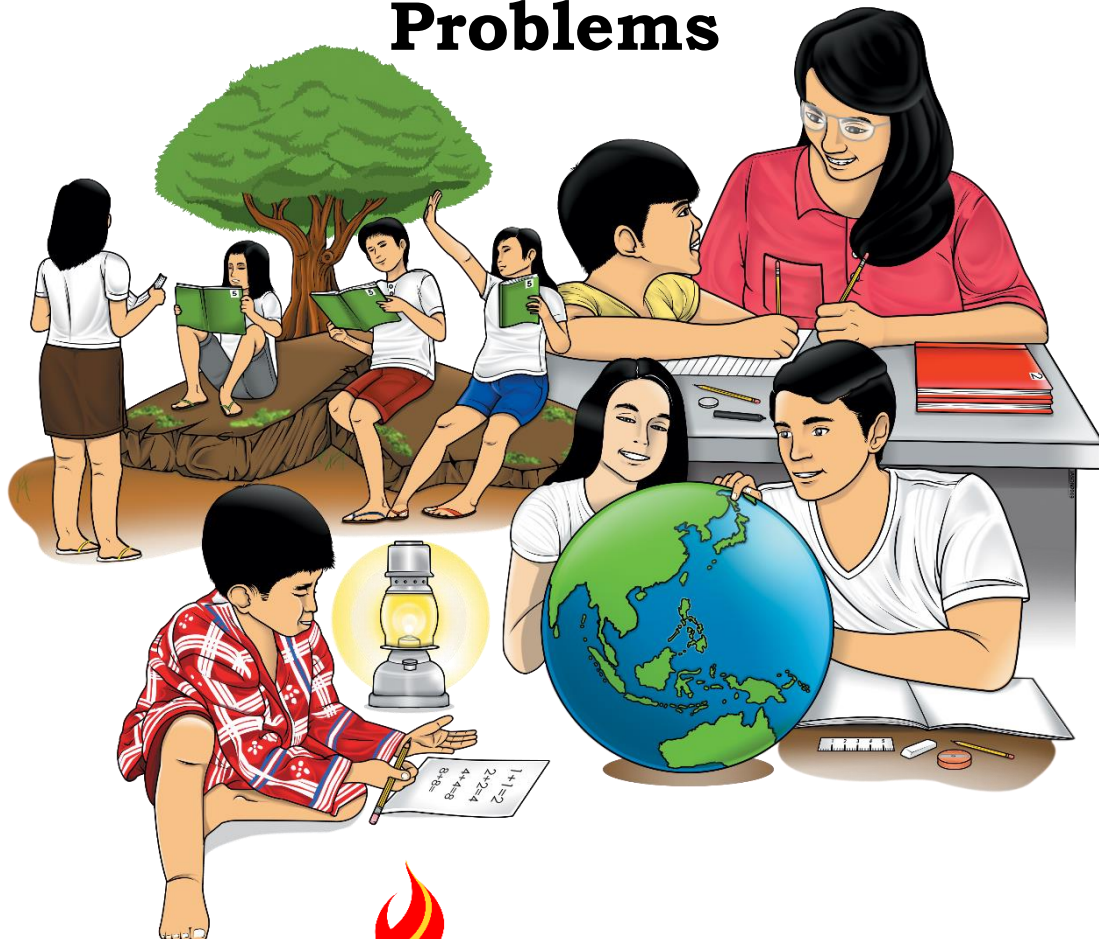


Statistics and Probability

Quarter 4 – Module 2: Identifying Parameters for Testing in Given Real-Life Problems



Statistics and Probability – Grade 11

Alternative Delivery Mode

Quarter 4 – Module 2: Identifying Parameters for Testing in Given Real-Life Problems
First Edition, 2021

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Statistics and Probability

Quarter 4 – Module 2: Identifying Parameters for Testing in Given Real-Life Problems

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



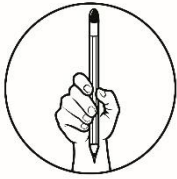
What I Need to Know

In the previous module, you were introduced to what hypothesis testing is and other terms related to it. You were able to determine the null and alternative hypothesis in given statistical hypotheses. You also learned to identify the steps used in hypothesis testing.

With this module, you will learn how to identify the parameter to be tested in a statistical hypothesis. The first step in hypothesis testing, defining the parameter, will be given emphasis in this module.

After going through this module, you are expected to:

1. define the parameters used in statistical analysis; and
2. identify the parameter to be tested in a real-life problem.



What I Know

Choose the best answer to the given questions or statements. Write the letter of your answer on a separate sheet of paper.

