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ANALYZING THE NEW STUDENT ADMISSION FORECASTS USING SINGLE AND DOUBLE EXPONENTIAL SMOOTHING FORECASTING METHODS AT STABN SRIWIJAYA COLLEGE TANGERANG BANTEN

[1]Pringgondani, [2]Franky Okto Bernando
[1,2]Program Studi Bisnis dan Manajemen Buddha, STABN Sriwijaya Tangerang, Banten

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ABSTRACT

This study aims to assess the utilization of Single Exponential Smoothing (SES) and Double Exponential Smoothing (DES) techniques in predicting the number of new students at STABN Sriwijaya Tangerang. Additionally, the study aims to analyze the forecasted new student admissions for 2024 using the SES and DES methods. Lastly, the study seeks to identify the optimal value of the Constant error (α) for accurate forecasting. The research methodology employed is applied research, utilizing a population of all historical data on new student admissions. The sample for analysis spans from 2013 to 2023 and was chosen using a purposive sampling procedure. The research yielded the following results: (1) SES forecasting is conducted by determining the constants 0.1 and 0.9, followed by DES forecasting using the same constants. The forecasting methods are then evaluated using error metrics such as MAD, MSE, and MAPE. (2) Using the SES method, the forecasted number of new STABN Sriwijaya students for 2024 is 67 for an alpha value of 0.1 and 95 for an alpha value of 0.9. The Double Exponential Smoothing (DES) method predicts that there will be 80 new students in 2024 when using an alpha value of 0.1. However, using an alpha value of 0.9, the forecasted number of new students is 76. (3) The DES approach outperforms the SES method in terms of accuracy, yielding a MAPE result of 27%.

E-mail:
mrpringgondani@gmail.com

1. INTRODUCTION

Within the realm of higher education, there exists an educational institution responsible for overseeing the organization of the teaching and learning process. This institution possesses a substantial and expanding data warehouse. The significance of this data warehouse in the current era of information is crucial for formulating the college's future strategy. Data mining techniques can be applied to process these data sets for specific goals, yielding valuable information patterns that benefit the company or institution. Data mining is an empirical discipline that aims to reveal concealed information inside extensive datasets to offer essential insights for enhancing organizational efficacy. The primary objective of this scientific discipline is to retrieve data from intricate systems by employing suitable methodologies tailored to the specific goals at hand (Van der Aalst, 2016).

The University's new student admission initiates the first activity known as NSR. Student enrollment is an essential determinant in the achievement of higher education. The presence of a limited number of students in a college adversely affects the quality of the college, leading to the disruption of academic processes. When implementing new student admission, each university has its approach, which is usually tailored to the specific challenges within the school. The main issue that arises is determining the optimal student capacity that can be accommodated given the institution's available resources. This includes scenarios where there is a high demand for new students but insufficient facilities available to support them, situations where there are sufficient facilities but the number of prospective students who wish to enroll is low, cases where there are adequate facilities and high interest from prospective students, but an insufficient number of teaching staff, and various other challenges that arise within the institution. To address these issues, institutions must ensure the provision of excellent facilities and infrastructure, thereby preventing prospective new students from experiencing dissatisfaction concerning the college's advertised offerings. Design and analysis are essential for formulating policies to guide decision-making. Forecasting is an appropriate method to analyze university performance and predict future conditions [2]. Forecasting can be a valuable tool for universities to optimize their spending on facilities and infrastructure acquisition, ensuring efficiency and cost-effectiveness.

Sriwijaya State Buddhist College (STABN) is Indonesia's inaugural state Buddhist college.To effectively compete with other universities in Indonesia, STABN Sriwijaya must have solid and accurate tactics. To improve the accuracy of the target setting for New Student Admission at STABN Sriwijaya, it is necessary to develop projections that can serve as a foundation for forecasting the number of accepted students. Currently, the target setting is solely based on possibilities and relies on intuitive predictions made by the committee. Without a reliable method to predict the influx of new students at STABN Sriwijaya, there will inevitably be challenges in formulating policies and making decisions regarding the provision of facilities and infrastructure, recruitment of educators and lecturers, and other potential avenues to ensure optimal service for registered students. Quantitative analysis is employed to calculate the number of pupils sensibly. Using quantitative analysis, the forecasting method can be utilized as an influential indication in projecting outcomes. Hence, it is vital to use the forecast of incoming students as the foundation for academic strategizing [3]. The Single Exponential Smoothing (SES) and Double Exponential Smoothing (DES) approaches are forecasting methodologies.The Single Exponential Smoothing (SES) method is a forecasting methodology that calculates a moving average by adjusting the forecast based on the most recent observed data. The Single Exponential Smoothing (SES) algorithm is an alternative name for this method.

