

## Simulation Technique in Determining Student Attendance Using The Monte Carlo Method

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### Abstrak

*Dalam perkuliahan, kehadiran merupakan salah satu point penilaian yang berperan penting dalam menentukan kelulusan seorang mahasiswa. Ketika seorang mahasiswa berada di semester atas tingkat kehadiran mereka dalam perkuliahan mulai berkurang. Simulasi prediksi kehadiran merupakan sebuah estimasi tentang perhitungan tingkat kehadiran mahasiswa dalam perkuliahan. Jenis penelitian ini adalah penelitian kuantitatif dengan menggunakan teknik pengumpulan data dengan cara observasi dan studi dokumentasi. Dalam proses analisa, data yang diamati adalah data absensi mahasiswa prodi keknik komputer semester 5 dan sampelnya sebanyak 83 orang sebagai subjek penelitian. Adapun tahapan simulasi monte carlo yang digunakan: Menentukan Frekuensi variabel; Menghitung kumulatif probabilitas; Menentukan interval random number; Membuat simulasi untuk menentukan kehadiran mahasiswa; Membuat bilangan acak; Membuat simulasi dari rangkaian percobaan. Simulasi dilakukan dengan membandingkan dan memasukkan angka acak yang telah dibangkitkan kedalam simulasi perbandingan data kehadiran dan ketidak hadiran mahasiswa prodi teknik komputer semester 5 pada Kampus STMIK Agama Wamena Papua, mulai dari tanggal 3 Oktober sampai dengan 31 Oktober tahun 2022. Berdasarkan rangkaian percobaan data yang telah disimulasikan didapatkan hasil simulasi prediksi kehadiran dan ketidak hadiran mahasiswa prodi teknik komputer pada kampus STMIK Agama Wamena mulai dari tanggal 7 November sampai dengan tanggal 19 Desember tahun 2022 dengan jumlah kehadiran rata-rata diatas 50 %.*

**Kata kunci**— Kehadiran,, Simulasi, Monte carlo, Prediksi

### Abstract

*In lectures, attendance is one of the assessment points that play an important role in determining a student's graduation. When a student is in the upper semester their attendance rate at lectures starts to decrease. The attendance prediction simulation is an estimate of the calculation of student attendance in lectures. This type of research is quantitative research using data collection techniques using observation and documentation study. In the process of analysis, the observed data were attendance data of 5th-semester computer engineering study program students and a sample of 83 people as research subjects. The stages of the monte carlo simulation are used: Determining variable frequency; Calculating cumulative probabilities; Determining random number intervals; Creating a simulation to determine student attendance; Generating random numbers; Make a simulation of the experimental circuit. The simulation is carried out by comparing and entering random numbers that have been generated into a comparison simulation of attendance and absence data for 5th-semester computer engineering study program students at the STMIK Agama Wamena Papua Campus, starting from October 3 to October 31, 2022. Based on a series of experimental data that has The simulation results*

*obtained predicted attendance and absence of computer engineering study program students at the STMIK Agamua Wamena campus from November 7 to December 19, 2022 with an average attendance of above 50%.*

**Keywords**— *Attendance, Simulation, Monte carlo, Prediction*

## 1. INTRODUCTION

The rapid development of technology and communication now provides many benefits that can facilitate human work, one of which is in the field of prediction [1]. Information technology is also used to process data, including processing, obtaining, compiling, storing, and manipulating data in various ways to produce relevant, accurate, and timely information so that technology is needed in all sectors of human life at this time [2]. Technological developments force all field types to be well computerized, inseparable from processing and calculating data where the results obtained from the process are not only limited to manual searches but must have instant searches that are computerized based [3]. With the development of technology at this time, it is almost certain that all work can be optimized with the help of technology, one of which is to predict a nominal or useful amount for the future [4].

Prediction or forecasting is defined as the forecasting process of a variable (event) in the future based on previous variable data [5]. Prediction is a way to compare data in the past and serve as a guide in the future based on existing knowledge or data in the form of quantitative data, predictions are used to find answers as close as possible because when predicting answers are not always certain [6]. Many things can be predicted to become the basis for making a decision or policy, one of which is raised in this study is a simulation of determining student attendance in lectures using the Monte Carlo method.

