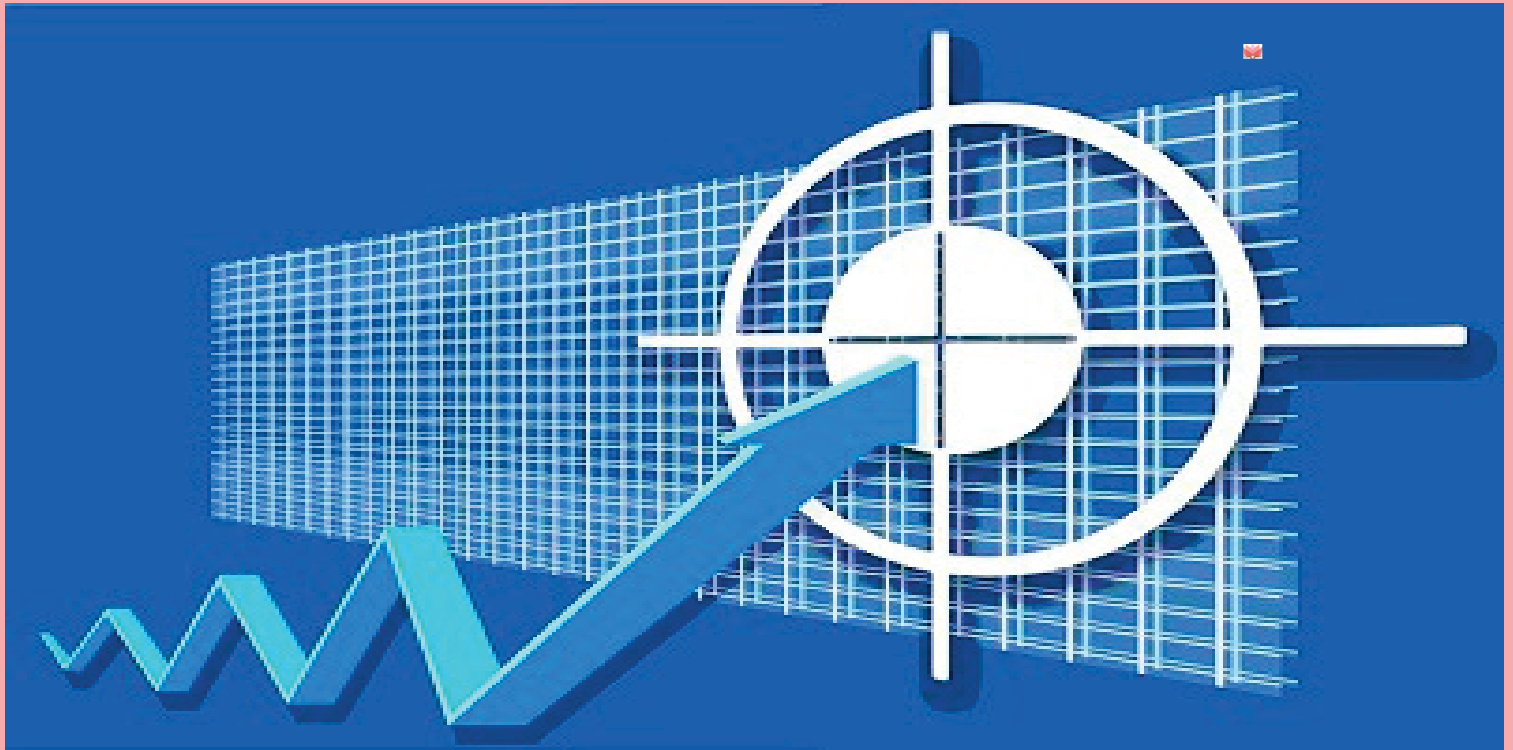# IMMCMSS

*"Determined and Dedicated to Shaping the Future"*



# Conference  Proceedings

## Institute of  Mathematics  and  Management Conference on Managament & Social Sciences – 2023 Sydney, Australia
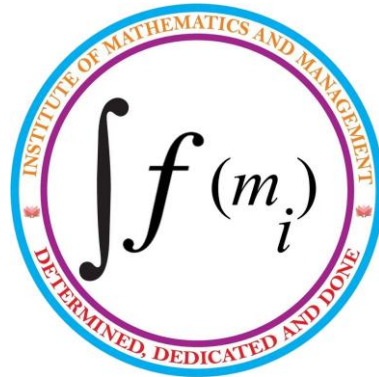
### Volume  2    Issue  1