Research with the SES method has been conducted by [4] with 36% accuracy. The Single Exponential Smoothing (SES) method is the most widely applied method in forecasting. This can be attributed to its simplicity, ease of adjusting the response to changes in the forecasting process, and reasonable accuracy. In addition, the SES Method is the most widely used forecasting method. The main advantages of SES include its ease of operation, which is relatively low, and its high forecasting accuracy, which is better than using Moving Averages. These two advantages are seen in the fact that the Single Exponential Smoothing (SES) Method is a method that is still relatively under development. In research, the SES method [5]was also used to forecast drug demand at the Surbaya Health Office, and the accuracy reached 20%.

"Double exponential smoothing" (DES) refers to a forecasting method that is performed through a series of repeated and continuous calculations based on the most recent historical data and is based on the calculation results of the average exponential smoothing. The double exponential smoothing method is used to forecast data with an upward trend. In general, the more data used in the calculation for forecasting, the lower the percentage of forecasting error, and vice versa. The DES method is used in research[6], where this study compares the results of SES and DES calculations on forecasting the characteristics of the working population in Indonesia in 2017 and concludes that the DES method is more accurate. Based on the background that the author describes, the author conducted research on new student forecasting at STABN Sriwijaya with the title "*Analyzing the new student admission forecasts using single and double exponential smoothing forecasting methods at Stabn Sriwijaya College Tangerang Banten*."

Literature Review

Forecasting

The art and science of predicting what will happen in the future is called forecasting [7]. Forecasting is an essential component of decision-making. Typically, the estimation of a data set is derived from previously analyzed data using specific methods. The past is collected, examined, and researched about the passage of time, and predictions are made. The predictive accuracy of each problem and factor is unique. In daily activities, prediction is essential; in their research, [8] "It is clear that forecasting activities have an important role in our daily lives. Every day, the weather forecast tells us what the weather will be like tomorrow. We can prevent major damage by forecasting the arrival of storms or hurricanes. We usually forecast many things concerning our daily lives, such as the economy, stock market, population growth, weather, etc. To make a forecast with 100% accuracy is, of course, impossible, but we can do our best to reduce or improve the forecasting error of the speed of the forecasting process."

Exponential Smoothing Method

Exponential smoothing extends the Moving Averages technique [9]. In this method, forecasting is done by continuously repeating calculations using the latest data. The latest information is given greater weight than older information. Single Exponential Smoothing, Double Exponential Smoothing, and Triple Exponential Smoothing are three methods of Exponential Smoothing.

Single Exponential Smoothing

Single Exponential Smoothing, commonly called Simple Exponential Smoothing, is a method that will be used soon. When using the Single Exponential Smoothing (SES) method for forecasting, the optimal alpha value is established through trial and error [10] . The goal is to find the alpha value that minimizes the forecast error. The formula for performing single exponential smoothing is as follows:

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

F_{t+1} = Forecast Period t+1
X_t = Real value of period t
α = A smoothing constant between 0 and 1
F_t = Forecasting for period t

Double Exponential Smoothing

The rationale behind using single exponential smoothing and double exponential smoothing methods is based on the observation that if a trend component exists in the data, the smoothing value will manifest itself before the actual data. To account for the trend, combining the double smoothing value with the single smoothing value is essential [11]. The formula for performing double exponential smoothing is as follows:

$$S_t = \alpha * X_t + (1-\alpha) * (S_{t-1} + T_{t-1})$$
$$T_t = \beta * (S_t - S_{t-1}) + (1-\beta) * T_{t-1}$$
$$F_{t+m} = S_t + T_t * m$$

S_t = Single smoothing value
X_t = Actual data at time t
T_t = Trend smoothing
F_{t+m} = Forecast value
m = Future period
α = Smoothing coefficient $0 < \alpha < 1$
β = Smoothing coefficient $0 < \beta < 1$

Forecast Error

Forecasting error is a metric used to assess forecasting accuracy and compare its performance. To mitigate inaccuracies in forecasting, it is necessary to employ data analysis techniques that can reduce errors [12] . This can be achieved through the utilisation of mean absolute percent error (MAPE), mean absolute deviation (MAD), and mean square error (MSE).

