

# Binomial Distribution As a Measurement of The Success and Failure FMIPA Untrib Students in The 2018-2023 Academic Year

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Abstract. This research aims to determine the estimated probability of failure for the number of FMIPA Untrib Kalabahi student graduates from 2018 to 2023 for each study program. This research uses secondary data obtained directly from the Untrib Student Affairs Academic Administration Bureau for the last six years from 2018 to 2023. The Binomial Distribution is a distribution of discrete random variables with two possibilities, namely success and failure. This research shows that the three study programs at FMIPA Untrib Kalabahi have different opportunity or probability values. For the mathematics study program, it can be seen that the largest predicted failure will be in 2022, namely 0.225585937500 and the smallest predicted failure will be in 2019, namely 0.000000000015. For the chemistry study program, the biggest failure estimate is in 2023, namely 0.37500 and the largest failure estimate is in 2021, namely 0.0000000298023223876953 and the smallest failure estimate is in 2018, namely 0.0000000298023223876953 and the smallest failure estimate is in 2023, namely 0.000000000087.

Keywords: Binomial Distribution; Number of Graduates; Probability

# 1. INTRODUCTION

Higher education as an educational institution, is one of the important educational facilities in the process of transferring values and knowledge that takes place between educators, namely lecturers and students as learners, so that from this process it is hoped that it will be able to produce superior individuals and be able to make significant contributions to the progress of the nation and state (Pratiwi 2017).

Education is a very important human need because education has the task of preparing Human Resources (HR) for the development of the nation and state. The advancement of science and technology (IPTEK) results in changes and growth in a more complex direction. Education is a conscious effort to realize the inheritance of culture from one generation to the next. Education makes this generation a role model for teaching the previous generation. Until now, education has no limits to explain the concept of education completely because of its complex nature such as its target, namely humans. Its complex nature is often referred to as educational science. Educational science is a continuation of educational science. Educational science is more related to educational theory which prioritizes scientific thinking. Education and educational science are interrelated in terms of practice and theory. So, in the process of human life, both collaborate with each other. (Rahman et al, 2022).

Tribuana Kalabahi University (Untrib) is one of the higher education institutions located in Alor Regency, Jln.Soekarno Hatta, Batu Nirwala Kalabahi Alor, East Nusa Tenggara Province (NTT) Indonesia and also a higher education institution Untrib Kalabahi as one of the private campuses bordering the State of East Timor, or the Democratic Republic of East Timor (RDTL).

Untrib Kalabahi was established since August 1, 2007 with 5 (five) Faculties and 11 (eleven) study programs, namely: The Faculty of Mathematics and Natural Sciences (FMIPA) has 3 study programs, namely: Chemistry, Mathematics and Informatics Engineering. The Faculty of Economics has 1 study program, namely: Management. The Faculty of Teacher Training and Education has 3 study programs, namely: Elementary School Teacher Education, Theological Education, English Language Education. The Faculty of Law has 1 study program, namely: Legal Science. The Faculty of Agriculture and Fisheries has 3 study programs, namely: Agribusiness, Fisheries, and Agricultural Product Technology.

Graduates are students who have completed their studies at a university by obtaining an academic degree. The Untrib Kalabahi campus annually releases undergraduate graduates from five faculties, with the number of graduates and the length of study period of students varying. Each year the number of graduates always changes as well as the length of study period of each graduate, the time of student graduation is one of the things that must be considered by universities and study programs as implementing units of higher education. The determination of the time of student graduation has different criteria for each study program available at the university level. One of the faculties at Untrib is FMIPA which is the target of research in graduate data every year. The number of FMIPA Untrib Kalabahi student graduates fluctuates (changes) every year because there are students who complete their studies exactly eight semesters (4 years) and there are also those who complete their studies more than eight semesters. According to the data taken as a preliminary study in 2018-2023, there was a fluctuation where the number of FMIPA student graduates at Untrib Kalabahi in 2018 was 44 people, in 2019 it was 70 people, in 2020 it was 74 people, in 2021 it was 69 people, in 2022 it was 70 people, in 2023 it was 76 people.

