Predicting the Increase in Early Marriages During the COVID-19 Period Using the Single Exponential Smoothing Method (Case Study: Department of Population and Civil Registration in Medan City)

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ABSTRACT

The Department of Population and Civil Registry of North Sumatra Province must know the prediction of the number of early marriages in the following year so that they can anticipate the occurrence of early marriages. The problem that occurs is that the government through the Department of Population and Civil Registry of North Sumatra Province cannot predict early marriage due to the impact of COVID-19, this is due to the lack of community activity in obtaining knowledge and the difficulty of obtaining information about the occurrence of early marriage. Therefore we need a way that can help the government in predicting early marriage. This study uses single exponential smoothing (SES) to predict an increase in early marriage due to the impact of COVID-19. With the application to predict the increase in marriage due to the impact of COVID-19 using the single exponential smoothing method, it is hoped that the Population and Civil Registry Office of North Sumatra Province will be able to find out the increase in the number of early marriages in the coming period.

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1.   INTRODUCTION

Based on Constitution Republic of Indonesia Number 16 of 2019 concerning marriage Article 7 Number 1 namely " Marriage only allowed if man and woman Already reach age 19 (nine fifteen) years ". Wedding early interpreted marriage is the culprit Still young and yet Can fulfil the requirements that have been determined in do wedding . On the type of person with under 19 years of age state of the reproductive organs Not yet fully ripe and still in stage growth . this time called with term reproduction young It means although can pregnant and giving birth will but Actually body Not yet Ready For pregnant . Problem Wedding early own various risk start from social risk , risk psychology and risk health . (Haidi Nurfadilah et al., 2021).

Problem happened _ is government No can predict wedding early consequence impact of COVID-19, p This because lack of activity public in obtain knowledge and difficult For obtain information about risk happening wedding early . because _ That needed A way you can help government in predict wedding early.

Computer Already Lots help performance man in various matter especially data and information management. because _ That researcher utilise technology computer For make A system that can help

government in predict amount wedding early. System that can used that is system prediction. In use system prediction needed method that can produce good and accurate predictions.

Based on research conducted by (Rosa et al., 2019) regarding deep exponential smoothing method project friday poor people in the archipelago southeast west, summed up that based on results calculation use ES method is obtained results of the 2019 Poor Population Forecasting in NTB with analysis forecast error level using MAD, MSE, MRSE, and MAPE indicators.

Based on research conducted by (Pakpahan et al., 2020) regarding prediction amount poor people of Kalimantan east using single and double exponential smoothing, it is concluded that Based on Single Exponential Smoothing method is obtained results forecasting best 2019 (total_ residents; MAPE) at a value of α (alpha) = 0.3.

From several study previously used _ single exponential smoothing (SES) method for overcome various problem predictions and have produce good and precise predictions, then _ researcher using single exponential smoothing (SES) to predict increase wedding early in the time of COVID-19. Single Exponential Smoothing method is procedure repair constantly on predictions to object observation latest. In method This prediction done with repeat calculation in a manner continously with using the latest data. Each data is given weights, more data new given more weight _ big. (Hayami et al., 2021).

With exists application prediction increase wedding early in the time of COVID-19 using single exponential smoothing method then Service Population and Registration Civil city Medan expected can with easy know amount increase wedding early in the coming period come.

2. RESEARCH METHODS

The work procedure in this study includes several stages, namely planning, data collection techniques, needs analysis, design, testing and use.

This research plan is modeled on a block diagram. Some of the stages used in this study are as follows:
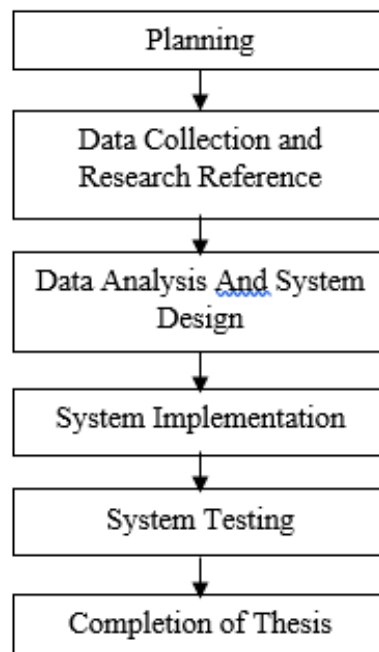

Figure 1. Work Procedure

Information :
1. Planning
Researchers plan to make a thesis starting from the title, research location and the data needed.
2. Data Collection and Research Reference
Researchers collected data and research references related to thesis writing, namely data on early marriage and the single exponential smoothing method.