1. Which of the following population parameters is used as symbol for the mean or average population?
a. σ b. μ c. ρ d. x
2. Which of the following statements best describes a parameter?
a. It describes the sample. c. It describes the hypothesis.
b. It describes the researcher. d. It describes the population.
3. A researcher estimates that the average height of buildings in a large city is at least 700 feet. Based on the given data, which is the parameter?
a. the researcher c. buildings in the large city
b. at least 700 feet d. the average height of the building
4. The average height of a 1-year-old child is 29 inches. What is the parameter?
a. one-year-old child
a. the mean height of 33 inches
b. the average height of 29 inches
c. a random sample of 30 children who are 1-year old
5. Which is the parameter in the given situation below? "The average age of 10 college students is 24 years."
a. 24 years c. age of the college students
b. 10 college students d. the average age of 24 years
6. A parameter is...
a. a numerical value summarizing the sample data
b. a planned activity with results yielding a set of data
c. a numerical value that summarizes all the data of an entire population
d. the set of values collected from the variable from each of the elements that belongs to the sample
7. Which of the following is a parameter?
a. S_x B. \bar{x} C. \hat{p} D. μ
8. Which of the following symbols represents population standard deviation?
a. p B. σ C. \hat{p} D. μ

9. SWS survey was trying to see if people in the Philippines thought the pollution was too high. Which choice best represents a parameter?
 - a. all people in the Philippines
 - b. 500 randomly selected residents of the Philippines
 - c. 71% of the residents surveyed who thought the pollution was too high
 - d. percentage of all people in the Philippines who thought the pollution was too high
10. A research conducted on a certain company last year showed that 25% of the employees would rather drink coffee than soft drinks during break time. Which choice best represents a parameter?
 - a. 25 employees
 - b. all employees
 - c. the percentage of employee
 - d. coffee rather than soft drinks
11. What is the parameter in the problem that follows?
 A fast food outlet claims that the mean waiting time in line is less than 1.9 minutes. A random sample of 20 customers has a mean of 1.7 minutes with a standard deviation of 0.8 minute. Test the fast food outlet's claim at $\alpha = 0.05$.
 - a. mean of 1.7 minutes
 - b. the level of significance of 0.05
 - c. random sample of 20 costumers
 - d. the mean waiting time of line less than 1.9 minutes
12. A councilor is concerned about the percentage of city residents who express disapproval of her performance. Her political committee pays for a newspaper ad, hoping to keep her disapproval rating below 21%. What is the parameter?
 - a. average of all residents
 - b. disapproval rating below 21%
 - c. political committee paying a newspaper ad
 - d. percentage of city residents who express disapproval
13. A motorcycle manufacturer advertises that its new subcompact models get 47 mpg. If μ is the mileage of these cars, what kind of parameter is used?
 - a. mean
 - b. variance
 - c. proportion
 - d. standard deviation
14. Three percent (3%) of cars of a certain model have needed new engines after being driven between 0 and 80 miles. The manufacturer hopes that redesigning one of the engine's components has solved this problem. What kind of parameter is illustrated in the problem?
 - a. mean
 - b. variance
 - c. proportion
 - d. standard deviation
15. A random sample of 101 bottles of cologne showed an average content of 4 oz. It is known that the population standard deviation of the contents is 0.22 oz. In this problem, translate the parameter into symbols.
 - a. $\mu = 4$
 - b. $\sigma = 101$
 - c. $\mu = 0.22$
 - d. $\sigma = 0.22$

Lesson

1

Identifying Parameters for Testing in Given Real-Life Problems

Inferential statistics makes use of sample data to make an inference and conclusion about a population. The main activities of inferential statistics are using sample data (1) to estimate a population parameter and (2) to test a hypothesis or claim about a population parameter. But before you test a hypothesis, you should understand first what parameter is and how to identify it in each real-life problem.

For instance, you might be interested in the average age of your section where you belong and found the average age was 17. Do you think this is an example of parameter? To be able to answer this question, read and understand this module.



What's In

Activity 1. Choose Wisely!

Choose the best answer and write the letter of your choice on a separate sheet of paper.

1. The _____ in a set of data is the sum of the values divided by the total number of values.
a. mean
b. range
c. variance
d. standard deviation
2. The _____ is the middle value of a data set when it is arranged from smallest to largest.
a. mean
b. median
c. variance
d. standard deviation
3. The _____ is the item of data that appears most frequently in a set of data.
a. mean
b. mode
c. median
d. standard deviation
4. The measurement that shows how data are spread above and below the mean is the _____.
a. mean
b. range
c. variance
d. standard deviation
5. Mean, median, and mode are examples of measures of _____.
a. variation
b. data sets
c. statistics
d. central tendency



Notes to the Teacher

Check the student's level of readiness for the next topic. If the student did not answer most of the item, you may provide another review activity on the concepts related to quantitative statistics.