Factors that cause varying graduation times for students at FMIPA Untrib Kalabahi are: economic conditions are the position or standing of a person in a group of people which is determined by economic activity and income, so that the economic conditions of parents are one of the factors that influence the level of education of children in this case finances are related to the burden of registration. (Cookson and Stirk 2019); Direction and interest greatly influence a person to achieve something that is a goal, with a strong interest a student will be enthusiastic to pursue his goals, interest is very functional for humans can direct someone to achieve a goal. Direction and interest in this case whether students in choosing a study program according to their interests or just fulfilling other people's expectations or forced, so every choice we determine ourselves we will definitely try until the end but we just fulfill other people's expectations or forced one day we will fail because of discomfort (Yasin Limpo No, 2019); Organization is a place to actualize oneself and achieve common goals as students, student activeness in the organization can be seen through student participation or membership in an organization. Students have the freedom to actively participate in organizations, students who focus on academics will be more active in learning, because they are only busy with academics and have a long time to study, students carry out learning activities in lectures every day, so that the learning process carried out by students will affect academic results (Suryosubroto, 2002).

Success is an achievement or luck, success is not an end goal with mediocre quality and justifies any means to achieve it but rather as a process that must be carried out step by step for the desired goal, failure is the desire to achieve something that is delayed such as wanting to graduate from college on time but with the conditions and circumstances of an individual does not allow it then the desire will automatically be postponed. The binomial distribution is a discrete probability distribution where the number of successes in n trials has two outcomes, yes/no, success/failure, which are independent of each other, where each outcome has a probability P. Success/failure trials are also called Bernoulli trials. When n = 1, it is a Bernoulli distribution. This distribution is often used to model the number of successes/failures in a sample size n of the total number of trials. (Maulana, Jayadi, and Gunawan, 2021).

The Binomial Distribution is a probability distribution that can be used when a sampling process can be assumed to conform to the Bernoulli process. For example, in tossing a coin 5 times, the result of each repetition may appear either the picture side or the number side. Likewise, if cards are drawn in succession, we can label them as "success" if the card drawn is a red card or "failure" if the card drawn is a black card. The repetitions are independent and the probability of success for each repetition remains the same, which is <sup>1</sup>/<sub>2</sub> or equal to 0.5 (Setyaningsih et al. 2021).

The binomial distribution was discovered by a Swiss mathematician named Jacob Bernoulli. Jacob Bernouli (also known as James or Jacques). He was born on December 27, 1654 in Basel, Switzerland he was one of many prominent mathematicians in the Bernoulli family. Probability is a value used to measure the level of occurrence of a random event. The word probability itself is often referred to as chance or possibility. Probability in general is the chance that something will happen. (Jhw and Putra 2022). The probability of a successful event is described on a scale of 0 to 1. A probability value of 0 means that the event will not occur, and a probability degree of 1 means that the event will definitely occur. The probability range is between 0 and 1. If we say that the probability of an event is 0, then the event is impossible to occur. (Yanti, 2016).

Research conducted by A. F. Febriyanto, D. Sartika et al. in September 2021 with the title Binomial Distribution as a measure of success and failure of Home Industry Production @ One Hand Made, the results obtained were based on the producer data obtained, the author can conclude that bag production has a low failure rate. (Desthihan, 2023).

## 2. MATERIAL AND METHODS

## Material

In calculating graduates at FMIPA UNTRIB, binomial distribution is used and assisted by Rstudio software in calculating the probability of failure and success from graduate data from the Faculty of Mathematics and Natural Sciences.

#### Data

	Study program				
Year	Mathematics	Chemistry	Information Technology		
2018	14	5	25		
2019	36	7	27		
2020	16	7	51		
2021	17	14	38		
2022	11	6	53		
2023	13	3	60		
$\sum X$	107	42	254		
$\overline{X}$	18	7	42		

Table 1. Number of FMIPA graduates in 2018-2023

Based on table 1 above, it shows that the average number of graduates in the mathematics study program over six years is 18 people, the chemistry study program has an average number over six years of 7 people, and for the informatics engineering study program, the average number of graduates over six years is 42 people.