**Proceedings of**
**3rd Institute of Mathematics and Management Conference on**
**Management & Social Sciences**

*"Determined and Dedicated to Shaping the Future"*

**IMMCMSS 2023**



**21st and 22nd October 2023**
**Western Sydney University**
**Parramatta City Campus, New South Wales,**
**Australia**

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**Proceedings of the 3rd Institute of Mathematics and Management Conference on Management & Social Sciences 2023**

Edited by IMMCMSS 2023 Editorial Board
Institute of Mathematics and Management

# Preface

Institute of Mathematics and Management (Pvt) Ltd, is incorporated as a Private Liable Company under the Companies Act, No 7 of 2007, Sri Lanka in October 02, 2012. With the excellence in the educational and research spheres, the Institute of Mathematics and Management (IMM) is staunch in its niche of being the quality education, research, and analytical support service provider. IMM expands its horizon through vertical integration and established the institute in Australia in May 25, 2022.

The IMM is one of the fastest-growing Education and Research Institute which conducts courses on research in various disciplines. The IMM discoveries, named: Circular Model, Circular Indicator, Sama Circular Model, Damped Circular Model, Forced Circular Model and Coefficient of Stability are unique and applicable in modelling real life data in the fields of Agriculture, Medical & Healthcare, Engineering, Meteorology, Economics, Finance, Tourism & Hospitality, Management, Social Sciences and more. The IMM International Journals; Journal of New Frontiers in Mathematics and Statistics (JNFMS) , Journal of New Frontiers in Healthcare and Biological Sciences (JNFHBS), Journal of New Frontiers in Economics and Business (JNFEB) and Journal of New Frontiers in Education and Social Sciences (JNFESS) promote scientific research by providing publication opportunities at free of charge and open access to all published articles to enhance the performance of, Mathematicians; Statisticians, Epidemiologists, and professionals in the fields of Agriculture, Meteorology, Business, Management, Health, Life Sciences, Social sciences, and Technology.

Over the decades, it had been observed that a large number of published research articles are erroneous due to misuse of statistics and lack of knowledge in quantitative research. The IMM determined to fill the knowledge gap; take initiative to conduct the International Research Conferences along with the "Workshop in Data Analytics".

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# Keynote Speaker



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- Researcher, Western Sydney University, Australia

Dr. (Mrs.) W. G. Samanthi Konarasinghe, an award winning Scientist has served as a Statistical Consultant and an Academician for more than two decades. She has developed various Mathematical and Statistical techniques to the world. The Circular Model (CM) and Sama Circular Model (SCM) are two of the widely applied techniques whilst the Damped Circular Model (DCM) and Forced Circular Model (FCM) are the recently developed models.

Dr. Samanthi has won the Best paper Award from International Conference on Advances in Mathematics, Computers & Physical Sciences and the International Conference on Business, Economics, Social Sciences & Humanities for her research findings.

She was awarded the "IMRF BEST SCIENTIST AWARD, INDIA" for her invaluable contribution to the field of Statistics. She has been in constant demand due to her new findings, gets invitation from various destinations to share her knowledge as the keynote speaker, invited speaker etc. at international research forums in Thailand, Singapore, Malaysia, India, Australia and many other countries. Also, she was the guest of honor and the chief guest of many International research forums.

Dr. Samanthi is a multi-disciplinarian; has obtained Bachelor of Science Degree in Mathematics; Postgraduate Diploma in Industrial Mathematics; Master of Science in Applied Statistics, Master of Business Administration (MBA) and Doctor of Philosophy in Statistics. Also has obtained a Diploma in Classical Music.