MAD formulation as follows:

$$MAD = \frac{\sum |(At - Ft)|}{n}$$

Keterangan :
A_t = Actual Data period t
F_t = Forecasting in period t
n = Number of Periods of Forecasting involved

MSE formulation as follows:

$$MSE = \frac{\sum Et^2}{n}$$

Keterangan :
Et^2 = Squared Error Value
n = lots of data

MAPE formulation as follows:

$$\text{MAPE} = \frac{1}{n}\sum_{t=1}^{n}\frac{Xt-Ft}{ft}\ 100$$

Keterangan :
X_t = Actual Data period t
F_t = Forecasting in period t
n = Number of time periods

The MAPE value is utilized to assess the degree of precision in forecasting, as depicted in the table provided below:

Table 1 Forecasting Accuracy

MAPE Value	Forecasting Accuracy
MAPE ≤ 10%	High
10% ≤ MAPE ≤ 20%	Good
20% ≤ MAPE ≤ 50%	Proper
MAPE > 50%	Low

2. METHOD

Types of research

This study employs an applied research methodology, utilizing a quantitative approach for data gathering and analysis. Applied research refers to the type of research that focuses on testing a substantial problem and evaluating a theory to address profound societal issues [13]. The secondary data utilized in this study was obtained from Sriwijaya Tangerang State Buddhist College's academic department in Banten Province. The research was conducted at Sriwijaya Tangerang State Buddhist College (STABN), located at Edutown BSD City Road, Pagedangan, Tangerang Regency. The duration required to conduct this research is six months, commencing in June 2023.

Sampling technique

The population for this study consists of all the new student admission data from STABN Sriwijaya. In contrast, the sample used in this research comprises the new student admission data collected over 11 years. Purposive sampling conducts sample processes with specified aims and considerations [14]. The sample for this study was chosen from the data of new students received between 2013 and 2023. The decision was based on the assumption that the student data obtained from 2013 to 2023 was comprehensive and well-structured, unlike the previous year's data, which needed to be more organized and, therefore, less reliable.

3. RESULT AND DISCUSSION

Data Collection

The data analysis for this study will focus on the student enrollment figures at STABN Sriwijaya from 2013 to 2023. The data was acquired through interviews with the STABN Sriwijaya academic division. The obtained data is presented as follows:

Table 2. Data on the number of students from 2013 to 2023

Year	New student Data
2013	54
2014	57
2015	43
2016	21
2017	38
2018	42
2019	53
2020	89
2021	105
2022	118
2023	93

Source: STABN Sriwijaya Academic

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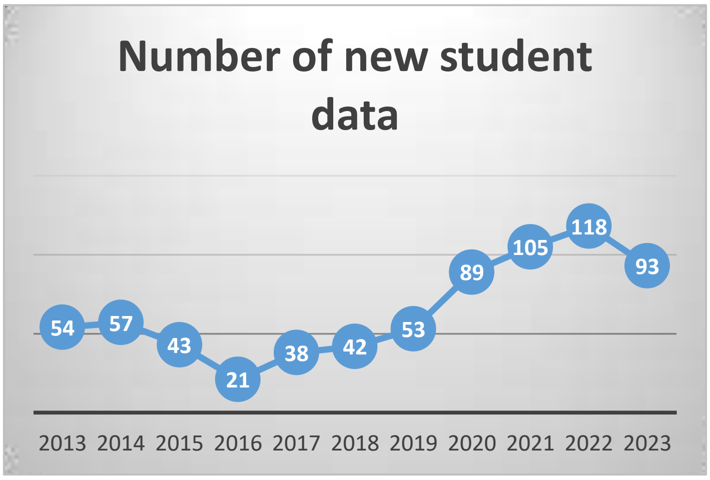

Figure 1. Graph of Number of New Student Data STABN Sriwijaya 2013 to 2023

The scatter plot displays data on new students during 11 years, spanning from 2013 to 2023. Figure 1 illustrates changes in new student admissions at STABN Sriwijaya. In 2013, there new students was 54, with no substantial increase in 2014. Subsequently, there was a decline in admissions in both 2015 and 2016. Between 2017 and 2022, there was a notable rise in the number of new students. However, in 2023, there was a decline of precisely 93 students.