#### 3. METHODS

## **History of Binomial Distribution**

The binomial distribution was discovered by a Swiss mathematician named Jacob Bernoulli. Jacob Bernoulli (also known as James or Jacques). He was born on December 27, 1654 in Basel, Switzerland he was one of many prominent mathematicians in the Bernoulli family. He was an early proponent of Calculus and had sided with Leibniz during the Leibniz-Newton Calculus controversy. He is known for his many contributions to calculus and along with his brother Johann, Johan is one of the founders of the calculus of variations. The binomial distribution comes from a binomial trial, which is a Bernoulli process repeated n times and is independent of each other (Bagui & Mehra, 2016; Bagui & Mehra 2017). A binomial distribution is formed by a Bernoulli trial. A Bernoulli trial must meet the following requirements: the possible outcomes are either "success" or "failure", if the probability of success is p, then the probability of failure is q = 1 - p. Suppose we conduct an experiment that produces only two events, such as a success event (S) and a failure event (G) (Setyaningsih et.al, 2021). Then the experiment is repeated n times independently of the n repetitions, event S occurs x times and the remaining (n-x) times event G occurs. We will calculate the probability that the number of successful events in the experiment is x times.

#### **Probability**

The Great Dictionary of the Indonesian Language (KBBI), probability is the possibility or chance of an event or incident occurring. Probability can be measured using numbers or percentages to describe how likely an event or incident is to occur. The probability theory of sample space is represented in a real number called a weight or probability (Adrianingsih et al, 2024; Maulana et al, 2021). The value ranges from zero to one. In probability theory, there are terms such as the probability of an event, the number of possibilities, in the sample space. All of these things will determine the probability value of an event. The probability of an event is a value that describes the possibility of an event occurring, symbolized by P(A). Meanwhile, the number of possibilities is the number of possibilities that can occur in an event, symbolized by n(A). The sample space is the number of samples in an event or the set of all possible outcomes from an experiment. This is symbolized by the letter n(S). The probability formula is as follows:

$$P(A) = \frac{n(A)}{n(S)} \tag{1}$$

Where P(A) is the probability of event A occurring, n(A) is the number of events A and n(S) is the number of samples (Desthihan 2023).

#### **Binomial Probability Function**

Menurut Darsyah dan Ismunarti, 2013 (Loban et. al, 2023) A random variable X is said to have a binomial distribution if and only if its probability is in the form:

$$P(x) = \binom{n}{x} p^{x} (1-p)^{n-x}; \ x = 0, 1, 2, 3, \dots, n$$
<sup>(2)</sup>

A random variable x that has a binomial distribution is also called a binomial random variable. The notation for a random variable x with a binomial distribution is B(x;n,p), meaning that a random variable x has a binomial distribution with a number of experimental repetitions

up to n times, the probability of a success is p and the number of successful events is x. It writes the following properties:

- Experiments occur due to events, such as success and failure.
- The experiment is repeated several times and the number of repetitions is determined.
- The probability of success and failure in each repetition of the experiment is constant.
- Each experimental room is free

### **Understanding Binomial Distribution**

Binomial distribution in various kinds of probability problems only has two possible outcomes or can be simplified into two possibilities. For example, when a coin is thrown, we will get a number or a picture. When a baby is born, then the baby is a boy or a girl. In a basketball game, the team that plays can win or lose (Yanti, 2016). The binomial distribution is one of the probability distributions for discrete random variables. An experiment/trial satisfies the binomial distribution if it is carried out with n returns with x successes. In each experiment there are only two possibilities, namely, success with a probability of p and failure with a probability of q. The Binomial distribution is a probability distribution that can be used when a sampling process can be assumed to conform to a Bernoulli process. (Andriani, 2019). According to the opinions of the experts above, the author can conclude that the binomial distribution is a distribution that can only solve problems that only have 2 (two) outcomes, for example success/failure, satisfied/not satisfied, yes/no.p + q = 1