What's New

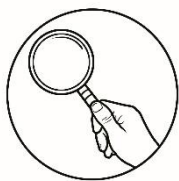
Activity 2: Grouping!

Group the following symbols into two. Place the first group inside Box A and the second group in Box B.

\bar{x}	p	s	s^2	\hat{p}	μ	σ	σ^2
A				B			

Guide Questions:

1. What are the symbols that you placed in Box A? Box B?
2. How did you categorize each symbol or notation?
3. What mathematical principle did you consider in answering the activity?
4. Which symbols seemed to be familiar to you and which are not?



What is It

Parameters in statistics are important component of any statistical analysis. In simple words, a **parameter** is any numerical quantity that characterizes a given population or some of its aspects. This means the parameter tells us something about the whole population.

However, the numerical measure that is calculated from the sample is called **statistic**. Statistic is a known number and a variable that depends on the portion of the population.

A parameter denotes the **true value** that would be obtained if a census rather than a sample was undertaken.

Examples of parameters are the measures of **central tendency**. These tell us how the data behave on an average basis. For example, **mean**, **median**, and **mode** are measures of central tendency that give us an idea about where the data concentrate. Meanwhile, **standard deviation** tells us how the data are spread from the central tendency, i.e. whether the distribution is wide or narrow. Such **parameters** are often very useful in analysis.

In the normal distribution, there are two parameters that can characterize a distribution - **the mean** and **standard deviation**. By varying these two parameters, you can get different kinds of normal distribution.

Different symbols are used to denote parameters. Based on Activity 2, symbols are grouped as indicated in the table below.

Measure	Statistic	Parameter
<i>mean</i>	\bar{x} (x-bar)	μ (myu)
<i>variance</i>	s^2	σ^2 (sigma squared)
<i>standard deviation</i>	s	σ (sigma)
<i>proportion</i>	\hat{p} (p hat)	p



Mean and standard deviation are two common parameters.

Identifying Parameter to be Tested

Illustrative Examples:

1. The average height of adult Filipinos 20 years and older is 163 cm for males.
Parameter: the average height of adult Filipinos 20 years and older
In hypothesis testing, the parameter will be translated into symbols such as $\mu = 163$ where μ is the symbol for mean/average and **163** is the value that pertains to the average height.

2. A Grade 11 researcher reported that the average allowance of Senior High School students is ₱100. A sample of 40 students has mean allowance of ₱120. At $\alpha = 0.01$ test, it was claimed that the students had allowance of ₱100. The standard deviation of the population is ₱50.

Parameters: the average allowance of Senior High School students is ₱100 or $\mu = ₱100$



In this claim, there are different parameters used but the parameter to be tested in this hypothesis would be the average allowance of Senior High School students since it relates to the population, not in sample. Statistical hypothesis is a conjecture about the population parameter that's why you will look for the population mean, population standard deviation, or population proportion but not sample mean.

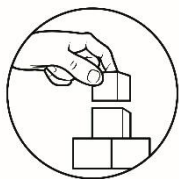
3. According to a survey, 63% of the parents are willing to spend extra money for their children's health and education matters.

Parameter: the percentage/proportion of parents willing to spend extra money in their children's health and education matter or $p = 0.63$



To identify the parameters to be tested:

1. Just look for mean/average, standard deviation, variance, and proportion of **population**.
2. Determine the value that pertains to the given parameter, then translate them in symbols for hypothesis testing.



What's More

Activity 3. Translate It!

Determine the notation of the given parameter, inequality symbol, or value of the parameter.

Parameter	Notation (μ, σ, p, σ^2)	Symbols ($=, \neq, <, >, \leq, \geq$)	Value
1. Average salary of Polytechnic University of the Philippines (PUP) graduates is at most ₱324,000.	_____	\leq	_____
2. The standard deviation of adults riding a bus is 1.5.	_____	$=$	_____
3. Filipino employers offer a mean of 15 days of paid vacation for sick leave.	_____	_____	15
4. Survival rate of breast cancer in the Philippines is below 50%.	_____	_____	.50
5. Mean number of vehicles in households is at most 1.9 personal vehicles.	μ	_____	_____

Activity 4. What Is Your Parameter?

Determine the parameter to be tested in each situation by writing your answer on a separate sheet of paper. Translate it into symbols.