To examine the influx of new students in 2024, the researchers utilized historical data from 2013 to 2023. To determine the appropriate alpha value, which serves as a statistical significance threshold, the researchers selected the values of 0.1 and 0.9, representing the most minor and most significant possible values, respectively. This decision was made due to the need for an established foundation for selecting the alpha value. The forecasting will be conducted using single exponential smoothing and double exponential smoothing techniques to identify the most effective way to predict future student demand.

Data analysis with Single Exponential Smoothing (SES)

The forecasting will be conducted using the single Exponential Smoothing technique, employing alpha values of 0.1 and 0.9. Subsequently, researchers will utilize the Mean Absolute Percentage Error (MAPE) to determine the magnitude of errors in the predicted value. Based on the forecasting results above, researchers will complete the commas, and the final results of forecasting using the SES method with alpha 0.1 are as follows:

Table 3. Forecast results with alpha 0.1

No	Period	Fact Data	Forecast alpha 0,1
1	2013	54	54
2	2014	57	54
3	2015	43	54
4	2016	21	53
5	2017	38	50
6	2018	42	49
7	2019	53	48
8	2020	89	49
9	2021	105	53
10	2022	118	58
11	2023	93	64
12	2024		67

According to the data in Table 3, the forecast for 2024, with an alpha value of 0.1, predicts an increase of 67 new students. The computation is performed manually and sequentially, and using commas facilitates forecasting calculations. Following the initial forecast with an alpha value of 0.1, the researchers conducted further forecasting using an alpha value of 0.9. Here are the computed results:

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Table 4. Forecast Result With alpha 0,9

No	Year	Factual Data	Forecast alpha 0,9
1	2013	54	54
2	2014	57	54
3	2015	43	57
4	2016	21	44
5	2017	38	23
6	2018	42	37
7	2019	53	41
8	2020	89	52
9	2021	105	85
10	2022	118	103
11	2023	93	117
12	2024		95

According to the data in Table 4, the prediction for 2024 using an alpha value of 0.9 predicts an increase of 95 new students. The calculation was performed manually and sequentially, including commas to aid the forecasting process. Following applying the SES method for forecasting, the subsequent step involves computing the Mean Absolute Deviation (MAD) to determine the forecasting error. The Mean Absolute Deviation (MAD) is a valuable metric for determining the average absolute error magnitude for each approach. The minimum value of the Mean Absolute Deviation (MAD) is used to determine the optimal value. The MAD value is presented for alpha values of 0.1 and 0.9 :

Tabel 5. Forecasting Error Results with MAD alpha 0.1 and 0.9

No	Year	Factual Data (A)	Forecast (F)	A-F	A-F Absolute (MAD) 0,1	A-F Absolute (MAD) 0,9
1	2013	54	54	54	0	0
2	2014	57	54	3	3	3
3	2015	43	54	-11	11	14
4	2016	21	53	-32	32	23
5	2017	38	50	-12	12	15
6	2018	42	49	-7	7	5
7	2019	53	48	5	5	12
8	2020	89	49	40	40	37
9	2021	105	53	52	52	20
10	2022	118	58	60	60	15
11	2023	93	64	29	29	24
12	2024		67	Total	251	168
				MAD Result	22.81818182	15.27272727

According to Table 5, the Mean Absolute Deviation (MAD) value for alpha 0.1 is 22.82 (rounded to two decimal places), whereas the MAD value for alpha 0.9 is 15.27. The minimum MAD value corresponds to the MAD value associated with an alpha value of 0.9. The Mean Square Error (MSE) measures the average squared difference between actual and forecasted values. A lower Mean Squared Error (MSE) score indicates a higher forecasting accuracy level. The subsequent analysis showcases the outcomes of the computation of the Mean Squared Error (MSE) using Alpha values of 0.1 and 0.9.

