

Quest for Research Excellence On Computing, Mathematics and Statistics

Editors

Kor Liew Kee

Kamarul Ariffin Mansor

Asmahani Nayan

Shahida Farhan Zakaria

Zanariah Idrus

**Quest for Research Excellence on Computing,
Mathematics and Statistics**

Chapters in Book

The 2nd International Conference on Computing, Mathematics
and Statistics (iCMS2015)

Editors:

Kor Liew Lee
Kamarul Ariffin Mansor
Asmahani Nayan
Shahida Farhan Zakaria
Zanariah Idrus



**Quest for Research Excellence on Computing,
Mathematics and Statistics**

Chapters in Book

The 2nd International Conference on Computing, Mathematics and Statistics
(iCMS2015)

4-5 November 2015
Langkawi Lagoon Resort
Langkawi Island, Kedah
Malaysia

Copyright © 2015 Universiti Teknologi MARA Cawangan Kedah

All rights reserved, except for educational purposes with no commercial interests. No part of this publication may be reproduced, copied, stored in any retrieval system or transmitted in any form or any means, electronic or mechanical including photocopying, recording or otherwise, without prior permission from the Rector, Universiti Teknologi MARA Cawangan Kedah, Kampus Merbok, 08400 Merbok, Kedah, Malaysia.

The views and opinions and technical recommendations expressed by the contributors are entirely their own and do not necessarily reflect the views of the editors, the Faculty or the University.

Publication by
Faculty of Computer & Mathematical Sciences
UiTM Kedah

ISBN 978-967-0314-26-6

Content

International Scientific Committee

Preface

CHAPTER 1	1
Towards Ameliorating the Problem of Packet Dropping in IDS using P System Model on GPU <i>Rufai Kazeem Idowu, Ravie Chandren M., and Zulaiha Ali Othman</i>	
CHAPTER 2	11
Analyses of Software Testing Problems in Small and Medium Software Enterprises (SME's) and a Proposed Framework on Exploratory Testing <i>Murugan Thangiah and Shuib Basri</i>	
CHAPTER 3	25
Senior Citizen and Online Form: Hybrid Guideline Form Design <i>Zanariah Idrus, Nor Hafizah Abdul Razak, and Noor Hasnita Abdul Talib</i>	
CHAPTER 4	35
Research Paradigms in Computing Disciplines: A Review <i>Nor Hafizah Abdul Razak, Noor Hasnita Abdul Talib, and Jasmin Ilyani Ahmad</i>	
CHAPTER 5	41
Dijkstra's Algorithm In Product Searching System (Prosearch) <i>Nur Hasni Nasrudin, Siti Hajar Nasaruddin, Syarifah Syafiqah Wafa Syed Abdul Halim and Rosida Ahmad Junid</i>	
CHAPTER 6	49
Developing Waqf Land Computing: A Preliminary Study On The Used Of Web-based Applications And Spatial Database <i>Siti Nurbaya Ismail, Zanariah Idrus, Nor Hafizah Abdul Razak</i>	

CHAPTER 7	59
Implementation Of CORDIC Algorithm In Vectoring Mode <i>Anis Shahida Mokhtar, Abdullah bin Mohd Fadzullah</i>	
CHAPTER 8	71
A Description of Projective Contractions in the Orlicz-Kantorovich Lattice <i>Inomjon Ganiev and M. Azram</i>	
CHAPTER 9	83
The Geometry of the Accessible Sets of Vector Fields <i>A.Y.Narmanov, and I. Ganiev</i>	
CHAPTER 10	89
Existence Result of Third Order Functional Random Integro-Differential Inclusion <i>D. S. Palimkar</i>	
CHAPTER 11	105
Fourth Order Random Differential Equation <i>D. S. Palimkar and P.R. Shinde</i>	
CHAPTER 12	115
New Concept of e - I -open and e - I -Continuous Functions <i>W.F. Al-omeri, M.S. Md. Noorani, and A. AL-Omari</i>	
CHAPTER 13	123
Visualization of Constrained Data by Rational Cubic Ball Function <i>Wan Zafira Ezza Wan Zakaria, and JamaludinMd Ali</i>	
CHAPTER 14	133
Octupole Vibrations in Even–Even Isotopes of Dy <i>A.A. Okhunov, G.I. Turaeva, and M. Jahangir Alam</i>	
CHAPTER 15	141
Characterization of p -Groups with a Maximal Irredundant 10-Covering <i>Rawdah Adawiyah Tarmizi and Hajar Sulaiman</i>	

