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TABLE OF CONTENT

PART 1: MATHEMATICS

	Page					
STATISTICAL ANALYSIS ON THE EFFECTIVENESS OF SHORT-TERM PROGRAMS DURING COVID-19 PANDEMIC: IN THE CASE OF PROGRAM BIJAK SIFIR 2020 Nazihah Safie, Syerrina Zakaria, Siti Madhihah Abdul Malik, Nur Baini Ismail, Azwani Alias Ruwaidiah	1					
Idris						
RADIATIVE CASSON FLUID OVER A SLIPPERY VERTICAL RIGA PLATE WITH VISCOUS DISSIPATION AND BUOYANCY EFFECTS Siti Khuzaimah Soid, Khadijah Abdul Hamid, Ma Nuramalina Nasero, NurNajah Nabila Abdul Aziz						
GAUSSIAN INTEGER SOLUTIONS OF THE DIOPHANTINE EQUATION $x^4 + y^4 = z^3$ FOR $x \neq y$ <i>Shahrina Ismail, Kamel Ariffin Mohd Atan and Diego Sejas Viscarra</i>	19					
A SEMI ANALYTICAL ITERATIVE METHOD FOR SOLVING THE EMDEN- FOWLER EQUATIONS Mat Salim Selamat, Mohd Najir Tokachil, Noor Aqila Burhanddin, Ika Suzieana Murad and Nur Farhana Razali	28					
ROTATING FLOW OF A NANOFLUID PAST A NONLINEARLY SHRINKING SURFACE WITH FLUID SUCTION <i>Siti Nur Alwani Salleh, Norfifah Bachok and Nor Athirah Mohd Zin</i>	36					
MODELING THE EFFECTIVENESS OF TEACHING BASIC NUMBERS THROUGH MINI TENNIS TRAINING USING MARKOV CHAIN Rahela Abdul Rahim, Rahizam Abdul Rahim and Syahrul Ridhwan Morazuk	46					
PERFORMANCE OF MORTALITY RATES USING DEEP LEARNING APPROACH Mohamad Hasif Azim and Saiful Izzuan Hussain	53					
UNSTEADY MHD CASSON FLUID FLOW IN A VERTICAL CYLINDER WITH POROSITY AND SLIP VELOCITY EFFECTS Wan Faezah Wan Azmi, Ahmad Qushairi Mohamad, Lim Yeou Jiann and Sharidan Shafie	60					
DISJUNCTIVE PROGRAMMING - TABU SEARCH FOR JOB SHOP SCHEDULING PROBLEM S. Z. Nordin, K.L. Wong, H.S. Pheng, H. F. S. Saipol and N.A.A. Husain	68					
FUZZY AHP AND ITS APPLICATION TO SUSTAINABLE ENERGY PLANNING DECISION PROBLEM <i>Liana Najib and Lazim Abdullah</i>	78					
A CONSISTENCY TEST OF FUZZY ANALYTIC HIERARCHY PROCESS Liana Najib and Lazim Abdullah	89					
FREE CONVECTION FLOW OF BRINKMAN TYPE FLUID THROUGH AN COSINE OSCILLATING PLATE	98					

Siti Noramirah Ibrahim, Ahmad Qushairi Mohamad, Lim Yeou Jiann, Sharidan Shafie and Muhammad Najib Zakaria

RADIATION EFFECT ON MHD FERROFLUID FLOW WITH RAMPED WALL106TEMPERATURE AND ARBITRARY WALL SHEAR STRESS106

Nor Athirah Mohd Zin, Aaiza Gul, Siti Nur Alwani Salleh, Imran Ullah, Sharena Mohamad Isa, Lim Yeou Jiann and Sharidan Shafie