She is a member of; American Statistical Association (ASA), Statistical Society Australia (SSA), and Institute of Applied Statistics, Sri Lanka (IASSL). She is the Editor in Chief of, Journal of New Frontiers in Mathematics & Statistics; Journal of New Frontiers in Economics & Business; Journal of New Frontiers in Healthcare & Biological Sciences; Journal of New Frontiers in Education & Social Sciences, published by Institute of Mathematics and Management of Sri Lanka. She is an Editorial Board of MATTER: International Journal of Science and Technology and an Advisory member Technical/ Scientific Conference Committee member of Scientific and Technical Research Association (STRA).

Most interestingly, Dr Samanthi is not only a Scientist, but also an Artist; a Violinist, Painter, Writer, Drama producer and an Actress. The membership magazine of the American Statistical Association; "AMSTATNEWS" wrote two testimonials on her,

https://magazine.amstat.org/blog/2018/07/01/konarasinge/
https://magazine.amstat.org/blog/tag/w-g-samanthi-konarasinghe/

For information about her research, see

https://imathm.edu.lk/view/dr-mrs-w-g-samanthi-konarasinghe

# Table of Content

# Likert Scale vs. Sama Radial Indicator (SRI) for Measuring Psychometric Variables

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## ABSTRACT

Psychometrics is a discipline related to: Statistics, Data theory, Econometrics, Biometrics, Measurement theory and Mathematical psychology. Psychometric variables attempt to measure and quantify the mental processes that influence behavior of people. These variables are not directly observed, therefore inferred from other, observable variables referred as hidden variables or Latent Variables (LV). The LV's are measured by polytomus item scales, where an "item" is a question, and a "scale" is the resulting estimate of the LV. The Likert scale is the mostly applied polytomus item scale in measuring psychometric variables. It assigns "codes or ranks" (numerical values) to categories of a qualitative variable. Several items are develop to measure a LV and then the total of the item ranks is taken as the outcome of the random variable. Despite the usefulness of the Likert scales, studies shown several weaknesses and limitations of them. The limited number of responses of the scale induced the error in rating. If the number of responses are increased, then the meanings of the responses become unclear. For example, Likert 7-point scale including: "strongly agree, moderately agree, slightly agree, neutral, slightly disagree, disagree, and strongly disagree", has higher response options compared to a 5-point scale ("strongly agree, agree, neutral, disagree, and strongly disagree"), but hardly the respondent could understand the difference between moderately agree and slightly agree and vice versa. Hence the response would be a guess and the measurement error would be high. Also the variables measured by Likert scales are very unlikely to be normally distributed, hence parametric statistical methods are not applicable for data analysis. However, power of parametric statistical techniques are higher than the non-parametric counterparts, as misuse of Likert scale has become a common practice. Sama Radial Indicator (SRI) is developed to overcome the limitations of the Likert scale as well as other polytomus item scales. The development of SRI is based on the fundamental properties of a circle. The scale has only three anchors, but gives 180 response options, hence the error of the response will be less. SRI converts the psychometric ratings of respondents into a continuous scale, hence the LV's become normally distributed. As such, the decade old problems in measuring psychometric variables is solved.

**Keywords:** Qualitative variable, Latent variable, Likert scale.

# Mathematical Modeling and Emperical Data Intelligence of Share Market Predictions through Markov Processes

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## ABSTRACT

Stock price prediction in the financial market plays a vital role and making the model builders and reseachers a competent challenging problem. This study deals with developing a Markovian mathemtcal model for an emperical data set pertaining to the daily clsoing prices of a stockmarket. It is broadly divided in to two major parts. The first part is on the formulation of probability distributions for different states using the parameters of the Markov model.AllPearson's coefficients like average, variance, third central moment, coefficients of skewness and kurtosis, coefficient of variation, etc. are obtained after finding the probability distributions. In the second part, real-time data of SBI is procured from the internet source. The entire data is segregated into 5 data sets (all business days like Monday to Friday) by considering the seasonality within the data set. Numerical calculations are obtained for the developed model using R software. The parameters in the Markov model like the transition probability matrix (TPM), initial probability vector (IPV) along with probability distributions and the statistical measures are computed by using the derived mathematical relations for all business days data sets separately. The developed model is designed in more scientific lines for adopting optimal investment policies. Developing suitable digital interfaces will make these tools more accessible for traders in understanding the SBI's share market behaviour in the Indian share market context. This study has explored indicators like (i) when to purchase and when to sell a specific share, (ii) what is the likelihood of *Rise/Fall* of the closing price on the day of interest, (iii) what is the expected gain/loss for selling/buying a specific share, (iv) what is the estimated closing price of the specific share on the date of the study, etc. similar.