CHAPTER 16	149
Sensitivity Index of HIV-1 model Parameters with Vertical transmission	
<i>Amiru Sule, Mamman Mamuda, Abdullahi Mohammed Baba, Jibril Lawal, and I.G. Usman</i>	
CHAPTER 17	163
Derivation of Four-Point Explicit Block Methods for Direct Solution of Initial Value Problems of Third Order Ordinary Differential Equations	
<i>Z. Omar, J. O. Kuboye, and Y.A. Abdullah</i>	
CHAPTER 18	175
Absolute Translativity of Generalized Nörlund Mean	
<i>Amjed Zraiqat</i>	
CHAPTER 19	189
Type I Error of the Modified Wilcoxon Signed Rank Test under Leptokurtic Distribution	
<i>Nor Aishah Ahad, Sharipah Soaad Syed Yahaya, Suhaida Abdullah, Lim Yai Fung and Zahayu Md Yusof</i>	
CHAPTER 20	199
The Combined EWMA-CUSUM Control Chart with Autocorrelation	
<i>Abbas Umar Farouk, and Ismail Bin Mohamad</i>	
CHAPTER 21	213
Estimating Philippine Dealing System Treasury (PDST) Reference Rate Yield Curves using a State-Space Representation of the Nelson-Siegel Model	
<i>Len Patrick Dominic M. Garces, and Ma. Eleanor R. Reserva</i>	
CHAPTER 22	225
A Structural Equation Model Analyzing the Relationship Model on Perception Students toward Mathematics	
<i>Siti Fairus Mokhtar</i>	

CHAPTER 23	233
Partial Least Squares Based Financial Distressed Classifying Model of Small Construction Firms	
<i>Amirah-Hazwani Abdul Rahim, Ida-Normaya M. Nasir, Abd-Razak Ahmad, and Nurazlina Abdul Rashid</i>	
CHAPTER 24	245
Logit Bankruptcy Model of Industrial Product Firms	
<i>Asmahani Nayan, Siti-Shuhada Ishak, and Abd-Razak Ahmad</i>	
CHAPTER 25	255
Data Mining in Predicting Firms Failure: A Comparative Study Using Artificial Neural Networks and Classification and Regression Tree	
<i>Norashikin Nasaruddin, Wan-Siti-Esah Che-Hussain, Asmahani Nayan, and Abd-Razak Ahmad</i>	
CHAPTER 26	265
Risks of Divorce: Comparison between Cox and Parametric Models	
<i>Sanizah Ahmad, Norin Rahayu Shamsuddin, Nur Niswah Naslina Azid @ Maarof, and Hasfariza Farizad</i>	
CHAPTER 27	277
Reliability and Construct Validity of DASS 21 using Malay Version: A Pilot Study	
<i>Kartini Kasim, Norin Rahayu Shamsuddin, Wan Zulkipli Wan Salleh, Kardina Kamaruddin, and Norazan Mohamed Ramli</i>	
CHAPTER 28	285
Outlier Detection in Time Series Model	
<i>Nurul Sima Mohamad Shariff, Nor Aishah Hamzah, and Karmila Hanim Kamil</i>	
CHAPTER 29	297
ROAD Algorithm for Control Charts	
<i>Gejza Dohnal</i>	

