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APPLICATION OF THE MONTE CARLO METHOD IN PREDICTING THE NUMBER OF BUDGET PROPOSALS ACCEPTED IN NORTH SUMATRA PROVINCIAL HEALTH OFFICE

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ABSTRACT

A budget is a planning tool regarding future expenditure and revenues, generally prepared for one year. The prediction simulation for approved budget proposals is an estimate of the calculation of the approval rate for approved proposals in the following year. This research uses the Monte Carlo method in solving problems. This method can be used in problems with nonlinear boundary conditions, namely prediction limits.the author uses a quantitative descriptive method, which is a form of research that focuses on the facts and characteristics of the research object by combining related variables. This research uses the Monte Carlo method uses random numbers and probability statistics to solve problems. The data used to predict the approved proposal budget is the budget proposal data that is approved each year. The following is one of the approved proposal data, namely the approved budget proposal data from 2021, 2022 and 2023 budget proposals received using the Monte Carlo Method which has been implemented at the North Sumatra Provincial Health Service with the simulation namely with an average percentage in 2022 of 84% and in 2023 by 76%. So, with the successful application of the Monte Carlo Method to predict the number of budget proposals received at the North Sumatra Provincial Health Service for 2024 it will provide convenience for the North Sumatra Provincial Health Service to find out what the predicted number of budgets.

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1. INTRODUCTION

As we know that it is difficult to produce skilled and qualified workers, many universities are trying to improve the quality of human resources by improving the quality of education and providing supporting facilities to produce reliable graduates. Therefore, the Faculty of Science and Technology, North Sumatra State Islamic University, Medan, requires its students to carry out Practical Work, so that students can apply the knowledge they have gained in lectures to a real work environment [1]. Apart from fulfilling academic obligations, it is hoped that this activity can become a link between the industrial world and the world of

education and can increase knowledge about the industrial world so that students will be able to overcome competition in the world of work[2].

While carrying out practical work at the North Sumatra Provincial Health Service, I, as a practitioner, became aware of the problems that occurred, namely obstacles in collecting data on the number of budget proposals received by the North Sumatra Provincial Health Service which were submitted each year [2]. A budget is a planning tool regarding future expenditure and revenues, generally prepared for one year [3].

The prediction simulation for approved budget proposals is an estimate of the calculation of the approval rate for approved proposals in the following year. This research uses the Monte Carlo method in solving problems. This method can be used in problems with nonlinear boundary conditions, namely prediction limits [4].

Therefore, to gain experience and observation between theory and practice, students are required to undergo practical field work in government agencies or private companies as one of the requirements that must be met before completing their studies [5]. At the end of the Work Practice activities, students are also required to prepare a report [6]. The author's practical work report is entitled "Application of the Monte Carlo Method in Predicting the Number of Budget Proposals Accepted in North Sumatra Provincial Health Office"

2. RESEARCH METHODE

To overcome this problem, the author uses a quantitative descriptive method, which is a form of research that focuses on the facts and characteristics of the research object by combining related variables. Quantitative research often focuses on the use of numerical data, such as collecting, interpreting, and presenting research findings [7]. Meanwhile, descriptive research is used to explain or describe existing phenomena, including natural and artificial phenomena (Sugiyono, 2018). This research uses the Monte Carlo method, which is a method with a class of algorithms that calculates problem solutions using random samples. This Monte Carlo method uses random numbers and probability statistics to solve problems [8]. Random number generation simulation using the Monte Carlo method is an important step that must be carried out, where the resulting random numbers can be generated using computer software or manually. The agency's address is Jl. Prof. H.M Yamin No.41AA, Perintis, Kec. Medan Tim., Medan City, North Sumatra 20232.

3. RESULT AND ANALYSIS

The data used to predict the approved proposal budget is the budget proposal data that is approved each year. The following is one of the approved proposal data, namely the approved budget proposal data from 2021, 2022 and 2023 in the following table:

Table 1. Data on Approved Budget Proposals for 2021, 2022 and 2023

Code	Symbol	Frequency of Cost Budget Proposals Accepted Annually		
		2021	2022	2023
A-1	A	6	9	7
B-1	B	11	13	16
C-1	C	15	13	17
D-1	D	8	11	14
E-1	E	10	8	14
Total		50	54	68

The following is how to calculate probability distribution values using data for 2021, 2022 and 2023:

Calculation in 2021:

1st Probability Distribution= $\frac{6}{50} = 0{,}12$

2nd Probability Distribution= $\frac{11}{50} = 0{,}22$

3rd Probability Distribution= $\frac{15}{50} = 0{,}30$

4th Probability Distribution= $\frac{8}{50} = 0{,}16$

5th Probability Distribution= $\frac{10}{50} = 0{,}20$
Total Probability Distribution = 0,12 + 0,22 + 0,30 + 0,16 + 0,20 = 1

