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Constructing a *MUSA* Model to Determine Priority Factor of a *SERVPERF* Model.

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Abstract

The study aimed to determine the priority factor among the factors in a *SERVPERF* Model. The *SERVPERF* Model explains the students' satisfaction towards the quality of service provided by their hostel management. Priority factor is the factor that is considered important by the customers, but they are not satisfied with the service provided for that factor. A Multi-criteria Satisfaction Analysis (*MUSA*) Model is built based on ordinal regression with linear programming approach. However, study found that the *MUSA* Model built is not stable and could not interpret the data set used. This finding is consistent with the fact that *MUSA* Model does not always give out an interpretable results..

Keywords: Multi-criteria Satisfaction Analysis (*MUSA*), Modified SERVPERF Model, Priority Factor, Ordinal Regression, Linear Programming Approach.

1. Introduction

Quality matter is an important aspect in both the government and private organizations. Only if good quality of service is provided, then the customers will be satisfied. On the other hand, satisfaction can be defined as the assessment of customers towards the service they received. According to Tse & Wilton (1988), satisfaction is the result of comparison between the service that customers expected with the service they receive at real. If the service they receive is better than the one they expected, then customers are said to be satisfied and vice versa.

There are many type of models that can be used to measure customer satisfaction. Among them is the (Service Performance) *SERVPERF* model by Cronin & Taylor (1992). This *SERVPERF* model have five dimensions, namely Tangible, Responsive, Assurance, Reliability and Empathy. The dimensions describe the quality of service received by the customer, with each have a specific explanation.

As there are five factors in the *SERVPERF* Model, the management need to take care all these factors in order to provide a good quality of service, to ensure the students are satisfied with their service. However, it might be a big challenge to the management to take care all the factors at the same time, and therefore the quality of their service might decrease, causing customers not being satisfied and stop using their service. Therefore, management should know which dimensions need the priority (Grigoroudis & Siskos, 2002). For this, factors should be arranged according to their importance and satisfaction of the customers. Priority should be given to the factor which is considered important by customers, but they are not satisfied with service provided for that factor.

2.0 Literature Review

Arabatzis. & Grigoroudis (2010) carried out a study to investigate the visitors of Dadia-Lefkini-Souflion National Park' satisfaction and perception towards the service provided and to analyze the gap between them. The study aims to determine the factors that influences visitors satisfaction and to determine aspects that need more attention and improvements by the management. The study uses primer data through surveys from the visitors directly, with few aspects being touched in the survey. The aspects been discussed were on aspects of nature, staffs' service, infrastructure, recreational facilities, and information centre. Study used Multi-criteria Satisfaction Analysis (MUSA) and Gap Analysis method. Findings show that 88% of the visitors are satisfied with the service provided, with mainly they are satisfied with nature and staffs' service.

Grigoroudis *et al.* (2000) carried out a study entitled TELOS: A Computer Software to Evaluate Customers Satisfaction. The study aimed to introduce TELOS as the software to construct *MUSA* Model. This TELOS software only needs a brief data of respondents and it does not have any limit for on the number of scales and levels of criteria to be used. Three different types of analysis can be done using this software, which are; Descriptive Analysis, Global Exploratory Analysis (Average Global Satisfaction Index and Added Value Curve for global satisfaction), and Partial Exploratory Analysis (weight of each criteria, Average Partial Satisfaction Index, Added Value Curve for each criteria).

Ipsilandis *et al.* (2008) carried out a study entitled MUSA Approach on Evaluating an Education Program Operation. The study's objective is to identify the pattern of satisfaction on interaction and support received by the Project Manager from three different group of shareholders. The group of shareholders differ from the authority where Project Management Authority (PMA) is the highest group, followed by Project Organization (PO). Both these groups are at the higher authority compared to the Project Manager. The third group of shareholder is the Project Team (PT) who were the shareholders who helps out the manager in completing the project. Study found that the Project Manager globally described a low satisfaction level for the interaction and support he gained from these three goup of shareholders., especially from the Project Organization (PO).