CHAPTER 30	311
Learning Numerals for Down Syndrome by applying Cognitive Principles in 3D Walkthrough	
<i>Nor Intan Shafini Nasaruddin, Khairul Nurmazianna Ismail, and Aleena Puspita A.Halim</i>	
CHAPTER 31	329
Predicting Currency Crisis: An Analysis on Early Warning System from Different Perspective	
<i>Nor Azuana Ramli</i>	
CHAPTER 32	341
Using Analytic Hierarchy Process to Rank Takaful Companies based on Health Takaful Product	
<i>Noor Hafizah Zainal Aznam, Shahida Farhan Zakaria, and Wan Asma 'a Wan Abu Bakar</i>	
CHAPTER 33	349
Service Discovery Mechanism for Service Continuity in Heterogeneous Network	
<i>Shaifizat Mansor, Nor Shahniza Kamal Basha, Siti Rafidah Muhamat Dawam, Noor Rasidah Ali, and Shamsul Jamel Elias</i>	
CHAPTER 34	361
Ranking Islamic Corporate Social Responsibility Activities under Product Development Theme using Analytic Hierarchy Process	
<i>Shahida Farhan Zakaria, Wan-Asma ' Wan-Abu-Bakar, Roshima Said, Sharifah Nazura Syed-Noh, and Abd-Razak Ahmad</i>	
CHAPTER 35	369
A Fuzzy Rule Base System For Mango Ripeness Classification	
<i>Ab Razak Mansor, Mahmud Othman, Noor Rasidah Ali , Khairul Adilah Ahmad, and Samsul Jamel Elias</i>	

CHAPTER 36.....381

**Technology Assistance for Kids with Learning Disabilities:
Challenges and Opportunities**

*Suhailah Mohd Yusof, Noor Hasnita Abdul Talib, and Jasmin Ilyani
Ahmad*

CHAPTER 32

Using Analytic Hierarchy Process to Rank Takaful Companies based on Health Takaful Product

Noor Hafizah Zainal Aznam, Shahida Farhan Zakaria, and
Wan Asma'a Wan Abu Bakar

Abstract. This research is conducted to identify the main factor that influencing people to choose health takaful product and to propose the most appropriate benefits to takaful operators to be more aware the needs of participants. Using the opinions of experts in takaful field among lecturers, the researcher intends to rank the factors based on independent variables; inpatient hospitalization, emergency treatment, out-patient treatment and critical illness. All these four factors were analyzed using Analytical Hierarchy Process (AHP) to gain the weights for each by evaluating the respondents' opinion. Afterward, all the criteria were collected into one group to identify the most crucial criterion in choosing health takaful product. As a result, the position of the takaful companies was ranked based on the weights of criteria and the average obtained from pairwise comparison between takaful operators. This research will help the takaful operator in improvement and development of takaful products especially the health takaful products. Moreover, the takaful operator tends to fulfill the desires of participants in ensuring both parties could get win-win situation.

Keywords: takaful, AHP; takaful products; takaful companies; ranking

1 Introduction

In all studies on the performance of takaful companies, the performance of the companies is measured using the mainstream approach used to measure conventional financial institutions. The approach is a measure of efficiency based mostly on cost or profit. To use this approach to assess takaful companies miss the essence of what the companies aim to achieve. These companies have to meet certain social objectives and priorities as required by Shariah. To overcome this shortcoming we propose a new set of approach to evaluate the performance of takaful companies. An alternative is to account for the interests of the institutions, depositors, shareholders, clients and the society at large. However, due to the large work involved, we started work on measuring the performance of takaful companies by ranking the companies based on their takaful medical products.

One of the objectives of Shariah is to secure benefits for and rid evils from the so-ciety at large. In business transactions like transactions in Islamic banks and takaful, Shariah forbids exploitation which might jeopardise fair dealing. (Kamali, 2008).