PART 2: STATISTICS

A REVIEW ON INDIVIDUAL RESERVING FOR NON-LIFE INSURANCE Kelly Chuah Khai Shin and Ang Siew Ling						
STATISTICAL LEARNING OF AIR PASSENGER TRAFFIC AT THE MURTALA MUHAMMED INTERNATIONAL AIRPORT, NIGERIA <i>Christopher Godwin Udomboso and Gabriel Olugbenga Ojo</i>	123					
ANALYSIS ON SMOKING CESSATION RATE AMONG PATIENTS IN HOSPITAL SULTAN ISMAIL, JOHOR Siti Mariam Norrulashikin, Ruzaini Zulhusni Puslan, Nur Arina Bazilah Kamisan and Siti Rohani Mohd Nor	137					
EFFECT OF PARAMETERS ON THE COST OF MEMORY TYPE CHART Sakthiseswari Ganasan, You Huay Woon and Zainol Mustafa	146					
EVALUATION OF PREDICTORS FOR THE DEVELOPMENT AND PROGRESSION OF DIABETIC RETINOPATHY AMONG DIABETES MELLITUS TYPE 2 PATIENTS <i>Syafawati Ab Saad, Maz Jamilah Masnan, Karniza Khalid and Safwati Ibrahim</i>	152					
REGIONAL FREQUENCY ANALYSIS OF EXTREME PRECIPITATION IN PENINSULAR MALAYSIA <i>Iszuanie Syafidza Che Ilias, Wan Zawiah Wan Zin and Abdul Aziz Jemain</i>	160					
EXPONENTIAL MODEL FOR SIMULATION DATA VIA MULTIPLE IMPUTATION IN THE PRESENT OF PARTLY INTERVAL-CENSORED DATA <i>Salman Umer and Faiz Elfaki</i>	173					
THE FUTURE OF MALAYSIA'S AGRICULTURE SECTOR BY 2030 Thanusha Palmira Thangarajah and Suzilah Ismail	181					
MODELLING MALAYSIAN GOLD PRICES USING BOX-JENKINS APPROACH Isnewati Ab Malek, Dewi Nur Farhani Radin Nor Azam, Dinie Syazwani Badrul Aidi and Nur Syafiqah Sharim	186					
WATER DEMAND PREDICTION USING MACHINE LEARNING: A REVIEW Norashikin Nasaruddin, Shahida Farhan Zakaria, Afida Ahmad, Ahmad Zia Ul-Saufie and Norazian Mohamaed Noor	192					
DETECTION OF DIFFERENTIAL ITEM FUNCTIONING FOR THE NINE- QUESTIONS DEPRESSION RATING SCALE FOR THAI NORTH DIALECT	201					

Suttipong Kawilapat, Benchlak Maneeton, Narong Maneeton, Sukon Prasitwattanaseree, Thoranin Kongsuk, Suwanna Arunpongpaisal, Jintana Leejongpermpool, Supattra Sukhawaha and Patrinee Traisathit

ACCELERATED FAILURE TIME (AFT) MODEL FOR SIMULATION PARTLY 210 INTERVAL-CENSORED DATA

Ibrahim El Feky and Faiz Elfaki

MODELING OF INFLUENCE FACTORS PERCENTAGE OF GOVERNMENTS' RICE 217 RECIPIENT FAMILIES BASED ON THE BEST FOURIER SERIES ESTIMATOR 217

Chaerobby Fakhri Fauzaan Purwoko, Ayuning Dwis Cahyasari, Netha Aliffia and M. Fariz Fadillah Mardianto

CLUSTERING OF DISTRICTS AND CITIES IN INDONESIA BASED ON POVERTY 225 INDICATORS USING THE K-MEANS METHOD 225

Khoirun Niswatin, Christopher Andreas, Putri Fardha Asa OktaviaHans and M. Fariz Fadilah Mardianto

ANALYSIS OF THE EFFECT OF HOAX NEWS DEVELOPMENT IN INDONESIA 233 USING STRUCTURAL EQUATION MODELING-PARTIAL LEAST SQUARE

Christopher Andreas, Sakinah Priandi, Antonio Nikolas Manuel Bonar Simamora and M. Fariz Fadillah Mardianto