3. Data Analysis and System Design
Researchers analyzed the data obtained and then designed a system according to the data obtained, namely early marriage data.
4. System Implementation
The researcher implements the running system or design into the application that is made and implements the single exponential smoothing method into the application that is made.
5. System Testing
The researcher tested the system after the application, all data was implemented into the application, if there was an error, it was checked again.
6. Completion of Thesis
The researcher completed the thesis after system testing, both theory and application, went well.

2.1 Analysis of needs
　　　　Researcher analyze need For study namely:
1. Marriage data early.
2.Hardware.
3. Software.

3.   RESULTS AND ANALYSIS

3.1 Data collection techniques
　　　　Following This is a number of technique data collection researchers do For complete that is studies literature . At stages This researcher use journals and works scientific as references and foundations related theory _ with single exponential smoothing method.

3.2 Data analysis
　　　　The data analysis needed in this study is data on early marriages in the 2020 and 2021 periods. The data will be processed using the Single Exponential Smoothing method to obtain predictive results for an increase in early marriages during the COVID-19 period in the city of Medan. Therefore some of the analyzes and methods made in this study are:
　　1. Early Marriage Data
　　2. The Single Exponential Smoothing Method
　　3 . Data Processing For Predictions
　　4. Prediction Results
　　5.Prediction Result Accuracy

3.3 System Design
　　　　In designing the system, researchers use several forms of database design and flowcharts .
1. Databases
　　　　The following is a table design of the prediction application for the increase in early marriage during the COVID-19 period in the city of Medan using the single exponential smoothing method:

　　a. Login Table Design
　　　　Table 3.1 is the design of the Login table in the prediction application for the increase in early marriage during the COVID-19 period in the city of Medan using the single exponential smoothing method.

Table 1. Login Table Design

Field name	Data Type	Size	Information
ID_Login	Varchar	10	Search ID
Password	Varchar	100	Admin Password

　　b. Age & JK Table Design
　　　　Table 3.4 is the design of the Age & JK table in the application to predict the increase in early marriage during the COVID-19 period in the city of Medan using the single exponential smoothing method.

Table 2. Age & JK Table Design

Field name	Data Type	Size	Information
ID_ Age & JK	Varchar	10	Search ID
Age	Varchar	50	Age
Gender	Varchar	50	Gender

c. Early Wedding Table Design

Table 3.5 is the design of the Early Marriage table in the prediction application of the increase in early marriage during the COVID-19 period in the city of Medan using the single exponential smoothing method.

Table 3. Early Marriage Table

Field name	Data Type	Size	Information
ID_ Marriage_Early	Varchar	10	Search ID
Month	Varchar	20	Month
Year	Varchar	10	Year
ID_Age & JK	Varchar	10	Search ID
Amount	Varchar	10	Amount

d. Forecasting Table Design

Table 3.6 is the design of the Forecasting table in the prediction application for the increase in early marriage during the COVID-19 period in the city of Medan using the single exponential smoothing method.

Table 4. P prediction table

Field name	Data Type	Size	Information
ID_Forecasting	Varchar	10	Search ID
ID_Age & JK	Varchar	10	Search ID
Month_ Marriage_Early	Varchar	20	Early Marriage Month
Year_ Marriage_Early	Varchar	20	Early Marriage Years
Total_ Marriage_Early	Varchar	20	Number of Early Marriages
Moon_Forecast	Varchar	20	Month of Forecast
Year_Forecast	Varchar	20	Year of the Divination
Total_Forecast	Varchar	20	Number of Forecasts
Difference	Varchar	20	Difference Cases