Grigoroudis et al. (2008) carried out a study on Quality Evaluation of Customer Website: Application of Satisfaction Benchmarking. The study aimed to identify the best website provider among the three companies compared and was based on two objectives; to categorize criteria according to priority given by customers and their satisfaction for each company. The first objective was achieved by building the Action Diagram involving satisfaction of customers for each criteria, importance of each criteria and improvement effort needed for each criteria. Second objective is achieved through the evaluation of the performance of each company, compared to their competitors. Through this objective, advantages and disadvantages of each company compared to their competitors can be identified. The study uses the basis MUSA model for the first objective and a modified *MUSA* Model for the second objective. From the first Action Diagram, it was found that criteria `Physical Efficiency' is the priority factor/factor that needs the most improvement action. Based on the second Action Diagram, it was found that the criteria `Animation' and criteria `Technical Efficiency' are advantage criteria for the respective company, A and B. This is because both criteria are in the Waiting Quadrant. That is the performance provided is low, but the quality of the criteria compared to competitors, is still higher compared to the competitors.

3.0 Methadology

According to Siskos et al., 1998; Grigoroudis & Siskos, 2002, The *MUSA* (Multi-criteria Satisfaction Analysis) is an analysis with multi-criteria preference disaggregation technique. The main objective of the *MUSA* method is the disaggregation of individual judgments into a collective value function, and therefore it assumes that customer's global satisfaction depends on a set of criteria representing few service characteristics dimensions.

MUSA uses the ordinal-regression based approach for the assessment of a set of collective satisfaction functions, which causes the global satisfaction criterion becomes as consistent as possible with customers-judgments. Given customers' global satisfaction Y, and partial satisfaction x_i (according to the i^{th} criterion of ordinal scaling), the method follows and additive collective value function Y* and a set of partial satisfaction (value) function x_i*. The goal of this method is to obtain the maximum consistency between the value function Y* and customers' judgments, Y.

According to the modeling preference disaggregation approach and addition of a double-error variable, the ordinal regression equation is :

$$Y^{\sim *} = \sum_{i=1}^{n} b_i X_i^* - \sigma^+ + \sigma^-, \quad (1)$$

Where, $Y^{\sim *}$ indicates the estimation of global value function Y*, σ^+ and σ^- indicates the overestimation and underestimation respectively.

Y* and X_i^*, which are the global and partial satisfaction value respectively, are normalized in the interval of 0 to 100. Therefore, they are monotone function. Thus, mono-tonicity constraints for Y* and X_i^* are removed, so that the size of mathematical program could be reduced. For this, the transformation equations are used :

$z_m = y^{*m+1} - y^{*m}$, for m= 1,2,…,α-1

$d_{ik} = b_i x_i^{*k}$ for k = 1,2,…,α_i-1 and i = 1,2,…,n

where y^{*m} is value of the y^m satisfaction level,

x_i^{*k} is the value of the x_i^k satisfaction level,

α and α_i are the number of global and partial satisfaction value respectively.

Therefore, the basic estimation model can be written in the form of a linear program formulation, as below:

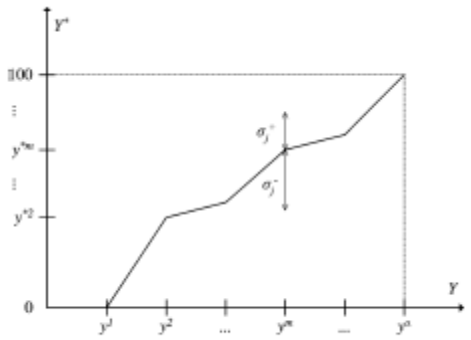

Fig. 1. Error variables for the jth customer.

Stability Analysis

Considering that the *MUSA* method is based on a linear programming modeling, the stability analysis is considered as a post-optimality analysis problem. As shown in Figure below, the post-optimal solution space is defined by the polyhedron :

$F \leq F^* + \varepsilon$

All the constraints of Linear Programming (LP),

-where F^* is the optimal value of the objective function of LP, and ε is a small % of F^*

Objective Function: Min $\sum((\varepsilon(a_i^+) + \varepsilon(a_i^-))$

Subject to

$$\sum_{i=1}^{n}\sum_{i=1}^{\propto_i(a_j)} d_{ik} - \sum_{i=1}^{\propto(a_j)} z_k - \varepsilon(a_i^+) + \varepsilon(a_i^-) = 0, for\ j = 1, \dots, m$$

Given that,

$$\sum z_k = 1$$

$$\sum\sum d_{ik} = 1$$

$$z_k \geq 0, \quad d_{ik} \geq 0, \quad for\ \forall_{ik}$$

$$\varepsilon(a_i^+), \varepsilon(a_i^-), \geq 0, \text{ for } \forall_i \qquad (2)$$