Table 6. Forecasting Error Results with MSE alpha 0.1 and 0.9

No	Year	Factual Data (A)	Forecast F	A-F	A-F (KUADRAT) MSE 0,1	A-F (KUADRAT) MSE 0,9
1	2013	54	54	54	0	0
2	2014	57	54	3	9	9
3	2015	43	54	-11	121	196
4	2016	21	53	-32	1024	529
5	2017	38	50	-12	144	225
6	2018	42	49	-7	49	25
7	2019	53	48	5	25	144

8	2020	89	49	40	1600	1369
9	2021	105	53	52	2704	400
10	2022	118	58	60	3600	225
11	2023	93	64	29	841	576
12	2024		67	Total	10117	3698
				MSE Result	919.7272727	336.1818182

Table 6 shows that the Mean Squared Error (MSE) for SES forecasting is 919.72 when using an alpha value of 0.1 and 336.18 when using an alpha value of 0.9. The most optimal forecasting strategy suited to the SES (Simple Exponential Smoothing) technique is to employ an alpha value of 0.9. MAPE, or Mean Absolute Percentage Error, quantifies how much the forecasting error deviates from the actual number. The subsequent information showcases the outcomes of the Mean Absolute Percentage Error (MAPE) computation for the Simple Exponential Smoothing (SES) technique, employing alpha values of 0.1 and 0.9.

Tabel 7 Forecasting Error Results with MAPE alpha 0.1 and 0.9

No	Year	Factual Data (A)	Forecast F	A-F	A-F ABSO/ Actual *100% (MAPE) 0,1	A-F ABSO/ Actual *100% (MAPE) 0,9
1	2013	54	54	54	0	0
2	2014	57	54	3	5.263157895	5.263157895
3	2015	43	54	-11	25.58139535	32.55813953
4	2016	21	53	-32	152.3809524	109.5238095
5	2017	38	50	-12	31.57894737	39.47368421
6	2018	42	49	-7	16.66666667	11.9047619
7	2019	53	48	5	9.433962264	22.64150943
8	2020	89	49	40	44.94382022	41.57303371
9	2021	105	53	52	49.52380952	19.04761905
10	2022	118	58	60	50.84745763	12.71186441
11	2023	93	64	29	31.1827957	25.80645161
12	2024		67	Total	417.402965	320.5040313
				MAPE Result	37.94572409	29.13673012

Table 7 reveals that the Mean Absolute Percentage Error (MAPE) is 37% when alpha is set at 0.1. However, it decreases to 29% when alpha is increased to 0.9. The two acquired results are categorized as practicable. Nevertheless, the best result is selected based on the smallest MAPE value, with an alpha of 0.9.

Data analysis with Double Exponential Smoothing (DES)

Double Exponential Smoothing (DES) is a forecasting technique that involves applying two levels of smoothing. The initial smoothing process has been completed, and we now only need to compute the second smoothing. The alpha values chosen are 0.1 and 0.9. First, it is necessary to ascertain the initial and secondary smoothing values. These are the values used for smoothing.

Table 8. First and second smoothing value results alpha 0.1

No	Period	Factual data	S't	S"t
1	2013	54	54	54
2	2014	57	54.3	54.03
3	2015	43	53.17	53.944
4	2016	21	49.953	53.5449
5	2017	38	48.7577	53.06618
6	2018	42	48.08193	52.56776
7	2019	53	48.57374	52.16835
8	2020	89	52.61636	52.21315
9	2021	105	57.85473	52.77731
10	2022	118	63.86925	53.88651
11	2023	93	66.78233	55.17609

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To calculate the forecast using the Double Exponential Smoothing (DES) method, the next step is determining the constant (at) using an alpha value of 0.1.