3.4 System Implementation

The data used is marriage data obtained from the Medan City Government Office of the Population and Civil Registration Office in 2020 and 2021 and is presented as follows:
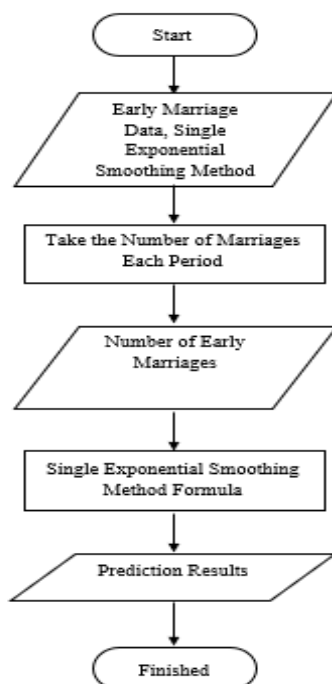
Figure 2. Prediction Diagram Flowchart

The mathematical form of the Single Exponential Smoothing method is shown as follows:

Ft+1   = αXt + (1-α)Ft
Where :
Ft+1   = New Forecast
Ft   = Prior Forecast
α   = Exponential Constant
Xt   = Rated Current.

Sample case :
There is data on early marriage in 2020 with the following conclusions:

Table. 5. Early Marriage Data

YEAR 2020				
No.	MONTH	NUMBER OF MARRIAGES	AGE	
			MAN - 19	WOMAN - 19
1.	JANUARY	37	10	27
2.	FEBRUARY	30	9	21
3.	MARCH	24	11	13
4.	APRIL	23	12	13
5.	MAY	16	7	9
6.	JUNE	33	16	17
7.	JULY	51	25	26
8.	AUGUST	36	17	19
9.	SEPTEMBER	74	23	51
10.	OCTOBER	52	15	37
11.	NOVEMBER	88	27	61
12.	DECEMBER	85	21	64
	AMOUNT	549	193	356

Ft+1 = αXt + (1-α)Ft   with alpha (α =0.1)
Male Case:
F1 = 10
F2 = (0.1*9)+(0.9*10)=9.9
F3 = (0.1*11)+(0.9*9.9)=10.01
F4 = (0.1*12)+(0.9*10.01)=10.209
F5 = (0.1*7)+(0.9*10.209)=9.8881
F6 = (0.1*16)+(0.9*9.8881)=10.49929
F7 = (0.1*25)+(0.9*10.49929)=11.94936
F8 = (0.1*17)+(0.9*11.94936)= 12.45442
F9 = (0.1*23)+(0.9*12.45442)=13.50898
F10= (0.1*15)+(0.9*13.50898)=13.65808
F11= (0.1*27)+(0.9*13.65808)=14.99228
F12= (0.1*21)+(0.9*14.99228)=15.59305

Table 6. _ MAPE Prediction of Single Exponential Smoothing Method

| No. | MONTH | AGE | | | |
| | | MAN | | | |
		-19 (Original result)	-19 (Forecast data)	Comparison (MAPE)	MAPE percentage form
1.	JANUARY	10		-	-
2.	FEBRUARY	10	10	0	0%
3.	MARCH	11	10	0.090909	9%
4.	APRIL	10	10	0	0%
5.	MAY	9	10	0.11111	11%
6.	JUNE	17	11	0.352941	35%
7.	JULY	20	12	0.4	40%
8.	AUGUST	17	13	0.235294	24%
9.	SEPTEMBER	24	14	0.416667	42%
10.	OCTOBER	18	14	0.222222	22%
11.	NOVEMBER	27	15	0.444444	44%
12.	DECEMBER	22	16	0.272727	27%
	MAPE			0.231483	23%

Ft+1 = αXt + (1-α)Ft   with alpha (α =0.2)
Male Case:
F1 = 10
F2 = (0.2*9)+(0.8*10)=9.8
F3 = (0.2*11)+(0.8*9.8)=10.04
F4 = (0.2*12)+(0.8*10.04)=10.432
F5 = (0.2*7)+(0.8*10.432)=9.7456
F6 = (0.2*16)+(0.8*9.7456)=10.99648
F7 = (0.2*25)+(0.8*10.99648)=13.79718
F8 = (0.2*17)+(0.8*13.79718)= 14.43775
F9 = (0.2*23)+(0.8*14.43775)=16.1502
F10= (0.2*15)+(0.8*16.1502)=15.92016
F11= (0.2*27)+(0.8*15.92016)=18.13613
F12= (0.2*21)+(0.8*18.13613)=18.7089