4.0 Findings and Data Analysis

In This study uses *SERVPERF* Model, where this model has five criteria, therefore the weight of each criteria is 1/3. Both the variables in global satisfaction and satisfaction for each criteria used a likert scale of seven, so each variable will have an increment of 16.67% in each level. The value of levels in global satisfaction variable is as below:

$$Y^{*1} = 0, \quad Y^{*2} = 16.67, \quad Y^{*3} = 33.34,$$

$$Y^{*4} = 50.01, \quad Y^{*5} = 66.68, \quad Y^{*6} = 83.35,$$

$$Y^{*7} = 100$$

The values for each criteria is as below:

$$x_1^{*1} = 0, \quad x_1^{*2} = 16.67, \quad x_1^{*3} = 33.34$$

$$x_1^{*4} = 50.01, \quad x_1^{*5} = 66.68, \quad x_1^{*6} = 83.35$$

$$x_1^{*7} = 100$$

$$x_2^{*1} = 0, \quad x_2^{*2} = 16.67, \quad x_2^{*3} = 33.34$$

$$x_2^{*4} = 50.01, \quad x_2^{*5} = 66.68, \quad x_2^{*6} = 83.35$$

$$x_2^{*7} = 100$$

$$x_3^{*1} = 0, \quad x_3^{*2} = 16.67, \quad x_3^{*3} = 33.34$$

$$x_3^{*4} = 50.01, \quad x_3^{*5} = 66.68, \quad x_3^{*6} = 83.35$$

$$x_3^{*7} = 100$$

$$x_4^{*1} = 0, \quad x_4^{*2} = 16.67, \quad x_4^{*3} = 33.34$$

$$x_4^{*4} = 50.01, \quad x_4^{*5} = 66.68, \quad x_4^{*6} = 83.35$$

$$x_4^{*7} = 100$$

$$x_5^{*1} = 0, \quad x_5^{*2} = 16.67, \quad x_5^{*3} = 33.34$$

$$x_5^{*4} = 50.01, \quad x_5^{*5} = 66.68, \quad x_5^{*6} = 83.35$$

$$x_5^{*7} = 100$$

Therefore, based on equation (1), function value for the global satisfaction is estimated to be consistent with the summation of partial satisfaction. Any differences between both satisfaction is covered by the introduction of estimation error.

Next, *MUSA* Model was built using the Excel Solver software. However, it was found that the model could not be interpreted as the solution was formed on the infeasible region. Therefore, modification is done with introducing the preference threshold (γ and γ_i). However, this modification could not be done as the preference threshold value will be negative even with a minimum increase of two. This condition does not obey the equation 3 below, that is:

$$\sum^{n} \gamma_i (\alpha_i - 1) \leq 100 \qquad \text{(3)}$$

where,

(2 x (7-1)) x 22 = 264 > 100

Therefore, the model is modified by categorizing respondent according to gender. It is found that models of both gender boys and girls could be interpreted, and it is located at the feasible region. However, the models were found not to be stable as it only have the value of 100 at only one criteria and zero at all the other criteria. In detailed categorization into original states (either East Coast, West Coast, and Sabah& Sarawak). However, even after the categorization, the models were still found not to be stable. Therefore, it can be concluded that MUSA Model could not be build for this data set. Table 9 till 18 (in Appendix Section) shows the result of MUSA Model built for each category.

5.0 Conclusion

Study found that MUSA Model built is not stable and could not interpret the data set. The result of unstable model is consistent with the theory that MUSA Model not necessarily could interpret data well, and there is always a possibility to obtain an unstable model (Grigoroudis & Siskos, 2002). This conclusion is also supported by the writing by Jao *et al.* (2007), where they did not obtain a stable model when used a data set of 70

respondents, but obtained stable models with 30 and 100 respondents. They discussed that MUSA Model uses Least Absolute Deviation method to find the error in the model, where this method is based on iteration approach. This approach gives more than one solution, and therefore causing unstable results/models.

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References

Arabatzis, G. Grigoroudis, E. (2010). Visitors' Satisfaction, Perception and Gap Analysis: The Case of Dadia-Lefkini-Souflion National Park *Forest Policy and Economics*. 12(2010)163-172

Grigoroudis, E. & Siskos, Y. (2002). Preference Disaggregation For Measuring and Analyzing Customer Satisfaction : The MUSA Method. *European Journal of Operational Research* 143(1), 148-170.