$$q = 1 - p$$

Based on the equation above, it is known that the probability of success plus the probability of failure will be worth one. If you are looking for the probability of failure, then 1 is subtracted from the probability of success.Dari persamaan 2.2 dapat diturunkan menjadi:

$$P(x) = \binom{n}{x} p^{x} (1-p)^{n-x}; x = 0,1,2,3,\dots,n$$

$$P(x) = (C_{x}^{n}) p^{x} (1-p)^{n-x}$$

$$P(x) = \frac{n!}{(n-x)! x!} p^{x} (1-p)^{n-x}$$

$$P(x) = \frac{n!}{(n-x)! x!} p^{x} q^{n-x}$$
(3)

Description:

P = probability of event

x = number of expected events

n =total number of trials

p = probability of success

# *q* = probability of failure

### 4. RESULTS AND DISCUSSIONS

The following will calculate the estimated failure from the data in table 1 using the binomial method (p=0.5). With the formula:

$$P(x) = \frac{n!}{(n-x)! \, x!} \, p^x \, q^{n-x}$$

The following is a calculation of the estimated failure rate of the number of graduates of FMIPA Untrib Kalabahi students from 2018-2023 for each study program.

# Mathematics study program

**Year 2018** 

$$P(0) = \frac{14!}{(14-0)!0!} (0,5)^{0} (0,5)^{14-0}$$
  

$$= \frac{14!}{14!} (1) (0,0000610352)$$
  

$$= 0,000061035156$$
  

$$P(1) = \frac{14!}{(14-1)!1!} (0,5)^{1} (0,5)^{13}$$
  

$$= \frac{14.13!}{13!1!} (0,5)(0,0001220703)$$
  

$$= 14 (0,000610325)$$
  

$$= 0,000854492187$$
  

$$P(2) = \frac{14!}{(14-2)!2!} (0,5)^{2} (0,5)^{12}$$
  

$$= \frac{14.13.12!}{12!2.1!} (0,25) (0,000244140625)$$
  

$$= (7)(13)(0,00006103515625)$$
  

$$= 0,005554199218$$
  

$$P(3) = \frac{14!}{(14-3)!3!} (0,5)^{3} (0,5)^{11}$$
  

$$= \frac{14.13.12.11!}{11!3.2.1!} (0,125) (0,00048828125)$$
  

$$= (7) (13) (4) (0,00006103515625)$$
  

$$= 0,022216796875$$
  

$$P(4) = \frac{14!}{(14-4)!4!} (0,5)^{4} (0,5)^{10}$$
  

$$= \frac{14.13.12.11.00!}{10!4.3.2.1!} (0,0625) (0,0009765625)$$
  

$$= (7)(13)(11)(0,00006103515625)$$
  

$$= 0,061096191406$$

$$P(5) = \frac{14!}{(14-5)!\,5!} (0,5)^5 (0,5)^9$$
  
=  $\frac{14.13.12.11.10.9!}{9!5.4.3.2.1!} (0,03125) (0,001953125)$   
= (7) (13) (11) (2) (0,00006103515625)  
= 0,122192382813

The complete calculation results from 2018 to 2023 can be presented in table 2. The data calculation from 2019 to 2023 is as follows:

Table 2. Results of Calculation of Data on the Number of Graduates of the Mathematics Study Program With  $P(X = x) = \frac{n!}{(n-x)!x!} p^x q^{n-x}$  Dengan (x = 0, x = 1, x = 2, x = 3, x = 3)