Calculation in 2022:
1st Probability Distribution= $\frac{9}{54} = 0{,}17$
2nd Probability Distribution= $\frac{13}{54} = 0{,}24$
3rd Probability Distribution= $\frac{13}{54} = 0{,}24$
4th Probability Distribution= $\frac{11}{54} = 0{,}20$
5th Probability Distribution= $\frac{8}{54} = 0{,}15$
Total Probability Distribution = 0,17 + 0,24 + 0,24 + 0,20 + 0,15 = 1

Calculation in 2023:
1st Probability Distribution= $\frac{7}{68} = 0{,}10$
2nd Probability Distribution= $\frac{16}{68} = 0{,}23$
3rd Probability Distribution= $\frac{17}{68} = 0{,}25$
4th Probability Distribution= $\frac{14}{68} = 0{,}21$
5th Probability Distribution= $\frac{14}{68} = 0{,}21$

Total Probability Distribution= 0,10 + 0,23 + 0,25 + 0,21 + 0,21 = 1

After obtaining the probability distribution, the cumulative probability distribution is then calculated based on data from the probability distribution.

$$D_i + P_i \quad (1)$$

Where:
D_i = Possible Number;
P_i = Sum of Previous Numbers

Table 2. Probability Distribution and Cumulative Distribution in 2021

Symbol	Frequency	Probability Distribution	Cumulative Distribution	Boundary Indicator
A	6	0,12	0,12	0 – 12
B	11	0,22	0,34	13 – 34
C	15	0,30	0,64	35 – 64
D	8	0,16	0,80	65 – 80
E	10	0,20	1,00	81 - 100
Total	50	1		

Table 3. Probability Distribution and Cumulative Distribution in 2022

Symbol	Frequency	Probability Distribution	Cumulative Distribution	Boundary Indicator
A	9	0,17	0,17	0 – 17
B	13	0,24	0,41	18 – 41
C	13	0,24	0,65	41 – 65
D	11	0,20	0,85	66 – 85
E	8	0,15	1,00	86 – 100
Total	54	1		

Table 4 Probability Distribution and Cumulative Distribution in 2023

Symbo	Frequency	Probability Distribution	Cumulative Distribution	Boundary Indicator
A	7	0,10	0,10	0 – 10
B	16	0,23	0,33	11 – 33
C	17	0,25	0,58	34 – 58
D	14	0,21	0,79	59 – 79
E	14	0,21	1,00	80 – 100
Total	68	1		

In this calculation the interval will be generated using the Mixed Congruent Method:

$$Z_i + 1 = (a. Z_i + C) \bmod m \quad (2)$$

Where:

Z_i = Initial number (integer ≥ 0, Z0 < m);
a = Multiplier Constant (a < m);
C = Shift Constant (c < m);
mod = Modulus Constant (m > 0)
m = Limit of random number values

Generating intervals with the Mixed Congruent Method requires 4 parameters whose values must be set first and then filled in with the values a = 22, c = 4, Z0 = 5, m = 99. The results obtained in generating intervals at Symbol A = 15, Symbo B = 37, Symbo C = 26, Symbo D = 81 and Symbo E = 4.

The simulation is carried out by comparing and entering the random numbers that have been generated with the random number interval table to produce data for 2022 and 2023.

Then, to predict data for 2024, it is compared with random number intervals. The following are the results of simulations and comparisons of data for 2022 and 2023 as well as predictions of the number of budget proposals received at the North Sumatra Health Service for 2024 that are likely to occur.

Table 5 Simulation Results 2022

Symbol	Random Numbers	Forecasting Data for 2022	Original Data for 2022	Percentage
A	15	11	9	82%
B	37	15	13	87%
C	26	11	13	85%
D	81	10	11	91%
E	4	6	8	75%
		Average		84%

Table 6 Simulation Results 2023

Symbol	Random Numbers	Forecasting Data for 2023	Original Data for 2023	Percentage
A	15	9	7	78%
B	37	13	16	81%
C	26	13	17	76%
D	81	11	14	79%
E	4	9	14	64%
		Average		76%

Table 7 Simulation Results 2024

Symbol	Random Numbers	Forecasting Data for 2024
A	15	16

Symbol	Random Numbers	Forecasting Data for 2024
B	37	17
C	26	16
D	81	14

4. CONCLUSION

From the results of the discussion, it can be seen the level of prediction of the number of budget proposals received using the Monte Carlo Method which has been implemented at the North Sumatra Provincial Health Service with the simulation results in Table 5 and Table 6, namely with an average percentage in 2022 of 84% and in 2023 by 76%. So with the successful application of the Monte Carlo Method to predict the number of budget proposals received at the North Sumatra Provincial Health Service for 2024 which is presented in Table 7, it will provide convenience for the North Sumatra Provincial Health Service to find out what the predicted number of budget proposals will be. received the following year at the North Sumatra Provincial Health Service.

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