**Keywords:** Markov Model, Probability Distribution, Stock Price, Financial Market, Portfolio Management
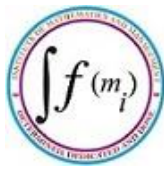
# Indigenous Healthcare Systems of Australia

Dr. T. M Chaudhry
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## ABSTRACT

Traditional medicine practices of indigenous Australians encompasses a holistic world view. Indigenous Australians believed that the mind and body are inseparable and that to prevent ill health there is a need to maintain a balance between the physical and spiritual selves. Traditional forms of healing in Australia consist the use of traditional healers, healing songs and bush medicines. Most Indigenous medical treatments were derived from food, a big part of maintaining their health was just eating right. When indigenous people did fall sick, they used plants in a variety of ways to quell their ills. Some plants, like goat's foot, were crushed, heated and applied to the skin. Others were boiled and inhaled, and occasionally drunk. Witchetty (Witjuti) grubs also a good source of bush tucker, were crushed into a paste, placed on burns and covered with a bandage to seal and soothe the skin. Some indigenous people suck on the bright orange desert mushroom to cure a sore mouth or lips. It has been known to be a kind of natural teething ring, and is also useful for babies with oral thrush. Literature revealed that the indigenous plants contained anti-bacterial and anti-inflammatory compound that are known to western medicine. The plants that were used by indigenous people are very likely to be useful to us.

**Keywords:** Indigenous Australians, Traditional medicine

# Math behind the Elliptic Curve Cryptography:
# A Backbone in BITCOINS Transaction

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## ABSTRACT

Bitcoin is a digital crypto currency that was established in 2009. It is a peer-to-peer consensus network that allows people to send or receive money anonymously. This study explains the importance of Elliptic curve concepts which serves as a backbone of cryptographic studies. An elliptic curve consists of all the points that satisfy an equation of the form: $y^2 = x^3 + ax + b$ where $4a^3 + 27b^2 \neq 0$. Here, two important properties of elliptic curves are explained in detail. Using Elliptic curve and finite field, how an Elliptic Curve Digital Signature Algorithm (ECDSA) are generated is illustrated. This is used to generate private and public key that can verify the authenticity of the signatures. These transactions are valid only if the data is verified using ECDSA with several distinctive arithmetic procedures for signing and verification.

**Keywords:** Cryptography, Elliptic Curve, BITCOIN Transaction, ECDSA

# Investment Bias

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## ABSTRACT

The paper measures the investment bias for 40 countries over the period of 2001 to 2019 using various approaches, such as shadow cost, deadweight costs, implicit cost on international equity investment, covariance-based measure, and economic home bias. Investors expect domestic portfolio returns that are higher than those of diversified foreign portfolios. The implicit costs of international equity markets are much higher for emerging markets than those of developed markets. The average implicit cost of international equity investment for sample countries varies depending on total wealth. The implicit cost of international equity investment is related to home-related, host-related, and interaction variables, including information asymmetries, financial development, institutional and explicit costs. The implicit cost of investment bias may have implications for foreign portfolio investment.