College of Informatics Management and Computer Engineering STMIK Agamua Wamena Papua is a private university and the only university in the city of Wamena, Jayawijaya Regency, Papua Mountains Province, which teaches computer science. When the registration process for new students was opened, the researchers noticed that the number of applicants in the computer engineering department was very large when compared to the information systems department each year, this indicated that the computer engineering department was more in demand by prospective new students at the Agamua Wamena STMIK Campus, Papua. In line with that, when they were accepted as computer engineering study program students in semester 1, there were still many students, even up to 4 classes with an average number of students per class of 30 to 40 students. In the lecture process, the STMIK Agamua Wamena Papua Campus conducts lectures from Monday to Saturday so that students can attend lectures well and demand STMIK Agamua Wamena Papua students to successfully complete their studies well and have abilities in their respective fields, especially information technology. When the lecture process took place in the first semester, students were very enthusiastic about attending the lectures because it was an honor to be accepted at a computer science college. Besides that, in the early semester, all courses were still relatively easy because the courses in semester one were transitional subjects from the past. high school equivalent. As time goes by due to the lack of previous student knowledge about the lecture system and the lecture load in the computer engineering study program, when entering the next semester students slowly begin to decrease due to various factors. One of the factors that influence student success and campus progress is the presence of lectures [7]. Based on the data obtained, the attendance of students in each particular department is in the lecture process and is unstable when attending lectures, even the number of attendance is apprehensive or decreasing in each semester [8].

Student attendance predictor simulation is an estimation of the calculation of student attendance in a lecture, then it can provide benefits in making decisions from information obtained based on previous events [9]. In the lecture process, students must attend because attendance is one of the determinants of graduation in the assessment system. By being present

in lectures students not only gain knowledge but students also build relationships between fellow students and student relations with lecturers. In an uncertain situation like this, the researcher wants to do modeling and simulation to be able to find out the attendance rate of students in the 5th semester of the computer engineering study program at STMIK Agamua Wamena Papua Campus every week using the monte carlo method.

Modeling and simulation are a tools for conducting trials that have the goal of getting a good alternative as support for deciding to solve a particular problem, the data used is past data [10]. Modeling is a process of describing a real system that is the focus of attention and is addressed through the relationships between existing real system elements [11]. Monte Carlo modeling and simulation are used to assist lecturers in knowing the level of student attendance in lectures every week. The thing that is aimed at research is the best choice or option for overcoming this problem by using observational data [12].

Monte Carlo simulation is a probabilistic simulation that provides a solution to a given problem based on a randomization process [13]. The probability used to estimate is by generating random numbers [14]. Monte Carlo simulation is defined as a statistical sampling technique used to estimate solutions to quantitative problems [15]. A simulation model is a model in a computer system that can describe the possibility of occurring in a real system [16]. This Monte Carlo simulation model has stochastic properties, which means that this Monte Carlo simulation model is built based on the use of random numbers to identify a problem [17]. Random numbers are used to describe the random events at all times of random variables and sequentially follow the changes that occur in the simulation process [18]. Simulation is a technique that mimics operations or processes that occur in a system with the help of a computer device and is based on certain assumptions so that the system can be studied scientifically [19]. Simulation is a numerical technique to do an experiment in computer involving a certain mathematical and logical model displaying business characteristic and economic system in a long time period [20]. Simulation is a method used to apply models and behaviors in software to be executed, usually simulation models capture the state of the system at one time through a set of predefined variable values [21]. Simulation has an understanding as a method for carrying out experiments with models of proper systems. Simulating means duplicating the features, shapes, and characteristics of the proper system. The basic idea of simulation is to use multiple devices to imitate proper systems to study and interpret the properties, behavior, and operations characteristics [22]. The Monte Carlo method is an algorithm for solving a problem with a random process (randomization) in the form of probability simulation [14]. Monte Carlo simulation is a very practical method that is widely used in solving real engineering problems especially repairable systems [23]. Monte Carlo is chosen because it does not need sophisticated software and does not explicitly contain time variable that makes simulation very expensive to run. It was built by using Microsoft Excel [24]. The benefits of the Monte Carlo simulation are easy to implement and the results are close to true values [25].

Based on the problems above, the researcher wants to conduct research to be achieved is to simulate the level of student attendance in lectures based on weekly attendance and specifically can be one of the guidelines for lecturers in giving grades and determining graduation from 5th-semester computer engineering study program students in STMIK Agamua Wamena Papua Campus in future lectures.