Takaful is an Islamic insurance based on the concept of shared protection where risk is shared jointly by participants of the takaful fund. The main concept is to spread the risk of damage or loss among the members of the fund. On the other hand, in conventional insurance, risk is undertaken by or transferred to the insurer (Abdul Rahim Abdul Wahab et al., 2007; Kwon, 2007). The essence of introducing an Islamic insurance company is not only it must satisfy lawful aspect of Shariah but also protect the interests of the companies, participants and the shareholders.

2 Methodology

This paper investigates preferable health takaful products based on four criteria by using Analysis Hierarchy Process (AHP). AHP is a widely known method for its capability to switch the qualitative factor into quantitative value. The hassle of a qualitative problem can be arranged systematically into a hierarchy and the hierarchy can be determined by the ranking process. The solution to get the ranking must be based on the calculation of weights for criteria and the scores for each alternative (Figure 1) (Fu et. al, 2009). AHP introduced the concept of pairwise comparison by using Saaty's scale. The nine-scale of Saaty's (Table 1) has been developed by considering the importance between two different elements. The comparison will be used to calculate the relative weights of criteria and then will be utilized to develop the overall ranking of alternatives (Sbeity et. al, 2014).

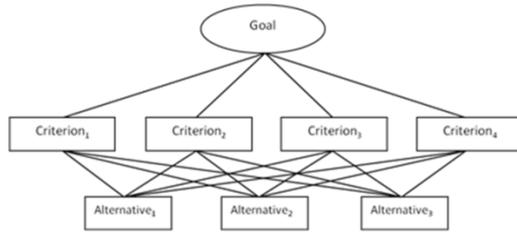


Fig. 1. General Hierarchy Model for Ranking Health Takaful Products

Table 1: Saaty’s Scale

Numerical Values	Definition
1	Equally important or preferred
3	Moderately more important or preferred
5	Strongly more important or preferred
7	Very strongly more important or preferred
9	Extremely more important or preferred
2,4,6,8	Intermediate values

(Agarwal et. al, 2014)

The ranking is derived from values and preferences of decision makers according to the consideration of several criteria. Prioritizing takaful products is essential as it will help participants choosing the product that suits their affordabilities as well as to meet their needs. Most health takaful products offer four main benefits in providing services to customers which are in-patient hospitalization, emergency treatment, out-patient treatment and critical illness. In this study, three health takaful products are being considered which each one represents each takaful company.

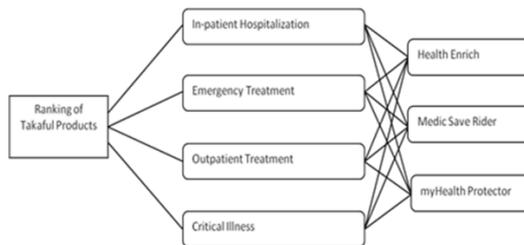


Fig. 2. Scenario of Ranking Health Takaful Products

Using the guidelines in AHP, an AHP framework was developed to ease this study. Therefore, the suggested steps are as follow:

Step 1: Define the objective of the study

The objective of this study is to evaluate and rank the health takaful products based on four criteria of the three observed takaful companies.

Step 2: Identify the benefits of health takaful products as criteria

In this study, the three takaful companies focusing on four health benefits in offering services to prospective policyholders. The four health benefits were chosen as the criteria in this study as those four balance the needs of policyholders. In-patient hospitalization, emergency treatment, out-patient treatment and critical illness are four elements that have been used for each health takaful products.

Step 3: Determine the health takaful companies as alternatives

The three takaful companies chosen are Prudential Malaysia, Etiqa Takaful and Takaful Malaysia.

Step 4: Construct a hierarchy framework for analysis

The criteria were structured into a hierarchy starting from the goal descending to criteria at the second level and finally to the third level which is alternatives (Simoes, et. al, 2010). The top level of the hierarchy represents the defined objective, while the second level of the hierarchy consists of four main health benefits of criteria. Finally, the bottom level of the hierarchy represents the alternatives of takaful companies.