Table 9. Result Constant value at with alpha 0.1

No	Period	Factual data	S't	S"t	S't-S"t	at
1	2013	54	54	54	0	
2	2014	57	54.3	54.03	0.27	54.57
3	2015	43	53.17	53.944	-0.774	52.396
4	2016	21	49.953	53.5449	-3.5919	46.3611
5	2017	38	48.7577	53.06618	-4.30848	44.44922
6	2018	42	48.08193	52.56776	-4.48583	43.59611
7	2019	53	48.57374	52.16835	-3.59462	44.97912
8	2020	89	52.61636	52.21315	0.403209	53.01957
9	2021	105	57.85473	52.77731	5.077415	62.93214
10	2022	118	63.86925	53.88651	9.982749	73.852
11	2023	93	66.78233	55.17609	11.60624	78.38857
12	2024					

The next stage carried out in DES forecasting is to find the constant bt with an alpha value of 0.1,

Table 10. Result Constant value bt with alpha 0.1

No	Period	Factual data	S't	S"t	S't-S"t	at	bt
1	2013	54	54	54	0		
2	2014	57	54.3	54.03	0.27	54.57	0.03
3	2015	43	53.17	53.944	-0.774	52.396	-0.086
4	2016	21	49.953	53.5449	-3.5919	46.3611	-0.3991
5	2017	38	48.7577	53.06618	-4.30848	44.44922	-0.47872
6	2018	42	48.08193	52.56776	-4.48583	43.59611	-0.49843
7	2019	53	48.57374	52.16835	-3.59462	44.97912	-0.3994
8	2020	89	52.61636	52.21315	0.403209	53.01957	0.044801
9	2021	105	57.85473	52.77731	5.077415	62.93214	0.564157
10	2022	118	63.86925	53.88651	9.982749	73.852	1.109194

Once the constant value has been determined, the subsequent task is to calculate the forecasted value.

Tabel 11. Results Forecasting value with alpha 0.1

No	Period	Factual data	S't	S"t	S't-S"t	at	bt	Ft
1	2013	54	54	54	0			
2	2014	57	54.3	54.03	0.27	54.57	0.03	
3	2015	43	53.17	53.944	-0.774	52.396	-0.086	54.6
4	2016	21	49.953	53.5449	-3.5919	46.3611	-0.3991	52.31
5	2017	38	48.7577	53.06618	-4.30848	44.44922	-0.47872	45.962
6	2018	42	48.08193	52.56776	-4.48583	43.59611	-0.49843	43.9705
7	2019	53	48.57374	52.16835	-3.59462	44.97912	-0.3994	43.09768
8	2020	89	52.61636	52.21315	0.403209	53.01957	0.044801	44.57972
9	2021	105	57.85473	52.77731	5.077415	62.93214	0.564157	53.06437
10	2022	118	63.86925	53.88651	9.982749	73.852	1.109194	63.4963
11	2023	93	66.78233	55.17609	11.60624	78.38857	1.289582	74.9612
12	2024							79.67815

The forecasted result for 2024 using the Double Exponential Smoothing (DES) method with an alpha value of 0.1 is 79.67, rounded to 80. The subsequent alpha to be computed is alpha 0.9, based on the obtained calculation results.

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Table 12. First and second smoothing value results alpha 0.9

No	Period	Factual data	S't	S"t
1	2013	54	54	54
2	2014	57	56.7	56.43
3	2015	43	44.37	45.576
4	2016	21	23.337	25.5609
5	2017	38	36.5337	35.43642
6	2018	42	41.45337	40.85168
7	2019	53	51.84534	50.74597
8	2020	89	85.28453	81.83068
9	2021	105	103.0285	100.9087
10	2022	118	116.5028	114.9434
11	2023	93	95.35028	97.3096

To calculate the forecast using the Double Exponential Smoothing (DES) method, the next step is determining the constant (at) using an alpha value of 0.9.

Table 13. Result Constant value at with alpha 0.9

No	Period	Factual data	S't	S"t	S't-S"t	at
1	2013	54	54	54	0	
2	2014	57	56.7	56.43	0.27	56.97
3	2015	43	44.37	45.576	-1.206	43.164
4	2016	21	23.337	25.5609	-2.2239	21.1131
5	2017	38	36.5337	35.43642	1.09728	37.63098
6	2018	42	41.45337	40.85168	0.601695	42.05507
7	2019	53	51.84534	50.74597	1.099366	52.9447
8	2020	89	85.28453	81.83068	3.453856	88.73839
9	2021	105	103.0285	100.9087	2.119778	105.1482
10	2022	118	116.5028	114.9434	1.559417	118.0623
11	2023	93	95.35028	97.3096	-1.95931	93.39097

