more heavily than RMSE and MAPE since it squares the errors. Using MSE value we selected the best combination of smoothing parameter/s.

Keywords: Data, Exponential smoothing, Mean squared error, Seasonality, Trend
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Classifying the Quality of Latex in Rubber using Support Vector Machine

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Rubber plantation in Sri Lanka was started in the year 1876. At present, over 315, 000 acres of land are used for rubber cultivation, the rubber industry contributes about 0.6% to the GDP in Sri Lanka. According to the current situation of the rubber industry, the knowledge of latest technology and equipment are essential for the development of the industry. Therefore, the main objective of this study is to find a productive method to choose a group of rubber cultivators by classifying the quality of Latex in Rubber using the Support Vector Machine. Data for the study was collected from a reputed rubber gloves manufacturing company in Sri Lanka. There were collected 1522 data samples representing average Dry Rubber Content (DRC) and Dry Rubber Quantity (DRQ) values ofthe natural rubber supplied throughout the past six months. Nonlinear data separation was converted to linear form using the kernel radial basis function and suitable support vectors were selected randomly. The hyperplane equation related to the DRC and DRQ of the SVM technique was able to classify the quality of latex perfectly. The resultsof this study will be an aiding program to identify a group of rubber cultivators who provide high quality natural latex.

Keywords: Classification, Latex, Natural rubber, Support Vector Machine
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Session III
BSc (Hons.) Degree in Financial Mathematics and Industrial Statistics

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Estimation of Value-at-Risk (VaR) using Random Forest Model

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This study is arranged on moving forward the estimation of Value-at-Risk (VaR) by using random forest method. The goal of this research is to link the capabilities of a machine learning model in order to increase the assessment and accuracy of estimating Value-at-Risk (VaR). The main goal is to forecast VaR in the background of a financial portfolio by utilizing a Random Forest Regressor that is developed in Python. This research is important because it adds to the improvement of risk assessment procedures by integrating machine learning techniques. The process comprises creating a random dataset in Excel, training the Random Forest model, and computing VaR using both historical and parametric methods. After the model is run, the results show that, at a 95% confidence level, the parametric VaR value is 48,579.95, and the historical VaR value is 481,235.60, according to our dataset. These results highlight how machine learning may be effectively combined into financial risk management, signifying how it can be used to anticipate and mitigate future dangers. Finally, this study contributes significantly to the development of risk management practices in the financial industry by introducing a new method for VaR estimation and highlighting the wider application of machine learning in financial risk forecasting and extenuation.

Keywords: Financial risk, Machine learning, Python, Random forest Regressor, Value-at Risk (VaR)

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Life Expectancy Prediction : Disclosing the Interaction between Social System, Economy, Health System and Life Expectancy of a Country

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Strong consistent evidence of past studies emphasizes the significant impact of social, economic and health related indicators of a country on its life expectancy. This study provides a comprehensive analysis of the relationship of life expectancy of a country with its social, economic and health related indicators by investigating individual relationships and quantifying the aggregate relationship between the indicators and life expectancy by developing a multiple linear regression model. A publicly available data set of life expectancy and other indicators of each country was obtained from Kaggle for this study. The indicators were classified into three categories as social, economic and health related. The individual relationships were studied through scatter plot visualization and correlation analysis. To develop the multiple linear regression model, the ordinary least squares method was used. Backward stepwise selection was used for the variable selection. Log transformation was used for all numerical variables in the model. The study indicates several strong relationships between the life expectancy of a country and social, economic and health related indicators. Additionally, analyzing individual correlations helped in further understanding these relationships. Violation of regression assumptions and removal of lower life expectancies as outliers may affect the generalizability of the findings.

Keywords: Life expectancy, Social indicators, Economic indicators, Health-related indicators, Multiple linear regression model

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Identifying Factors Affected to Motor Insurance Claim

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According to the road traffic acts in Sri Lanka, all users of motor vehicles are required to obtain minimum third party motor insurance. Motor insurance is an insurance for the vehicle that gives a policy of financial protection to compensate vehicle owners in an unfortunate event of loss or damage to their vehicle. Although vehicle owners expect a claim from the insurer when an accident occurs, the insurer may accept or reject it according to the agreed terms and conditions and subjectivities of the vehicle insurance policy. Therefore, it is very interesting to identify the factors affected for motor insurance claims. Therefore, the objective of this study is to examine the factors affecting motor insurance claims using Factor Analysis for Mixed Data (FAMD) as a robust analytical tool. The selected variables that are assumed to have a major impact on motor insurance claims, named vehicle number category, market value, brand, age, usage type, license revoked(based on the driverŠs quality of driving and the state of the accident) and claim price, were collected from an insurer for this study. There were 135 data records representing qualitative and quantitative variables. Results from the FAMD reveal that the vehicle number category, brand, market value, and license revoke have a positive and statistically significant relationship with claim amounts at the 95% level of significance. As well as FAMD identified that vehicle number category and brand mainly affected to the motor insurance claim. Next affected factors are market value of the vehicle and license revoke respectively. Vehicle age and usage type are not very much affected to the motor insurance claim approval process. That means more expensive modern vehicles tend to have higher claim amounts. As we as license revoke represents the nature of the event of loss or damage of the vehicle.