A COMPARATIVE STUDY OF MOVING AVERAGE AND ARIMA MODEL IN 241 FORECASTING GOLD PRICE

Arif Luqman Bin Khairil Annuar, Hang See Pheng, Siti Rohani Binti Mohd Nor and Thoo Ai Chin

CONFIDENCE INTERVAL ESTIMATION USING BOOTSTRAPPING METHODS 249 AND MAXIMUM LIKELIHOOD ESTIMATE

Siti Fairus Mokhtar, Zahayu Md Yusof and Hasimah Sapiri

DISTANCE-BASED FEATURE SELECTION FOR LOW-LEVEL DATA FUSION OF 256 SENSOR DATA

M. J. Masnan, N. I. Maha3, A. Y. M. Shakaf, A. Zakaria, N. A. Rahim and N. Subari

BANKRUPTCY MODEL OF UK PUBLIC SALES AND MAINTENANCE MOTOR 264 VEHICLES FIRMS

Asmahani Nayan, Amirah Hazwani Abd Rahim, Siti Shuhada Ishak, Mohd Rijal Ilias and Abd Razak Ahmad

INVESTIGATING THE EFFECT OF DIFFERENT SAMPLING METHODS ON 271 IMBALANCED DATASETS USING BANKRUPTCY PREDICTION MODEL

Amirah Hazwani Abdul Rahim, Nurazlina Abdul Rashid, Abd-Razak Ahmad and Norin Rahayu Shamsuddin

INVESTMENT IN MALAYSIA: FORECASTING STOCK MARKET USING TIME 278 SERIES ANALYSIS

Nuzlinda Abdul Rahman, Chen Yi Kit, Kevin Pang, Fauhatuz Zahroh Shaik Abdullah and Nur Sofiah Izani

PART 3: COMPUTER SCIENCE & INFORMATION TECHNOLOGY

ANALYSIS OF THE PASSENGERS' LOYALTY AND SATISFACTION OF AIRASIA 291 PASSENGERS USING CLASSIFICATION 291

Ee Jian Pei, Chong Pui Lin and Nabilah Filzah Mohd Radzuan

HARMONY SEARCH HYPER-HEURISTIC WITH DIFFERENT PITCH 299 ADJUSTMENT OPERATOR FOR SCHEDULING PROBLEMS

Khairul Anwar, Mohammed A.Awadallah and Mohammed Azmi Al-Betar

A 1D EYE TISSUE MODEL TO MIMIC RETINAL BLOOD PERFUSION DURING 307 RETINAL IMAGING PHOTOPLETHYSMOGRAPHY (IPPG) ASSESSMENT: A DIFFUSION APPROXIMATION – FINITE ELEMENT METHOD (FEM) APPROACH Harnani Hassan, Sukreen Hana Herman, Zulfakri Mohamad, Sijung Hu and Vincent M. Dwyer

INFORMATION SECURITY CULTURE: A QUALITATIVE APPROACH ON 325 MANAGEMENT SUPPORT

Qamarul Nazrin Harun, Mohamad Noorman Masrek, Muhamad Ismail Pahmi and Mohamad Mustaqim Junoh

APPLY MACHINE LEARNING TO PREDICT CARDIOVASCULAR RISK IN RURAL 335 CLINICS FROM MEXICO

Misael Zambrano-de la Torre, Maximiliano Guzmán-Fernández, Claudia Sifuentes-Gallardo, Hamurabi Gamboa-Rosales, Huizilopoztli Luna-García, Ernesto Sandoval-García, Ramiro Esquivel-Felix and Héctor Durán-Muñoz

ASSESSING THE RELATIONSHIP BETWEEN STUDENTS' LEARNING STYLES 343 AND MATHEMATICS CRITICAL THINKING ABILITY IN A 'CLUSTER SCHOOL' Salimah Ahmad, Asyura Abd Nassir, Nor Habibah Tarmuji, Khairul Firhan Yusob and Nor Azizah Yacob