Table 7. MAPE Prediction of the Single Exponential Smoothing Method

No.	MONTH	AGE			
		MAN			
		-19 (Original Data)	-19 (Forecast Results)	Comparison (MAPE)	MAPE percentage form
1.	JANUARY	10	-	-	
2.	FEBRUARY	10	10	0	0%
3.	MARCH	11	10	0.090909	9%
4.	APRIL	10	10	0	0%
5.	MAY	9	10	0.11111	11%
6.	JUNE	17	11	0.352941	35%
7.	JULY	20	14	0.3	30%
8.	AUGUST	17	14	0.176471	18%
9.	SEPTEMBER	24	16	0.333333	33%
10.	OCTOBER	18	16	0.111111	11%
11.	NOVEMBER	27	18	0.333333	33%
12.	DECEMBER	22	18	0.181818	18%
	MAPE			0.181002	18%

Comparison between Forecast Results for 2021 and Original Data for 2021

$F_{t+1} = \alpha X_t + (1-\alpha)F_t$ with alpha ($\alpha = 0.3$)

Male Case:

$F_1 = 10$

$F_2 = (0.3*9)+(0.7*10)=9.7$

$F_3 = (0.3*11)+(0.7*9.7)=10.09$

$F_4 = (0.3*12)+(0.7*10.09)=10.663$

$F_5 = (0.3*7)+(0.7*10.663)=9.5641$

$F_6 = (0.3*16)+(0.7*9.5641)=11.49487$

$F_7 = (0.3*25)+(0.7*11.49487)=15.54641$

$F_8 = (0.3*17)+(0.7*15.54641)= 15.98249$

$F_9 = (0.3*23)+(0.7*15.98249)=18.08774$

$F_{10}= (0.3*15)+(0.7*18.08774=17.16142$

$F_{11}= (0.3*27)+(0.7*17.16142)=20.11299$

$F_{12}= (0.3*21)+(0.7*18.13613)=20.37909$

Table 8 . MAPE Prediction of Single Exponential Smoothing Method

No.	MONTH	AGE			
		MAN			
		-19 (Original Data)	-19 (Forecast Result)	Comparison (MAPE)	MAPE percentage form
1.	JANUARY	10	-	-	
2.	FEBRUARY	10	10	0	0%
3.	MARCH	11	10	0.090909	9%
4.	APRIL	10	11	0.1	10%
5.	MAY	9	10	0.11111	11%
6.	JUNE	17	12	0.294118	29%
7.	JULY	20	16	0.2	20%
8.	AUGUST	17	16	0.058824	6%
9.	SEPTEMBER	24	18	0.25	25%
10.	OCTOBER	18	17	0.055556	6%
11.	NOVEMBER	27	20	0.259259	26%
12.	DECEMBER	22	20	0.090909	9%
	MAPE			0.137335	14%

Comparison between Forecast Results for 2021 and Original Data for 2021

Table 9. Determination of the Minimum Error Alpha Value

Alpha (α)	MAPE	MAPE %
0.1	0.231483	23%
0.2	0.181002	18%
0.3	0.137335	14%
0.4	0.097216	10%
0.5	0.080625	8%
0.6	0.078016	8%
0.7	0.090582	9%
0.8	0.096811	10%
0.9	0.088854	9%

Table 10. Interpretation of MAPE Values

No	MAPE value	Information
1	<10%	Very accurate
2	10-20%	Good
3	20-50%	Reasonable
4	>50%	No accurate

Solution :

From marriage data early the 12 periods . _ So will foreseen 13th period onwards . Single Exponential Smoothing Method (with alpha = 0.6)

based on category MAPE value then got alpha value which is very accurate For prediction that is the lowest percentage error its (0.6).