**Keywords:** Home Bias, Shadow cost, Implicit cost on international investment

# Modelling International Tourist Occupancy in Kandy District of Sri Lanka

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## ABSTRACT

Kandy, the sacred Buddhist site, popularly known as the city of Senkadagalapura, is a cultural landscape with a history of more than 2500 years. It is also the site of the Temple of the Tooth Relic. The city is a world heritage site declared by UNESCO. The rich history, vibrant culture, glorious tea hills, artistic heritage and many other attractions made Kandy a place sought by tourists. Being the capital city of the Central province of Sri Lanka, Kandy is reported to have a high population density, the city is also identified as a place of over-tourism. The narrow roads of Kandy become jammed with high population and over-tourism, causes severe environmental and social issues. Therefore, it is a timely requirement to model the tourism occupancy in Kandy district. The study utilized the monthly occupancy data for the period from January 2015 to December 2020. The study reveals that occupancy in Kandy district has grown rapidly over the last decade, and significantly drop in 2019, but shows a sign of recovery in 2020 onwards. Time series plot and Auto Correlation Function (ACF) suggest an increasing trend with seasonal/ cyclical variations. Hence the Sama Circular Model (SCM) and the Seasonal Auto Regressive Integrated Moving Average (SARIMA) model were tested for forecasting. The Anderson Darling normality test and the ACF's of residuals were used to test the normality and independence of residuals, relative and absolute measurement of errors were used to assess the forecasting ability of the models. The results revealed that the SCM is the most suitable model for forecasting. Despite the present low occupancy, it would be back to normal with high seasonality component. Hence, there is a need to be more mindful of how and when to control visits and occupancy in the district to avoid one of the world's most beautiful places being dead.

**Keywords:** Over-tourism, Tourist Occupancy, SCM, SARIMA

# Board Gender Diversity, Corporate Risk-Taking and Profitability in the Stock Market. Evidence from Sri Lanka

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## ABSTRACT

The women participation in financial spheres has become a vital determinant in rising economic potential of a country. Gender involvement, investment and financial decisions are now very important for many organizations in the share market as they have been proven to play a key role in business. The current behavior of the share market is volatile, uncertainty, complex and ambiguous and many investors face market and business risk. The amount of women participation on the boards and senior management positions of listed companies in Colombo stock Exchange, Sri Lanka, has been increased in recent years, which has a substantial positive impact on growth in sales, leverage, and risk management. As per the empirical survey, female directors are less risk-averse than their male counterparts, female Chief officers have stronger risk aversion and accounting conservatism. Moreover, board diversity affects company profitability by influencing strategic decisions and responding to acquisitions and challenges. There have been relatively few empirical researches on this topic in Sri Lanka, compared to many other countries. Since each nation has a unique cultural and socioeconomic perspective on women's participation in the corporate labor market, there is no rationale for extrapolating data from other nations to Sri Lanka. Thus, the primary goal of this study is to examine how having more women on director boards in Sri Lanka affects the profitability and risk tolerance of the companies listed on the Colombo Stock Exchange. The study is based on a sample of 60 publicly traded companies from 20 industry subsectors listed on the Colombo Stock Exchange, and the data covers firms from 2011 to 2019. The relationship between female boardroom involvement, business risk-taking, and profitability was examined using the panel regression methodology. The Leverage, standard deviation of return on assets, profit after taxes, were used as dependent variables to indicate risk-taking and profitability. Three regression models; Pooled Ordinary Least squares, Fixed Effect Model, and Random Effect Model were used in the study. The validity of the panel regression models was tested using Hausman tests and the Redundant Fixed Effect Method. Based on the test statistics; it was evident that there is significant impact of gender of the board members over the risk tolerance. Although female chief executive officers may decide to reduce corporate risk-taking to the extent that suits their preferences, on average, female executives are less risk-averse than their male counterparts. So, gender-related variations in preferences and risk tolerance have been documented by experimental economics. The research findings on gender diversity and company's financial performances derived from the results of panel data analysis shows favorable signs for women empowerment. It is crucial and recommended to implement policies in place to encourage the presence of women on boards, rather than relying solely on legal requirements, social reforms, and professional advancements.