Keywords: Insurance claim, Factor analysis, Motor insurance
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Modelling and Forecasting the Sri Lankan Exchange Rate using Time Series Analysis

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The investigations of movements of the exchange rates are both interesting and important for a developing country. It can be forecasted and used for making future decisions. The main objective of this research study is to develop a forecasting model to predict dollar exchange rates in Sri Lanka with high accuracy. This study took monthly data of the exchange rates per US dollar in Sri Lanka from January 2010 to December 2022 which consists of 156 observations. 80% of observations (from 2010 to 2020) were used for modeling and 20% of observations (from 2021 to 2022) were used for testing. This research study developed four models; ARCH, GARCH, EGARCH, TGARCH and comparison tests were done to find the best model. AIC, BIC and SIC values were used to assess the suitability of fitted models. The GARCH (1,1) model was selected as the best model to forecast monthly dollar exchange rate prices in Sri Lanka as this model complies with the conditions and assumptions such as stationarity, serial independence, conditional heteroscedasticity, ARCH effect, conditional normality, adequate data and no outliers of the GARCH model. The AIC value of fitted data from the GARCH (1,1) model is -6.2843. When predicting future exchange rates for two years ahead, the forecasted data were matched with the original data taken from the Central Bank Sri Lanka for the year 2021 and 2022. So, the GARCH (1,1) is an efficient model for forecasting the dollar exchange rate in Sri Lanka.

Keywords: AIC, Exchange, Forecast, GARCH, Stationary
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Session IV
BSc (General) Degree - Level III

Determination of the Shortest Path for an Airplane using Dijkstra's Algorithm

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This project provides a practical implementation of Dijkstra's algorithm for calculating the shortest distance between two airports in a standardized airport system. The project making use of Java programming to generate code that allows users to enter their preferred airports and obtain information on the shortest path and total distance between them. The study begins by outlining the problem's significance, emphasizing the need of effective route planning and the value of Dijkstra's algorithm in solving such problems. The problem statement states clearly that the shortest distance between two airports in a standardized airport system needs to be found. The objectives of the project include implementing Dijkstra's algorithm, representing airports and routes through data sets, and creating a code using Java programming to calculate and display shortest path between any two airports as requested by the user.The methodology section gives an overview of the algorithm, describing the concepts behind Dijkstra's algorithm. It also gives some code explanation.This section provides information about the code structure, such as the data sets used, algorithm implementation, and input output processing. To improve readability and comprehension, comments are used throughout the code. The paper finishes with a project summary, emphasizing the effective implementation of the algorithm and the development of Java code. It suggests that future work should be carried out to expand the projectŠs capabilities and features. This project is a vital tool that benefits travelers and airport officials, allowing for more effective route planning and better overall airport system management.

Keywords: Dijkstra's, Airport, Shortest, Algorithm, Distance
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A Java-based Implementation of Two Group Linear Discriminant Analysis

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Two-Group Linear Discriminant Analysis (2-GLDA), which is the simplest version of Linear Discriminant Analysis (LDA), is a very powerful statistical and machine learning technique that is used as a binary classification tool between two groups. The main objective of this study is to implement 2-GLDA using Java, which is a high-level, object-oriented programming language. Using a Java program that implements 2-GLDA, the user will be able to formulate a discriminant function to achieve maximal separation between the two pre-defined groups by simply giving the values related to the characteristic variables of the sample observations, the names of the groups, and the names of characteristic variables to the Java program, while the program handles all the statistical and complex algebraic calculations, such as high-dimensional matrix operations. After formulating the discriminant function, the user will also be able to classify new observations among two pre-defined groups and measure the accuracy of the result using a confusion matrix. The main aim of implementing 2-GLDA through a Java-based program is to create a very user-friendly program that can be run on any operating system for data analysis, data preprocessing, and statistical classification. Not only that, as this program is open-source, developers will be able to further extend the constructed Java program for implementing other versions of Discriminant Analysis, such as Multiclass Linear Discriminant Analysis (MLDA) or Quadratic Discriminant Analysis (QDA).

Keywords: 2-GLDA, Java programming, Machine learning, Object-oriented programming, Statistical classification

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