$F_{t+1} = \alpha X_t + (1-\alpha)F_t$

Case male :
F1 = 10
F2 = (0.6* 9)+(0.4*10)=9.4
F3 = (0.6* 11)+(0.4*9.4)=10.36
F4 = (0.6* 12)+(0.4*10.36)=11.344
F5 = (0.6* 7)+(0.4*11.344)=8.7376
F6 = (0.6* 16)+(0.4*8.7376)=13.09504
F7 = (0.6* 25)+(0.4*13.09504)=20.23802
F8 = (0.6* 17)+(0.4*20.23802)= 18.29251
F9 = (0.6* 23)+(0.4*18.29251)=21.11808
F10= (0.6* 15)+(0.4*21.11808)=17.44723
F11= (0.6* 27)+(0.4*17.44723)=23.17889
F12= (0.6* 21)+(0.4*23.17889)=21.87156

Case :
F1 = 27
F2 = (0.6* 21)+(0.4*27)=23.4
F3 = (0.6* 13)+(0.4*23.4)=17.16
F4 = (0.6* 13)+(0.4*17.16)=14.664
F5 = (0.6* 9)+(0.4*14.664)=11.2656
F6 = (0.6* 17)+(0.4*11.2656)=14.70624
F7 = (0.6* 26)+(0.4*14.70624)=21.4825
F8 = (0.6* 19)+(0.4*21.4825)=19.993
F9 = (0.6* 51)+(0.4*19.993)=38.5972
F10= (0.6* 37)+(0.4*38.5972)=37.63888
F11= (0.6* 61)+(0.4*37.63888)=51.65555
F12= (0.6* 64)+(0.4*51.65555)=59.06222

Table 11. Prediction Results of the Single Exponential Smoothing Method

		NUMBER OF MARRIAGES	AGE	
No.	MONTH		MAN - 19	WOMAN - 19
1.	JANUARY			
2.	FEBRUARY	32	9	23
3.	MARCH	27	10	17
4.	APRIL	26	11	15
5.	MAY	20	9	11
6.	JUNE	28	13	15
7.	JULY	42	20	22
8.	AUGUST	38	18	20
9.	SEPTEMBER	60	21	39
10.	OCTOBER	56	1 8	38
11.	NOVEMBER	75	23	52
12.	DECEMBER	81	2 2	59
	AMOUNT	4 85	1 74	311

Table 12. M APE Prediction of Single Exponential Smoothing Method

		AGE					
		MAN			Woman		
No.	MONTH	- 19 (Forecast Results)	- 19 (Original Data)	Comparison (MAPE)	- 19 (Divination Results)	- 19 (Original Data)	Comparison (MAPE)
1.	JANUARY	-	10	-	-	21	-
2.	FEBRUARY	9	10	10 %	23	23	0 %
3.	MARCH	10	11	9%	17	15	13 %
4.	APRIL	11	10	10%	15	14	7 %
5.	MAY	9	9	0%	11	10	10 %
6.	JUNE	13	17	24%	15	17	12 %
7.	JULY	20	20	5%	22	26	15 %
8.	AUGUST	18	17	6%	20	20	0 %
9.	SEPTEMBER	21	24	13%	39	52	25 %
10.	OCTOBER	1 8	18	0%	38	39	3 %
11.	NOVEMBER	23	27	15%	52	61	15 %
12.	DECEMBER	2 2	22	0%	59	64	9 %
	AMOUNT	1 74	195	8 %	311	36 2	10 %

Table 13. MSE Prediction of the Single Exponential Smoothing Method

		AGE					
		MAN			Woman		
No.	MONTH	≤19 (Forecast Result)	≤19 (Original Data)	Comparison (M SE)	≤19 (Forecast Result)	≤19 (Original Data)	Comparison (M SE)
1.	JANUARY	-	10	-	-	21	-
2.	FEBRUARY	9	10	1	23	23	0
3.	MARCH	10	11	1	17	15	-2
4.	APRIL	11	10	-1	15	14	-1
5.	MAY	9	9	0	11	10	-1
6.	JUNE	13	17	4	15	17	2
7.	JULY	20	20	0	22	26	4