The next stage carried out in DES forecasting is to find the constant bt with an alpha value of 0.9,

Table 14. Result Constant value bt with alpha 0.9

No	Period	Factual data	S't	S"t	S't-S"t	at	bt
1	2013	54	54	54	0		
2	2014	57	56.7	56.43	0.27	56.97	2.43
3	2015	43	44.37	45.576	-1.206	43.164	-10.854
4	2016	21	23.337	25.5609	-2.2239	21.1131	-20.0151
5	2017	38	36.5337	35.43642	1.09728	37.63098	9.87552
6	2018	42	41.45337	40.85168	0.601695	42.05507	5.415255
7	2019	53	51.84534	50.74597	1.099366	52.9447	9.894296
8	2020	89	85.28453	81.83068	3.453856	88.73839	31.08471
9	2021	105	103.0285	100.9087	2.119778	105.1482	19.078
10	2022	118	116.5028	114.9434	1.559417	118.0623	14.03475
11	2023	93	95.35028	97.3096	-1.95931	93.39097	-17.6338

Once the constant value has been determined, the subsequent task is to calculate the forecasted value.

Tabel 15. Results Forecasting value with alpha 0.9

No	Period	Factual data	S't	S"t	S't-S"t	at	bt	Ft
1	2013	54	54	54	0			
2	2014	57	56.7	56.43	0.27	56.97	2.43	
3	2015	43	44.37	45.576	-1.206	43.164	-10.854	59.4
4	2016	21	23.337	25.5609	-2.2239	21.1131	-20.0151	32.31
5	2017	38	36.5337	35.43642	1.09728	37.63098	9.87552	1.098
6	2018	42	41.45337	40.85168	0.601695	42.05507	5.415255	47.5065
7	2019	53	51.84534	50.74597	1.099366	52.9447	9.894296	47.47032

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8	2020	89	85.28453	81.83068	3.453856	88.73839	31.08471	62.839
9	2021	105	103.0285	100.9087	2.119778	105.1482	19.078	119.8231
10	2022	118	116.5028	114.9434	1.559417	118.0623	14.03475	124.2262
11	2023	93	95.35028	97.3096	-1.95931	93.39097	-17.6338	132.097
12	2024							75.75714

The result of forecasting with the DES method using alpha 0.9 for the year 2024 is 75.75 rounded to 76. Forecasting is a prediction that is prone to inaccuracies, thus necessitating the inclusion of an error margin in its calculation. Researchers utilize the outcomes of the computation of MAD (Mean Absolute Deviation), MSE (Mean Squared Error), and MAPE (Mean Absolute Percentage Error) to derive the calculation. Here are the outcomes of the computation.

Tabel 16. Comparison Results of Alpha Error 0.1 and 0.9 Forecasting with MAD

No	Period	Factual data	MAD 0.1	MAD 0.9
1	2013	54		
2	2014	57		
3	2015	43	11.6	16.4
4	2016	21	31.31	11.31
5	2017	38	7.962	36.902
6	2018	42	1.9705	5.5065
7	2019	53	9.90232	5.52968
8	2020	89	44.42028	26.161001
9	2021	105	51.93563	14.823097
10	2022	118	54.5037	6.2262293
11	2023	93	18.0388	39.097015
12	2024	Total	231.64323	161.95552
		MAD Result	21.058475	14.723229

In Table 16, the Mean Absolute Deviation (MAD) value for alpha 0.1 is 21.05 (rounded to two decimal places), whereas the MAD value for alpha 0.9 is 14.72. The minimum MAD value corresponds to the MAD value associated with an alpha value of 0.9.