Probab	Tahun					
ilitas	2018	2019	2020	2021	2022	2023
P <sub>0</sub>	0,000061035	0,000000000	0,000015258	0,00007629	0,000488281	0,000122070
	156	015	789	394	250	312
<i>P</i> <sub>1</sub>	0,000854492	0,00000000	0,000244140	0,000129699	0,005371093	0,001586914
	187	524	625	707	750	062
<i>P</i> <sub>2</sub>	0,005554199	0,00000009	0,001831054	0,001037597	0,026855468	0,009521484
	218	168	688	656	750	375
<i>P</i> <sub>3</sub>	0,022216796	0,00000103	0,008544921	0,005187988	0,080566406	0,034912109
	875	901	875	281	250	375
$P_4$	0,061096191	0,00000857	0,027770996	0,018157958	0,161132812	0,087280273
	406	181	094	984	500	437
<i>P</i> <sub>5</sub>	0,122192382	0,000005485	0,066650390	0,047210693	0,225585937	0,157104492
	813	956	625	3593	500	187
1	1	1	1	1	1	

4, x	=	5)
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Based on table 2 above from 2019 to 2023 for P(0) meaning everyone is successful or no one fails then the greatest chance for everyone to succeed/no one fails is in 2022 which is 0.0004882812500 and the smallest chance in 2019 at P(0) which is 0.000000000015. For P(1)meaning one person fails from 2018 to 2023 then the chance that one person fails then the greatest chance is in 2022 which is 0.005371093750 and the smallest chance for one person to fail in 2019 which is 0.00000000524. For P(2) meaning two people failed from 2018 to 2023, then the greatest chance that two people failed was in 2022, namely 0.026855468750 and the smallest chance in 2019, namely 0.00000009168. For P(3) meaning three people failed, then the greatest chance that three people failed was in 2022, namely 0.080566406250 and the smallest chance in 2019, namely 0.000000103901. For P(4) meaning four people failed, then the greatest chance that four people failed was in 2022, namely 0.161132812500 and the smallest chance in 2019, namely 0.000000857181. For P(5) meaning five people who failed, then the largest chance of five people failing is in 2022, which is 0.225585937500 and the smallest chance is in 2019, which is 0.000005485956.

From the results of the binomial distribution calculation with P=0.5 and testing from P(0) to P(5) as in the table of estimated student failures per year, the largest chance of failure is in P(5) while the smallest chance is in P(0).

# Chemistry Study Program Year 2018

 $P(0) = \frac{5!}{(5-0)!0!} (0.5)^0 (0.5)^{5-0}$  $=\frac{5!}{5!}(1)(0,03125)$ = 0,03125 $P(1) = \frac{5!}{(5-1)! \, 1!} \, (0,5)^1 (0,5)^4$  $=\frac{5.4!}{4!1!}$ . (0,5) (0,0625) = (5) (0.03125)= 0.15625 $P(2) = \frac{5!}{(5-2)!2!} 0.5^2 0.5^3$  $=\frac{5.4.3!}{3!2.1!}(0,25)(0,0125)$ = (5) (2) (0,03125)= 0.31250 $P(3) = \frac{5!}{(5-3)! 3!} (0.5)^3 (0.5)^2$  $=\frac{5.4.3.2!}{2!3.2.1!}(0,125)(0,25)$ = (5) (2) (0,03125) = 0,31250 $P(4) = \frac{5!}{(5-4)! \, 4!} \, (0,5)^4 \, (0,5)^1$  $=\frac{5.4.3.2.1!}{1!4.3.2.1!}$  (0,0625) (0,5) = (5) (0,03125) = 0,1562

$$P(5) = \frac{5!}{(5-5)!\,5!} (0,5)^5 (0,5)^0$$
$$= \frac{5.4.3.2.1.0!}{0!.5.4.3.2.1!} (0,0312) (1)$$
$$= 0.03125$$

The complete calculation results from 2018 to 2023 can be presented in table 3. Data calculations from 2019 to 2023 can be seen in table 3 below.