STUDENTS' LEISURE WEEKEND ACTIVITIES DURING MOVEMENT CONTROL 351 ORDER: UiTM PAHANG SHARING EXPERIENCE

Syafiza Saila Samsudin, Noor Izyan Mohamad Adnan, Nik Muhammad Farhan Hakim Nik Badrul Alam, Siti Rosiah Mohamed and Nazihah Ismail

DYNAMICS SIMULATION APPROACH IN MODEL DEVELOPMENT OF UNSOLD 363 NEW RESIDENTIAL HOUSING IN JOHOR

Lok Lee Wen and Hasimah Sapiri

WORD PROBLEM SOLVING SKILLS AS DETERMINANT OF MATHEMATICS 371 PERFORMANCE FOR NON-MATH MAJOR STUDENTS 371

Shahida Farhan Zakaria, Norashikin Nasaruddin, Mas Aida Abd Rahim, Fazillah Bosli and Kor Liew Kee

ANALYSIS REVIEW ON CHALLENGES AND SOLUTIONS TO COMPUTER 378 PROGRAMMING TEACHING AND LEARNING

Noor Hasnita Abdul Talib and Jasmin Ilyani Ahmad

PART 4: OTHERS

ANALYSIS OF CLAIM RATIO, RISK-BASED CAPITAL AND VALUE-ADDED 387 INTELLECTUAL CAPITAL: A COMPARISON BETWEEN FAMILY AND GENERAL TAKAFUL OPERATORS IN MALAYSIA Nur Amalina Syafiga Kamaruddin, Norizarina Ishak, Siti Raihana Hamzah, Nurfadhlina Abdul Halim and Ahmad Fadhly Nurullah Rasade THE IMPACT OF GEOMAGNETIC STORMS ON THE OCCURRENCES OF 396 EARTHOUAKES FROM 1994 TO 2017 USING THE GENERALIZED LINEAR MIXED MODELS N. A. Mohamed, N. H. Ismail, N. S. Majid and N. Ahmad **BIBLIOMETRIC ANALYSIS ON BITCOIN 2015-2020** 405 Nurazlina Abdul Rashid, Fazillah Bosli, Amirah Hazwani Abdul Rahim, Kartini Kasim and Fathiyah Ahmad@Ahmad Jali GENDER DIFFERENCE IN EATING AND DIETARY HABITS AMONG UNIVERSITY 413 **STUDENTS** Fazillah Bosli, Siti Fairus Mokhtar, Noor Hafizah Zainal Aznam, Juaini Jamaludin and Wan Siti Esah Che Hussain MATHEMATICS ANXIETY: A BIBLIOMETRIX ANALYSIS 420 Kartini Kasim, Hamidah Muhd Irpan, Noorazilah Ibrahim, Nurazlina Abdul Rashid and Anis Mardiana Ahmad

PREDICTION OF BIOCHEMICAL OXYGEN DEMAND IN MEXICAN SURFACE 428 WATERS USING MACHINE LEARNING 428

Maximiliano Guzmán-Fernández, Misael Zambrano-de la Torre, Claudia Sifuentes-Gallardo, Oscar Cruz-Dominguez, Carlos Bautista-Capetillo, Juan Badillo-de Loera, Efrén González Ramírez and Héctor Durán-Muñoz

THE FUTURE OF MALAYSIA'S AGRICULTURE SECTOR BY 2030

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Agriculture is described as the art and science of developing the soil, growing crops, and raising livestock. Previously before the independence and until the early '80s, Malaysia was an agricultural country. However, the scenario has changed due to the rapid development of manufacturing and services sectors. Hence, the agriculture sector has been shrinking, and this is very alarming because the impact is very severe on our basic food production. Therefore, this study aims to forecast the agriculture sector by 2030 compared to the manufacturing and services sectors. Two forecasting techniques were used: Holt's Exponential Smoothing and Autoregressive Integrated Moving Average (ARIMA). The performances of the models were evaluated based on RMSE, GRMSE, and MAPE. The finding showed that the agriculture sector will decrease from 8.24% in 2021 to 6.20% by 2030. Thus, drastic strategic agricultural policy planning needs to be established and implement by incorporating modern technology in smart farming.