## 2. METHODS

The method used in this study uses a quantitative research method using an analysis technique using the Monte Carlo method, where this method can be used to predict student attendance using random numbers. This data collection technique is done by observation and documentation study. The population in this study were all STMIK Agamua Wamena Papua students, while the sample was 5th-semester Computer Engineering Study Program students. The data used was student attendance data for the 5th semester of the Computer Engineering

study program in October 2022. The time and place of this research was conducted from the 1st until November 30 2022 and is located at the STMIK Agamua Wamena Papua Campus. The following are the stages of the Monte Carlo Simulation, namely: 1. Determining variable frequency; 2. Calculating the cumulative probability; 3. Determine random number intervals; 4. Create a simulation to determine attendance; 5. Generate random numbers; 6. Make a simulation of the experimental circuit.

### 3. RESULTS AND DISCUSSION

#### 3.1 Preparation of Data

In this study, the population used was a limited population with a total of 501 computer engineering study program students. Determination of the sample using the Slovin method with the following formula:.

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Information:

n = Minimum number of samples

N = Total population

e = Percentage of inaccuracy allowance

$$n = \frac{501}{1 + 501(0,1)^2} = 83 \quad (2)$$

The sample used in this study were 83 students of the Computer Engineering Study Program semester 5 class A and B. The data used were attendance and absence data of students of Computer Engineering Study Program semester 5 classes A and B, starting from 01 August to 31 October 2022, shown in Table 1.

Table 1 Attendance Data for Computer Engineering Study Program Semester 5

Study Program	Month	Week/Date	Number Of Students	Not Present	Present
Computer Techniques	August	01/08/2022	83	1	82
		08/08/2022	83	1	82
		15/08/2022	83	3	80
		22/08/2022	83	4	79
		29/08/2022	83	3	80
	September	05/09/2022	83	0	83
		12/09/2022	83	6	77
		19/09/2022	83	2	81
		26/09/2022	83	4	79
	October	03/10/2022	83	4	79
		10/10/2022	83	5	78
		17/10/2022	83	4	79
		24/10/2022	83	2	81
		31/10/2022	83	2	81

### 3.2 Stages of monte carlo calculations:

1. Create a probability distribution of variables. The frequency is determined by the number of attendance and absent days of students each week, shown in Table 2 and Table 3.

Table 2 Frequency of Attendance of Semester 5 Computer Engineering Study Program Students

Number Of Attendance	Present Frequency
79	4
80	2
81	3
82	2
83	1
Total	12

Table 3 Frequency of Absence of 5th Semester Computer Engineering Study Program Students

Number Of Absences	Absent Frequency
0	1
1	2
2	3
3	2
4	4
Total	12

2. Determine Probability based on a predetermined frequency. To determine the probability distribution can be obtained with the formula below and shown in Table 4 and Table 5.

$$\text{Probability of being present} = \frac{\text{Number Of Present Frequency}}{\text{Total Data}}$$

$$\text{Probability not present} = \frac{\text{Number Of Frequency Not Present}}{\text{Total Data}}$$

Table 4 Probability of Attendance of Semester 5 Computer Engineering Study Program Students

Number Of Attendance	Present Frequency	Probability
79	4	0,33
80	2	0,17
81	3	0,25
82	2	0,17
83	1	0,08
Total	12	-

Table 5 Probability of Absence of Computer Engineering Study Program Semester 5

Number Of Absences	Frequency Not Present	Probability
0	1	0,08
1	2	0,17
2	3	0,25
3	2	0,17
4	4	0,33
Total	12	-

3. Calculates cumulative probabilities. The conversion from an ordinary probability distribution to a cumulative distribution is by adding up each possible number with the previous number, shown in Table 6 and Table 7.