Grigoroudis, E. & Siskos, Y. (2010). MUSA: Multi-criteria Satisfaction Analysis (MUSA) & Extension of the MUSA Method. In *Customer Satisfaction Evaluation*. ed. Hiller F.S., Price,C.C., pp 91-129. New York: Springer Press.

Grigoroudis, E. Siskos, Y., & Saurais, O. (2000). TELOS: A Customer Satisfaction Evaluation Software. *Computers & Operations Research* 27 (2000) 799-817

Ipsilandis, P.G., Samaras, G., & Mplanas, N. (2008). A MulticriteriaSatisfaction Analysis Approach in the Assessment of Operational Programes. *International Journal of Project Management* 26(2008) 601-611

Joao, I.M., Carlos, A., Costa, B.e., & Figueira, J.R. (2007). An Alternative to the MUSA Method for Customer Satisfaction Analysis. *Centre of Management Studies of IST(CEG-IST).*

Mihelis, G., Grigoroudis, E., Siskos, Y., Politis, Y., & Malandrakis, Y. (2001). Customer Satisfaction Measurement in the Private BankSector. *European Journal of Operational Research* 130(2001) 347-360

Appendix

Table 1: Value of Each Transformation Variable for All Students

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	100
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	0	w221	0	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	100		

Table 2: Value of Transformation Variable for Boy Students

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	100
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	100		
w11	0	w221	0	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	100		

Table 3: Value of Transformation Variable for Boy Students from East Coast

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	100	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	100	w221	0	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 4: Value of Transformation Variable for Boy Students from West Coast

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	0	w221	100	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	100					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 5: Value of Transformation Variable for Boy Students from Sabah & Sarawak

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	100	w211	0	a1	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	100
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	0	w221	0	w31	0	w41	100	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 6: Value of Transformation Variable for Girl Students

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	100	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	0	w221	0	w31	0	w41	100	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 7. Value for Transformation Variable of Girl Students from East Coast

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	100	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	100	w221	0	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 8. Value of Transformation Variable for Girl Students from West Coast

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	0	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w110	0	w210	0	w310	0	w410	0	w210	0	a0	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	100	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	0	w221	0	w21	0	w41	100	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

Table 9: Value for Each Transformation Variable for Girl Students from Sabah & Sarawak

Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value	Variable	Value
w111	100	w211	0	w311	0	w411	0	w211	0	a1	100
w112	0	w212	0	w312	0	w412	0	w212	0	a2	0
w113	0	w213	0	w313	0	w413	0	w213	0	a3	0
w114	0	w214	0	w314	0	w414	0	w214	0	a4	0
w112	0	w212	0	w312	0	w412	0	w212	0	a5	0
w110	0	w210	0	w310	0	w410	0	w210	0	a6	0
w121	0	w221	0	w321	0	w421	0	w221	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w123	0	w223	0	w323	0	w423	0	w223	0		
w124	0	w224	0	w324	0	w424	0	w224	0		
w122	0	w222	0	w322	0	w422	0	w222	0		
w120	0	w220	0	w320	0	w420	0	w220	0		
w131	0	w231	0	w331	0	w431	0	w231	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w133	0	w233	0	w333	0	w433	0	w233	0		
w134	0	w234	0	w334	0	w434	0	w234	0		
w132	0	w232	0	w332	0	w432	0	w232	0		
w130	0	w230	0	w330	0	w430	0	w230	0		
w141	0	w241	0	w341	0	w441	0	w241	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w143	0	w243	0	w343	0	w443	0	w243	0		
w144	0	w244	0	w344	0	w444	0	w244	0		
w142	0	w242	0	w342	0	w442	0	w242	0		
w140	0	w240	0	w340	0	w440	0	w240	0		
w11	100	w221	0	w31	0	w41	0	w221	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w13	0	w223	0	w33	0	w43	0	w223	0		
w14	0	w224	0	w34	0	w44	0	w224	0		
w12	0	w222	0	w32	0	w42	0	w222	0		
w10	0	w220	0	w30	0	w40	0	w220	0		
		w21	0					w21	0		
		w22	0					w22	0		
		w23	0					w23	0		
		w24	0					w24	0		
		w22	0					w22	0		
		w20	0					w20	0		

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