Keywords: Agriculture, food production, sustainability, modern technology, smart farming

1. Introduction

According to National Geographic (2021), "Agriculture is the art and science of cultivating the soil, growing crops, and raising livestock. It includes the preparation of plant and animal products for people to use and their distribution to markets". This indicates that agriculture can be a good food source and business that can contribute to a country's economy.

Malaysia was an agricultural country before independence until the early '80s (Mohamad Idham et al., 2015). During the British era, the big plantations were focused on rubber, oil palm, and cocoa. As for the basic food productions such as rice, fruits, vegetables and so forth were produced by smallholder who involved traditional farmers (Rozhan, 2015). However, the scenario has changed due to the rapid development of manufacturing and services sectors which have boosted the economy. Figure 1 shows the shrinking of the agriculture sector as compared to manufacturing and servicing sectors from 1960 to 2019. At the beginning of the 1960s agriculture sector has the highest percentage of GDP with 51% and above but was overtaken by the services sector from 1964 onwards. Later, the manufacturing sector also bypassed the agriculture sector from 1988 ahead. Then the agriculture sector kept on decreasing to 8.8% in 2019.

The shrinking of the agriculture sector has affected our basic food production. According to the Department of Statistics Malaysia (DOSM, 2019), the self-sufficiency ratio (SSR) for rice was only 69%, and the Import Dependency Ratio (IDR) was more than 31%. This is because domestic rice production increased by only 0.8 percent per year (1980–2015), while consumption increased by 1.8 percent per year (Sidique and Shaharudin 2019). Therefore, rice shortages were covered by importing them from Thailand, Vietnam, Myanmar, Cambodia, and India (World Bank Report, 2019). We also imported beef, chicken, and fish, where the IDR was 76.6%, 4.2% and 7.4%, respectively (DOSM, 2019).



Source: Department of Statistics Malaysia & World Bank Figure 1: Agriculture shrinkage from 1960 to 2019

Relying too much on importing them would cause shortages in the future if the supplier (i.e., other countries) decided not to sell them or increase the prices. This has happened to us recently when Vietnam has increased rice prices due to Covid-19 pandemic (The Star, 2021). Therefore, this study aims to forecast the agriculture sector by 2030 by comparing it to the manufacturing and services sectors. Thus, discussing the impacts on basic food productions and strategies to enhance the agriculture sector.

Methodology 2.

The percentage of Gross Domestic Products (% of GDP) data were obtained from Department of Statistics Malaysia and World Bank, which comprised of the three sectors (agriculture, manufacturing and services) from 1960 to 2019. The first 55 years of the data (1960 to 2014) was used for model estimation and the last 5 years (2015 to 2019) for model evaluation. In this study, we choose to have more in the estimation part (55 data points) because we were using ARIMA which required a lot of data points due to the lags variables and transformation to make it stationary (differencing). This was to ensure we established a strong estimated model and evaluated recursively using another 5 years of data points. Two forecasting techniques were used: Holt's Exponential Smoothing and Autoregressive Integrated Moving Average (ARIMA).

Holt's Exponential Smoothing

$$S_t = \alpha y_t + (1 - \alpha) \left(S_{t-1} + T_{t-1} \right) \quad 0 \le \alpha \le 1$$
 (1)

$$T_{t} = \beta (S_{t} - S_{t-1}) + (1 - \beta)T_{t-1} \quad 0 \le \beta \le 1$$

$$F_{t+m} = S_{t} + T_{t} \times m$$
(2)
(3)

$$Y_{t+m} = S_t + T_t \times m \tag{3}$$

ARIMA

$$y'_{t} = c + \phi_{1} y'_{t-1} + \dots + \phi_{p} y'_{t-p} - \phi_{1} \varepsilon_{t-1} - \phi_{q} \varepsilon_{t-q} + \varepsilon_{t} \quad (4)$$