**Keywords:** Gender, Market, Profitability, Risk, Stocks

# Impacts of Digital Transformation on the Sustainability of the Hospitality and Tourism Industry: A review

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## ABSTRACT

The third industrial revolution or Industry 3.0 is the'First computer era' of modern industries. It is commonly referred as the 'Digital revolution' or 'Digital Transformation (DT)'. It began in 20th century through partial automation of business using simple computers and programmable logic controllers. Today we are in the fourth industry revolution or Industry 4.0 led by internet of things, Cyber Physical System, Information and Communications Technology, Enterprise Architecture and Enterprise Integration. This study aimed to identify the impacts of DT on the sustainability of the Hospitality and Tourism (H&T) industry. Before the digital revolution, the H&T industry was linearly organized with three major components: suppliers, intermediaries, and end-consumers, but the digital revolution changed the H&T across the world. Digital technologies and accessories such as, internet, e-mail, social media, smart phones, action cameras etc. become essential parts of tourism activities. The internet enhanced transparency enabled tourists to facilitate price comparisons and access to instant, inexpensive and accurate information. As such, the bargaining power of buyers increased, intensifying rivalry among tourism suppliers. However, suppliers could access their target markets without depending on   intermediaries, reduced cost and increased sales. The World Tourism Organization and many other organisations highlighted the importance of DT for the sustainability of destinations, while many other studies highlighted the environmental pressures and risks. Fossil depletion due to the extraction of critical raw metals for the production of microelectronic components, abiotic resource depletion, global warming, freshwater eutrophication and toxicity, human toxicity and  e-waste are some of the impacts, causing long term damages to the globe. The DT is also responsible for over tourism which leads to environmental and social problems. Hence, tourism destinations should attempt to maintain the triple bottom lines within the H&T industry.

**Keywords:** Digital transformation, H&T industry, Sustainable tourism

# Modelling International Tourist Occupancy in Southern Coast of Sri Lanka

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## ABSTRACT

The Southern Coast of Sri Lanka is the second highest area occupied by international tourist. It covers from the beaches east of Galle down to the port of Hambanthota. There are 20 amazing attractions in the area, including wild life parks, sacred Buddhist and Hindu sites, natural and manmade landscapes, adventurous sites etc. The history of Southern region, vibrant culture, glorious beaches, turtles, birds and coral ecosystems, artistic heritage and many other attractions made Southern Coast is a place sought by international tourists. Higher the occupancy leads to increasing the healthcare, environmental pollution and other social issues. Therefore, it is a timely requirement to model the tourism occupancy in Sothern Coast of Sri Lanka. The study utilized the monthly occupancy data for the period from January 2011 to December 2020. The study reveals that occupancy in Southern Coast district has grown rapidly over the last decade, and significantly drop after December 2019, but shows a sign of recovery after May 2020. Time series plot and Auto Correlation Function (ACF) suggest an increasing trend with seasonal variations. Hence the Sama Circular Model (SCM) and the Seasonal Auto Regressive Integrated Moving Average (SARIMA) model were tested for forecasting. The Anderson Darling normality test and the ACF's of residuals were used to test the normality and independence of residuals to validate the model. The relative and absolute measurement of errors were used to assess the forecasting ability of the models under the fitting and verification. The results revealed that the SCM is the most suitable model for forecasting. Despite the present low occupancy, it would be back to normal with many seasonal components. Hence, there is a need to be more mindful of how and when to control visits and occupancy in the Southern Coast to avoid hazadical damages to the environment and the society.

**Keywords:** Sothern Coast, Tourist Occupancy, SCM, SARIMA
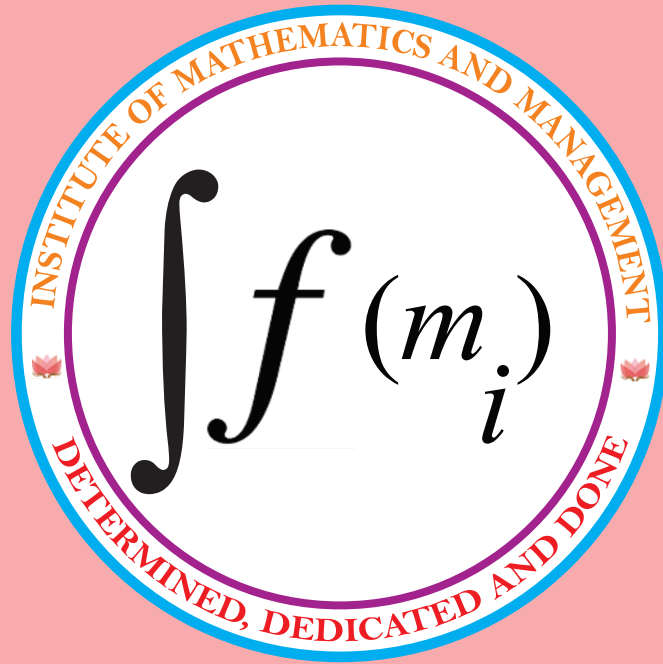
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