Step 5: Collect empirical information and data

Data used was gathered from the experts in takaful field among lecturers of UiTM Kedah.

Step 6: Perform pair-wise comparisons for each criterion

All lecturers were given the instruction on how to answer the questionnaires. Lecturers were requested to compare the four criteria by assigning relative scales by mean of comparing two criteria at the same time. The decision matrix is formed to obtain the level of importance of each criterion. These information were then combined using the geometric mean approach to obtain the priority vector for each criterion. A Saaty's scale of real numbers from 1 to 9 used in ranking is presented in Table 1. The purpose of this scale is to determine how many times more important or dominant one element is over another element with respect to the criterion with respect to which they are compared (Maletic et. al, 2014)

Step 7: Perform the consistency test and remove the inconsistency

For each decision, the consistency ratio (CR) is calculated to ensure inconsistency is removed from the calculation. Usually, the consistency ratio (CR) is used to check whether a criterion can be used for decision-making. The consistency ratio (CR) should be below 10 percent. CI is obtained by the following equation: $CI = (\lambda_{max} - n)/(n - 1)$, where 'n' is the number of criteria or and λ_{max} is the largest eigenvector in the matrix. Consistency ratio is obtained by dividing the CI with random index (Yin, 2013). In this study,

the random index of 0.9 was selected as it involves 4 criteria. From the calculation, the CR is less than 10% which indicate the judgment of pair-wise comparison is coherence. A few of data were removed because of the inconsistency gained from the calculation. Only the consistent data were furthered to the next evaluation.

Table 2: Random Index Values

Number of Criteria	2	3	4	5	6	7	8	9	10
Random Index	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Table 3: The Consistency Ratio

	Geometric Mean (Random Index=0.9)
Lambda Max	4.134
Consistency Index	0.045
Consistency Ratio	0.049

Step 8: Compute the weights of each criterion and calculate the average for each alternative

After the consistency was checked, the next step is getting the weights for each criterion. The pair-wise comparison was normalized and the priority vector is generated for each criterion. Other than that, the average for each alternative according to each criterion was computed. As shown in Table 5, critical illness has the highest weightage which is 0.434, followed by inpatient hospitalization with 0.261 weightage. The third-ranked is emergency treatment and the fourth-ranked is out-patient treatment. The weights gained were used to determine the rank later by combining them with the average of each alternative.

Table 4: The Matrix of Eigen Vectors for Health Takaful Products

Criteria	EnrichHealth	Medic Save Care	myHealth Protector	Priority Vector
Inpatient Hospitalization	0.371	0.148	0.482	0.261
Emergency Treatment	0.670	0.200	0.130	0.181
Out-patient Treatment	0.319	0.420	0.261	0.125
Critical Illness	0.355	0.164	0.481	0.434

Step 9: Synthesize the results

In order to obtain the final results, all of the alternatives are multiplied by the weight of the criteria. The results are summarized in Table 5.

Table 5: The Evaluation of Criteria with Alternatives

	Average
EnrichHealth	0.412
Medic Save Care	0.199
myHealth Protector	0.390

Step 10: Final ranking of alternatives studied

The final ranking is determined by calculating the average for three alternatives.

Table 6: Final Ranking of the Alternatives

Rank	Takaful Products	Takaful Companies
1	EnrichHealth	Prudential Malaysia
2	myHealth Protector	Takaful Malaysia
3	Medic Save Care	Etiqa Takaful

3 Result and Discussion

As can be seen from the Table 4, the priority vector gained from the analysis indicates critical illness is the main criterion when it comes to choose a medical policy. The inpatient hospitalization is in second rank while emergency treatment takes place in third. The fourth one is outpatient treatment with a weightage of 0.125. Based on the criteria offered by the three takaful companies, cancer treatment and kidney dialysis are the benefits promoted to attract customers in buying their products. Sudden diagnosis with these types of diseases would make one needs urgent money because the treatment is expensive. This leads the result to the priority vector of 0.434. Inpatient hospitalization mainly involves the assurance of hospital daily room, intensive care unit, the surgical fees, pre- and post-treatment as well as daily allowance per day. The benefits offered are enough to put it in second place with 0.261. Accidental dental treatment and the treatment for accidental injury, both under the emergency treatment category, offer little benefit but when compared to outpatient treatment, the sum insured is higher than outpatient treatment slightly which makes emergency treatment ranked third.