8.	AUGUST	18	17	-1	20	20	0
9.	SEPTEMBER	21	24	3	39	52	13
10.	OCTOBER	1 8	18	0	38	39	1
11.	NOVEMBER	23	27	4	52	61	9
12.	DECEMBER	2 2	22	0	59	64	5
	AMOUNT	1 74	195	21	311	36 2	51

3.5 Data Analysis Results

After analyzing the data above, we can predict the data using the Single Exponential Smoothing method

3.6 System testing

A number of the next stage become discussion in results study This is testing application and application

Figure 3. Display of the Login Form

Figure 4. Display of Form Menu

Figure 5. Display of Age and Gender Forms

Figure 6. Display of the Early Marriage Form

Figure 7. Display of the Prediction Form

Figure 8. Display of the User Prediction Form

3.8 Application

The application of this system is to predict the number of early marriages for men and women, so that the government can make preparations to deal with and overcome cases of early marriage in the city of Medan.

4. CONCLUSION

Based on the discussion of the results and analysis chapters that have been carried out, the following conclusions can be drawn:

By looking at and using data on early marriages in the previous period, the Population and Civil Registration Service can predict the increase in early marriages due to the impact of COVID-19 in the city of Medan.

By using early marriage data in the previous period and using the formula from the single exponential smoothing method, the single exponential smoothing method can be applied to predict the increase in early marriage.

By using web programming and the MySQL database as a data storage medium, it can produce an application to predict the increase in early marriage due to the impact of COVID-19 in the city of Medan using the single exponential smoothing method.

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REFERENCE

[1] Andikos, A. (2019). Designing Interactive Multimedia Applications as Learning Media for Animal Recognition in Islamic Kindergarten Bakti 113 Koto Salak. Sakinah Journal, 1(1), 34-49.

[2] Arfianto, FR, & Nugrahanti, F. (2019, November). Web-Based Housing Sales Application Design at Cv. Grand Permata Residence Magetan. In *Proceedings of the National Seminar on Information and Communication Technology (SENATIK)* (Vol. 1, No. 1, pp. 174-179) .

[3] Hanif, A., & Hadi, A. (2020). Evaluation of Information Technology Governance in the Office of Communication and Informatics Using the Cobit 5 Framework. *JST (Journal of Science and Technology)* , *9* (1), 94-101 .

[4] Hayami, R., & Oktaviandi, I. (2021). Application of the Single Exponential Smoothing Method in Bed Sheet Sales Predictions. *Journal of CoSciTech (Computer Science and Information Technology)* , *2* (1), 32-39 .

[5] Kurniawati, N., & Sari, KIP (2020). Determinant Factors Triggering the Occurrence of Early Marriage in Teenagers. *Journal of Nursing* , *13* (1), 12-12 .

[6] Nurfadilah, IH, Pertiwi, FD, & Prastia, TN (2021). Description of Early Marriage to Pus (Couples of Reproductive Age) in Pasir Jaya Village, West Bogor District in 2019. *Promoter* , *4* (4), 322-328.

[7] Pakpahan, HS, Basani, Y., & Hariani, RR (2020). Prediction of the Number of Poor Population in East Kalimantan Using Single and Double Exponential Smoothing. inform. Mulawarman J.Ilm. Computing Science, 15(1), 47-51.

[8] Rahmasari, T. (2019). Designing a Merchandise Inventory Accounting Information System at a Happy Department Store Using Php and Mysql. *@is The Best: Accounting Information Systems and Information Technology Business Enterprise* , *4* (1), 411-425.

[9] Rosa, DU, Alan, MS, Wulandari, H., & Ramadhan, S. (2019). The exponential smoothing method for projecting the number of poor people in West Nusa Tenggara. *Journal of Thought and Research in Mathematics Education (JP3M)* , *2* (1), 42-53.

[10] Sudibyo, NA, Iswardani, A., Septyanto, AW, & Wicaksono, TG (2020). Inflation Prediction in Indonesia Using the Moving Average Method, Single Exponential Smoothing and Double Exponential Smoothing. *Lebesgue Journal: Scientific Journal of Mathematics Education, Mathematics and Statistics* , *1* (2), 123-129.