Table 3. Results of Calculation of Data on the Number of Graduates of the Chemistry Study

(n = 0, n = 1, n = 0, n = 1, n = 0)							
Probability	Year						
	2018	2019	2020	2021	2022	2023	
$P_0$	0,03125	0,00781	0,00781	0,00006	0,01563	0,12500	
<i>P</i> <sub>1</sub>	0,15625	0,05469	0,05469	0,00085	0,09375	0,37500	
<i>P</i> <sub>2</sub>	0,31250	0,16407	0,16407	0,00555	0,23438	0,37500	
P <sub>3</sub>	0,31250	0,27344	0,27344	0,02222	0,31250	0,12500	
$P_4$	0,15625	0,273434	0,27344	0,06109	0,23434	-	
<i>P</i> <sub>5</sub>	0,03125	0,16407	0,16407	0,12219	0,09375	-	

Program With 
$$P(X = x) = \frac{n!}{(n-x)!x!} p^x q^{n-x}$$
 With  
 $(x = 0, x = 1, x = 2, x = 2, x = 4, x = 5)$ 

Based on table 3 above from 2019 to 2023 for P(0) meaning everyone is successful or no one fails then the greatest chance for everyone to succeed/no one fails is in 2023 which is 0.12500 and the smallest chance in 2021 which is 0.000061. For P(1) meaning one person fails from 2018 to 2023 then the chance that one person fails then the greatest chance is in 2023 which is 0.37500 and the smallest chance for one person to fail in 2021 which is 0.00085. For P(2) meaning two people fail from 2018 to 2023 then the greatest chance that two people fail is in 2023 which is 0.03750 and the smallest chance in 2021 which is 0.00555. For P(3) meaning three people who failed, then the probability that the three people who failed the most was in 2018, which is 0.31250 and the smallest probability in 2021, which is 0.02222. For P(4) meaning four people who failed, then the probability that the four people who failed the most was in 2019, which is 0.27343 and the smallest probability in 2021, which is 0.000061. For P(5) meaning five people who failed, then the probability that the five people who failed the most was in 2020, which is 0.16406 and the smallest probability in 2018, which is 0.03125.

From the results of the binomial distribution calculation with p = 0.5 and testing from P (0) to P (5) as in the table of estimated student failures per year, in 2018 the greatest opportunity is at P (3) and the smallest opportunity is at P (0), from 2019 to 2020 the greatest opportunity is at P (4) and the smallest opportunity is at P (0), in 2021 the greatest opportunity is at P (5) and the smallest opportunity is at P (0), in 2022 the greatest opportunity is at P (4)

and the smallest opportunity is at P (0), in 2023 the greatest opportunity is at P (1) and the smallest opportunity is at P (0). For the chemistry study program in 2023 the test only goes up to P (3) because the number of graduates for chemistry in 2023 is 3 people.

## **Informatics Engineering Study Program**

Year 2018

$$P(0) = \frac{25!}{(25-0)! 0!} (0,5)^{0} (0,5)^{25-0}$$

$$= \frac{25!}{25!} (1) (0,0000002980)$$

$$= 0,000000298023223876953$$

$$P(1) = \frac{25!}{(25-1)!1!} (0,5)^{1} (0,5)^{24}$$

$$= \frac{25.24!}{24!1!} (25) (0,5) (0,0000005960)$$

$$= (25) (0,0000002980)$$

$$= 0,000007450580596923830$$

$$P(2) = \frac{25!}{(25-2)!2!} (0,5)^{2} (0,5)^{23}$$

$$= \frac{25.24.23!}{23!2.1!} (0,25) (0,0000011920)$$

$$= (25) (12) (0,0000002980)$$

$$= 0,000089406967163085800$$

$$P(3) = \frac{25!}{(25-3)!3!} (0,5)^{3} (0,5)^{22}$$

$$= \frac{25.24.23!}{22!3.2.1!} (0,125) (0,0000002384185)$$

$$= (25)(4)(23) (0,0000002980)$$

$$= 0,0000685453414969910000$$

$$P(4) = \frac{25!}{(25-4)!4!} (0,5)^{4} (0,5)^{21}$$

$$= \frac{25.24.23.22.21!}{21!4.3.2.1!} (0,0625) (0,000004768371)$$

$$= (25) (23) (22) (0,0000002980)$$

$$= 0,000376999378204346000$$

$$P(5) = \frac{25!}{(25-5)!5!} (0,5)^{5} (0,5)^{20}$$

$$= \frac{25.24.23.22.21.20!}{20!5.4.3.2.1!} (0,03125) (0,0000002980)$$

= 0,001583397388458250000

The complete calculation results from 2018 to 2023 can be presented in table 4. The data calculation from 2019 to 2023 can be seen in the following table 4:

Table 4. Results of Calculation of Data on the Number of Graduates of the Informatics

Engineering Study Program With $P(X = x) = \frac{n!}{(n-x)!x!} p^x q^{n-x}$ Dengan $(x = 0, x = 1, x = 1)$	=
2, x = 3, x = 4, x = 5	

proba	Tahun					
bilita s	2018	2019	2020	2021	2022	2023
$P_0$	0,00000029	0,00000007	0,00000000	0,00000000	0,00000000	0,00000000
	80232238769	45058059623	00000044408	00363797880	00000011102	00000000000
	53	82	92	70	23	87
<i>P</i> <sub>1</sub>	0,00000745	0,00000201	0,00000000	0,00000000	0,00000000	0,00000000
	05805969238	16567611694	00002264854	13824431946	00000588418	0000000052
	30	40	97	69	20	04
<i>P</i> <sub>2</sub>	0,000008940	0,000002615	0,00000000	0,00000002	0,00000000	0,00000000
	69671630858	15378952020	00056621374	55749910138	00015298873	00000153523
	00	00	26	55	27	03
<i>P</i> <sub>3</sub>	0,000068545	0,000021792	0,00000000	0,00000030	0,00000000	0,00000000
	34149699100	94824600220	00924815779	68998921662	00260080846	00002968111
	00	00	51	69	23	68
<i>P</i> <sub>4</sub>	0,000376999	0,000130757	0,00000000	0,00000268	0,00000000	0,00000000
	37820434600	68947601300	11097789354	53740564547	03251010571	00042295594
	00	00	15	500	86	11
<i>P</i> <sub>5</sub>	0,001583397	0,000601485	0,00000001	0,000001826	0,00000000	0,00000000
	38845825000	37158966200	04319219929	05435838922	31859903604	00473710654
	00	00	04	00	21	03

Based on table 4 above from 2018 to 2023 for P(0) meaning everyone is successful or no one fails then the greatest chance for all people to succeed is in 2018 which is 0.000000298023223876953 and the smallest chance in 2023 which is 0.000000000000000087. For P(1) meaning one person who failed from 2018 to 2023 then the chance that one person failed the most was in 2018 which is 0.0000007450580596923830 and the smallest chance for one person to fail in 2023 which is 0.00000000000000005204. For P(2) meaning two people who failed from 2018 to 2023, then the greatest chance that the two people who failed were in 2018 is 0.0000089406967163085800 and the smallest chance in 2023 is 0.00000000000015352303. For P(3) meaning three people who failed, then the greatest chance that the three people from 2018 to 2023 who failed were in 2018 is 0.0000685453414969910000 and the smallest chance in 2023 is 0.000000000029681116874. For P(4) it means four people failed from 2018 to 2019, then

the probability that the four people failed the most was in 2018, which is 0.000376999378204346000 and the smallest probability in 2023. which is 0.00000000004229559411. For P(5) it means five people failed from 2018 to 2023, then the people failed the probability that the five most was in 2018. which is 0.001583397388458250000 and probability 2023. the smallest in which is 0.00000000047371065403. From the results of the binomial distribution calculation with P = 0.5 and testing P(0) to P(5) as in the table of estimated failures in the number of student graduates per year for the Informatics Engineering study program, in 2018 to 2023 the greatest chance of failure is at P(5) and the smallest chance of failure is at P(5).