Tabel 17. Comparison Results of Alpha Error 0.1 and 0.9 Forecasting with MSE

No	Period	Factual data	MSE 0.1	MSE 0.9
1	2013	54		
2	2014	57		
3	2015	43	134.56	268.96
4	2016	21	980.3161	127.9161
5	2017	38	63.393444	1361.7576
6	2018	42	3.8828703	30.321542
7	2019	53	98.055941	30.577361
8	2020	89	1973.1613	684.39797
9	2021	105	2697.3097	219.7242
10	2022	118	2970.6533	38.765931
11	2023	93	325.39831	1528.5766
12	2024	Total	9246.7309	4290.9973
		MSE Result	840.6119	390.09066

Based on Table 17, the MSE value for DES forecasting with alpha 0.1 is 840.61, while the MSE value for alpha 0.9 is 390.09. So, the best forecasting for the DES method is forecasting with alpha 0.9.

Tabel 18. Comparison Results of Alpha Error 0.1 and 0.9 Forecasting with MAPE

No	Period	Factual data	MAPE 0.1	MAPE 0.9
1	2013	54		
2	2014	57		
3	2015	43	26.976744	38.139535
4	2016	21	149.09524	53.857143
5	2017	38	20.952632	97.110526

6	2018	42	4.6916667	13.110714
7	2019	53	18.683623	10.433358
8	2020	89	49.910427	29.394383
9	2021	105	49.462505	14.117235
10	2022	118	46.189576	5.2764655
11	2023	93	19.396559	42.039801
12	2024	total	385.35897	303.47916
		MAPE Result	35.032634	27.589015

Table 18 reveals that the Mean Absolute Percentage Error (MAPE) is 35% for alpha 0.1 and 27% for alpha 0.9. The two derived outcomes are categorized as viable. However, the optimal outcome is selected based on the smallest value, precisely the MAPE value, with an alpha of 0.9.

Tabel 18. SES and DES Calculation Results Table

Forecast	Alpha	Forecast result	MAD Result	MSE Result	MAPE Result
Single Exponential Smoothing	0.1	67	22.82	919.72	37%
(SES)	0.9	95	15.27	336.18	29%
Double Exponential Smoothing	0.1	80	21.05	840.61	35%
(DES)	0.9	76	14.72	390.09	27%

Based on the analyzed findings, it has been determined that the optimal alpha value for Single Exponential Smoothing (SES) forecasting is 0.9. This choice yields a Mean Absolute Deviation (MAD) value of 15.27, a Mean Squared Error (MSE) value of 336.18, and a Mean Absolute Percentage Error (MAPE) value of 29%. The Double Exponential Smoothing (DES) results indicate that the optimal alpha value for forecasting is 0.9. This choice of alpha leads to a Mean Absolute Deviation (MAD) value of 14.72, a Mean Squared Error (MSE) value of 390.09, and a Mean Absolute Percentage Error (MAPE) value of 27%. Upon comparing the forecasting methods of SES and DES, it is evident that the DES approach yields the smallest MAPE value of 27%. This indicates that the DES method delivers more accurate forecasts with a lower error rate than the SES method.

This study aligns with the research carried out by [15], who utilized the DES approach to get the lowest MAPE value of 26.22%. Consequently, the DES method is a viable forecasting technique. This study aligns with the research carried out by[6], which found that the Mean Absolute Percentage Error (MAPE) value of the Double Exponential Smoothing (DES) approach is lower than that of the Simple Exponential Smoothing (SES) method. Additionally, DES was identified as the superior forecasting method.

4. CONCLUSION

The forecasted number of new STABN Sriwijaya students for 2024, based on the results obtained from the discussion using the SES approach, is 67 at a significance level of 0.1 and 95 at a significance level of 0.9. The DES technique predicts that there will be 80 new students in 2024 when using an alpha value of 0.1 and 76 new students when using an alpha value of 0.9. The optimal alpha value for Single Exponential Smoothing (SES) forecasting is 0.9, resulting in a Mean Absolute Deviation (MAD) of 15.27, Mean Squared Error (MSE) of 336.18, and Mean Absolute Percentage Error (MAPE) of 29%. The optimal alpha value for forecasting using Double Exponential Smoothing (DES) is 0.9, resulting in a Mean Absolute Deviation (MAD) of 14.72, Mean Squared Error (MSE) of 390.09, and Mean Absolute Percentage Error (MAPE) of 27%. Comparing the forecasting methods of SES and DES, it is evident that the DES approach yields the lowest MAPE value of 27%. This indicates that the DES method delivers more accurate forecasts with a lower error rate than the SES method.

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