After evaluating the integration of the criteria with alternatives, EnrichHealth by Prudential Malaysia is the most attractive based on the criteria studied in this re-search. Out of four criteria, EnrichHealth is so prominent in two criteria which are critical illness and emergency treatment while Takaful Malaysia is not far behind with a difference of 0.022. As in the

analysis, Takaful Malaysia dominates another criterion which is inpatient hospitalization and Medic Save Care by Etiqa Takaful dominates the outpatient treatment. It clearly shows the ranking is able to play two important roles involving two parties, which are the potential buyer and the takaful company. Prospective policyholders can choose takaful policy that is affordable and can meet their needs based on their financial capability while takaful companies can investigate to improve and enhance services to gain the trust of customers.

4 Conclusion and Recommendation

This study ranked the benefits of three health takaful products offered by three takaful companies in Malaysia. Those three were evaluated using AHP focusing on four main criteria in determining the hierarchy. AHP provides an approach to assist a decision which could be made by changing a complex problem into a simplified re-sult. The consistency ratio helps to determine the rank of criteria as it eliminates in-consistency. From the evaluation, the findings suggest that the benefits offered in critical illness as the most important element in buying health takaful product. The ranking gained from the calculation show that EnrichHealth as the best policy that met the needs of lecturers. For further studies, premium, co-takaful and profit sharing between policyholder and takaful company need to be implemented so that it will enhance the results. Furthermore, development of visual application can be a new tool to ease takaful companies to ensure their products always meet the customers' needs.

References

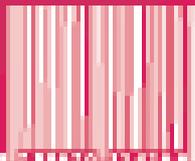
1. Abdul Rahim Abdul Wahab, K.M. Lewis and M.K. Hassan (2007). Islamic Takaful: Business Models, Shariah Concerns and Proposed Solutions. *Thunderbird International Business Review*, 49(3), 371-396.
2. Agarwal, P., Sahai, M., Mishra, V., Bag, M. & Singh, V. (2014). Supplier Selection in Dynamic Environment using Analytic Hierarchy Process. *International Journal Information Engineering and Electronic Business*, Vol. 4, 20-26.
3. Forman, E. and K. Peniwati (1998). Aggregating Individual Judgments and Priorities with the Analytical Hierarchy Process. *European Journal of Operational Research*, 108, 165-169.
4. Fu, H. & Lin, S. (2009). Applying AHP to Analyze Criteria of Performance Measurement for National Energy Promotion Projects.

International Journal of Electronic Business Management, Vol. 7, No. 1, 70-77.

5. Hasan, Z. (2007). "Evaluation of Islamic Banking Performance: On the Current Use of Econometric Models", *Advances in Islamic Economics and Finance* (vol 1), *Proceedings of the 6th International Conference on Islamic Economics and Finance*, Islamic Research and Training Institute, Islamic Development Bank.
6. Jandova, V. & Talasova, J. (2013). Weak Consistency: A New Approach to Consistency in the Saaty's Analytic Hierarchy Process. *Mathematica*, Vol. 52, No. 2, 71-83.
7. Kamali, M.H. (2008). *Maqasid Al-Shariah Made Simple*, Occasional Papers Series 13, The International Institute of Islamic Thought, London.
8. Kwon, W.J. (2007). Islamic Principle and Takaful Insurance: Re-evaluation. *Journal of Insurance Regulation*, 26(1), 53-81.



ISBN 978-967-0314-25-6



9 789670 314256