#### 5. DISCUSSION

From the results of the data analysis above, for the mathematics study program, the smallest probability P(0) to P(5) are all in 2019 with 36 graduates, if out of the 36 people all succeed and none fail /P(0) then the probability is 0.000000000015, if out of the 36 people one fails /P(1) then the probability is 0.000000000524, if out of the 36 people two fail or P(2) then the probability is 0.000000009168, if out of the 36 people 3 fail /P(3) then the probability is 0.0000000103901, if out of the 36 people four fail /P(4) then the probability is 0.0000000857181, if out of the 36 people five fail /P(5) then the probability is 0.000005485956. The largest probability value is in 2022, for P(0) it means that out of the 11 people all are successful and none fail, so the probability is 0.005371093750, P(2) means that out of the 11 people two people fail, so the probability is 0.026855468750, P(3) means that out of the 11 people three people fail, so the probability is 0.161132812500, P(5) means that out of the 11 people four people fail, so the probability is 0.225585937500.

The chemistry study program based on the results of data analysis obtained the smallest opportunity in 2021 with the number of graduates 14 people for P (0) to P (5). P (0) means that out of 14 people all are successful, so the opportunity is 0.000061, P (1) means that out of 14 people one person fails, so the opportunity is 0.00085, P (2) means that out of 14 people two people fail, so the opportunity is 0.00555, P (3) means that out of 14 people three people fail, so the opportunity is 0.022216796875, P (4) means that out of 14 people four people fail, so the opportunity is 0.06109, for 2018 there is only in P (5) with a probability value of 0.03125. while in 2023 the greatest opportunity for P(0) to P(5) (i.e. P(0)= 0.125 P(1)= 0.375 P(2)= 0.375, while in 2018 it was in P(3) which was 0.31250 in 2019 P(4) which was 0.27344 in 2020 it was in P(5) which was 0.16406.

For the informatics engineering study program with testing, namely P = 0.5 testing from P(0) to P(5) found that for 2018 to 2023 the minimum value or the smallest opportunity was in 2023, namely 25 people, P(0) means that out of 25 people all are successful, so the opportunity is 0.000000000000000087, P(1) means that out of 25 people one person fails, so the the probability is 0.000000000000015352303, P(3) means out of 25 people three people fail then the probability is 0.00000000000029681116874, P(4) means out of 25 people four people fail then the probability is 0.00000000000229559411, P(5) means out of 25 people five people fail then the probability is 0.000000000047371065403, and the biggest probability in 2018 with the number of graduates is 60 people for P(0) to P(5) namely: P(0) means out of 25 people four people fail then the probability is 0.0 ...04229559411, P(5) means out of 25 people five people fail then the probability is 0.000000000047371065403, and the biggest probability in 2018 with the number of graduates is 60 people for P(0) to P(5) namely: P(0)means out of 25 people four people fail then the probability is 0.0000000000047371065403, and the biggest probability in 2018 with the number of graduates is 60 people for P(0 all 60 people failed, then the probability is 0.000000298023223876953, P(1) means that out of 60 people one person fails, then the probability is 0.0000007450580596923830, P(2) means that out of 60 people two people fail, then the probability is 0.0000089406967163085800, P(3) means that out of 60 people three people fail, then the probability is 0.000068545341499910000, P(4) means that out of 60 people four people fail, then the probability is 0.000376999378204436000, P(5) means that out of 60 people five people fail, then the probability is 0.001583397388458250000, with the note that all are successful or none fail, the largest is in 2023 until 5 people fail and are also in 2023.

## 6. CONCLUSION

The conclusion obtained from this study is:

- For the mathematics study program, the largest estimated failure is in 2022, which is 0.225585937500 and the smallest estimated failure is in 2019, which is 0.000000000015.
- For the chemistry study program, the largest estimated failure is in 2023, which is 0.37500 and the smallest estimated failure is in 2021, which is 0.00006.
- For the informatics engineering study program, the largest estimated failure is in 2018, which is 0.0000000298023223876953 and the smallest estimated failure is in 2023, which is 0.000000000000000087.

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