The performances of the models were evaluated based on Root Mean Square Error (RMSE), Geometric Root Mean Square Error (GRMSE), and Mean Absolute Percentage Error (MAPE).

$$RMSE = \sqrt{\frac{\sum_{t}^{n} e_{t}^{2}}{n}}$$
(5)

$$GRMSE = (\prod_{t}^{n} e_{t}^{2})^{\frac{1}{2n}}$$
(6)
$$MAPE = \frac{100}{n} \sum_{t}^{n} \frac{|e_{t}|}{|Y_{t}|}$$
(7)

Several error measures were used to ensure the model's performance consistency where GRMSE is more robust than RMSE and MAPE when handling outliers (Mohd Alias Lazim, 2013). Forecasting technique that produces the smallest errors is considered as the best technique and would be used to forecast for the three sectors until 2030.

3. Results and Discussions

Table 1 displays the performances of Holt's Exponential Smoothing and ARIMA based on RMSE, GRMSE and MAPE for the three sectors. The best technique to forecast for agriculture and manufacturing sectors was Holt's Exponential Smoothing but for the services sector requires ARIMA.

Sector	Agriculture		Agriculture Manufacturing		Services	
Techniques	Holt's ES	ARIMA	Holt's ES	ARIMA	Holt's ES	ARIMA
RMSE	0.4832(1)	0.5314(2)	1.0924(1)	3.1572(2)	1.1812(2)	0.7161(1)
GRMSE	0.2470(1)	0.3736(2)	1.0524(1)	2.7823(2)	0.9165(2)	0.6196(1)
MAPE	<mark>4.5472(1)</mark>	5.0637(2)	4.0753(1)	11.3562(2)	1.7032(2)	1.0508(1)

Table 1: Error Measures and Forecasting Techniques

() – Rank

Figure 2 presents the forecast plots and values for the three sectors from 2020 to 2030. The forecast values are standardized values using 100 as the base in calculating the overall manufacturing, services, and agriculture sector to determine the shrinkage of agriculture sector. Therefore, the sum of these three sectors shows 100. The plots indicated that the percentages of the services sector would increase, but manufacturing and agriculture sectors will decrease by 2030. However, although the manufacturing sector will reduce but not as much as the agriculture sector, it will fall from 8.24% in 2021 to 6.20% by 2030. This is very alarming because the impact is very severe on our future basic food production such as rice, beef, chicken, fish, and so forth.

There are three factors that contributed to the shrinking of the agriculture sector (Rozhan, 2015). Firstly, labour shortages due to the ageing farmer population where the older generation of farmers has less ability to work in the field and younger generation reluctant to continue their parents' legacy. Thus, the agriculture sector dependent on foreign labour. This leads to the second factor, which is the increment of cost production related to foreign labour wages as well as price of agricultural inputs and capital cost. These costs keep on rising every year and hinder the profit from agriculture. Hence, it is much cheaper to import than produce on our own. The third factor is low productivity and quality of the agricultural produce due to the old ways of farming. Consequently, a lot of time spent on producing limited crops and livestock. This is also the reason why the younger generation unwilling to work in the agriculture sector because of the painstaking labouring time but not gaining enough money to survive.

Although importing them is a shortcut of addressing the agricultural problems, but it will not secure our basic food in the future. Recently the Covid-19 pandemic has taught us a valuable lesson not to rely heavily on other countries. The impact is very severe where we must pay a higher price in getting the basic food. Realising this serious situation, the government has allocated RM4.97 billion in budget 2021 to empowering the agriculture sector, and RM900 million was allocated for raising rice production to at least 75% in the near future through smart farming (The Star, 2020).



Figure 2: Forecast Plots and Values for the Three Sectors

4. Conclusion

The shrinking of the agriculture sector is very hazardous for our future basic food. Thus, drastic strategic agricultural policy planning needs to be established and implement by incorporating modern technology in smart farming. The paradigm shift in the agriculture sector is important in self-sustaining basic food production to ensure our future food security.

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