Table 6 Cumulative Probability of Attendance of Semester 5 Computer Engineering Study Program Students

Number Of Attendance	Present Frequency	Probability	Cumulative Probability
79	4	0,33	0,33
80	2	0,17	0,5
81	3	0,25	0,75
82	2	0,17	0,92
83	1	0,08	1
Total	12	-	-

Table 7 Cumulative Probability of Computer Engineering Study Program Students Absent

Number Of Absences	Frequency Not Present	Probability	Cumulative Probability
0	1	0,08	0,08
1	2	0,17	0,25
2	3	0,25	0,5
3	2	0,17	0,67
4	4	0,33	1
Total	12	-	-

4. Determine Random Number Intervals. The random number interval is determined based on the cumulative probability result. The random numbers used are 2-digit random numbers because the probability values are present and absent, the cumulative probability has 2 after the decimal point, shown in Table 8 and Table 9.

Table 8 Interval Random Number Attendance of Semester 5 Computer Engineering Study Program Students

Number Of Attendance	Present Frequency	Probability	Cumulative Probability	Interval Random Number
79	4	0,33	0,33	00-33
80	2	0,17	0,5	34-50
81	3	0,25	0,75	51-75
82	2	0,17	0,92	76-92
83	1	0,08	1	93-100
Total	12	-	-	

Table 9 Interval Random Number Absenteeism of Computer Engineering Study Program Semester 5

Number Of Absences	Absence Frequency	Probability	Cumulative Probability	Interval Random Number
0	1	0,08	0,08	00-08
1	2	0,17	0,25	09-25
2	3	0,25	0,5	26-50
3	2	0,17	0,67	51-67
4	4	0,33	1	68-100
Total	12	-	-	-

5. Generate random numbers. Generate random numbers using the Microsoft Excel application using the randbetween function available in Microsoft Excel, shown in Figure 1.

	A	B	C	D	E	F	G
1							
2	46	80	37	81	88	7	
3	32	68	51	84	75	46	
4	22	88	6	40	85	81	
5	80	98	51	82	1	35	
6	30	17	76	45	25	2	
7	32	60	8	14	84	80	
8	90	86	73	49	8	98	
9							

Figure 1 Random Numbers

6. Make a simulation of the experimental circuit. Make a series of an experiment by taking random numbers from picture 1 above, namely by taking the random numbers in columns A2-A8. The method of determining or predicting attendance by being absent is determined by random numbers, shown in Table 10 and Table 11.

Table 10 The simulation determines the attendance of Semester 5 Computer Engineering Study Program students

<b>Simulation/ Sunday</b>	<b>Random Numbers</b>	<b>Student Attendance Simulation</b>
07/11/2022	46	80
14/11/2022	32	79
21/11/2022	22	79
28/11/2022	80	82
05/12/2022	30	79
12/12/2022	32	79
19/12/2022	90	82

Table 11 The simulation determines the absence of Semester 5 Computer Engineering Study Program students

<b>Simulation/ Sunday</b>	<b>Random Numbers</b>	<b>Student Absence Simulation</b>
07/11/2022	46	2
14/11/2022	32	2
21/11/2022	22	1
28/11/2022	80	4
05/12/2022	30	2
12/12/2022	32	2
19/12/2022	90	4

The simulation is carried out by comparing and entering the generated random numbers contained in Figure 1. with the random number interval table for student attendance which is in Table 8. and the random number interval table that has been generated for the student absence rate which is in Table 9. The followings are the simulation results and comparison of attendance and absence data for computer engineering study program students at the STMIK Agama Wamena Papua Campus starting from October 3 to October 31, 2022. Table 10 shows the simulation results of predicting attendance of computer engineering study program students, while Table 11. is the result of a simulation predicting the absence of computer engineering study program students at the STMIK Agama Wamena Papua Campus starting from November 7 to December 19, 2022. From the predicted results of the monte carlo simulation, the student attendance rate is 260 times, while the absence rate is 15 times. This shows that the monte carlo method is suitable for carrying out simulations to predict the attendance of 5th-semester computer engineering study program students at the STMIK Agama Wamena Papua Campus for the future based on past attendance data..



#### 4. CONCLUSIONS

Based on the results of the discussion of the simulation of predicting attendance and absence rates of computer engineering study program students at the STMIK Agama Wamena Papua campus using absentee data for October, it can be concluded that the Monte Carlo Method can help predict attendance and absence rates of students in lectures starting from November 7 until December 19, 2022, with varying levels of accuracy in scores, as well as being one of the tools and guidelines for lecturers in assigning grades and determining graduation for each student in the future. It is hoped that Monte Carlo Simulation can also be applied in various other activities in academic activities so that it can assist in the lecture process.

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