1. The television habits of children were observed and found out that the standard deviation is 12.4 hours per week.
2. A newspaper article stated that students in the country take an average of 4 years to finish their undergraduate degrees. Suppose that you believe the mean time is longer, you conducted survey on 49 students. The result obtained a sample mean of 5 with a sample standard deviation of 1.2.
3. According to DOLE, registered nurses in government earned an average monthly salary of ₱9,700. For that same year, a survey was conducted on 41 registered nurses to determine if the mean salary is higher than the previous survey. The sample average was ₱10,000 with a sample standard deviation of ₱2,500.
4. Records of the Department of Health (DOH) revealed that 14.7% of the country's Filipino smokers have maintained their habit of smoking.



What I Have Learned

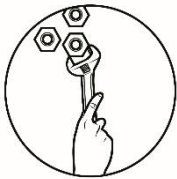
Answer the following questions.

1. What is a parameter?

2. What are the two commonly used parameters? What are their symbols or notations?

3. What are the other notations used as parameters?

4. To identify the parameter to be tested in a claim/hypothesis, what are the concepts to consider?



What I Can Do

List down five (5) different real-life situations where hypothesis testing can be done. Identify the parameter to be tested in each situation.

1. _____
2. _____
3. _____
4. _____
5. _____

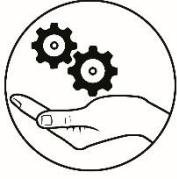


Assessment

Choose the best answer to the given questions or statements. Write the letter of your answer on a separate sheet of paper.

1. The numerical measure that describes the certain characteristics of a population is called _____.
a. sample b. statistics c. parameter d. population
2. What are the two common parameters of normal distribution?
A. μ and σ b. σ and p c. p and μ d. \hat{p} and p
3. Anna wants to estimate the average shower time of teenagers. From the sample of 50 teenagers, she found out that it takes 5 minutes for teenagers to shower. What is the parameter?
a. sample of 50 teenagers
b. 50 teenagers in 5 minutes
c. average shower time of teenagers
d. took 5 minutes for teenagers to shower
4. What kind of parameter is applied in the given situation? "The mean height of all Grade 11 students is 170 cm."
a. Mean C. proportion
b. variance D. standard deviation
5. An education official wants to estimate the proportion of adults aged 18 and above who had read at least one book during the previous year. A random sample of 1,006 adults aged 18 or older is obtained, and 835 of those adults had read at least one book during the previous year. Determine the parameter in the situation.
a. The parameter is the 835 adults.
b. The parameter is the average of adults aged 18 and above.
c. The parameter is the proportion of adults who had read at least one book during the previous year.
d. The parameter is the random sample of 1,006 adults 18 and above who had read a book in the previous year.
6. Which of the following denotes the true value that would be obtained if a census rather than a sample was undertaken?
a. sample b. statistic c. parameter d. population
7. Which of the following is NOT a parameter?
a. σ b. Σ c. μ d. p
8. Which of the following symbols is used for population variance?
a. Σ b. σ^2 c. σ d. μ

9. A study claims that the mean survival time for a certain cancer patient treated immediately with chemotherapy and radiation is 24 months. Which is the parameter?
 - a. 24 months
 - b. study claims on cancer
 - c. mean survival time for a certain cancer patient
 - d. mean survival time of 24 months with chemotherapy and radiation
10. What is the parameter to be tested in this claim? As stated by a company's shipping department, the number of shipping errors per million shipments has a standard deviation of 2.7.
 - a. million shipments
 - b. standard deviation of 2.7
 - c. number of shipping errors
 - d. company shipping department
11. A researcher claims that the mean monthly consumption of coffee per person is more than 19 cups. In a sample of 60 randomly selected people, the mean monthly consumption was 20. The standard deviation of the sample was 4 cups. Which is the parameter to be tested in this claim?
 - a. sample of 60 randomly selected people
 - b. mean consumption of 60 selected people
 - c. the mean consumption of coffee per person
 - d. the standard deviation of the sample which was 4 cups
12. A certified public accountant (CPA) claims that more than 30% of all accountants advertise. What kind of parameter is used in this claim?
 - a. mean
 - b. variance
 - c. proportion
 - d. standard deviation
13. The average baptismal cost includes 50 guests. A random sample of 32 baptismal during the past year in the National Capital Region has a mean of 53 guests and a standard deviation of 10. Which is the parameter?
 - a. the mean of 53 guests
 - b. the standard deviation of 10
 - c. a random sample of 32 baptismal
 - d. the average baptismal cost including 50 guests
14. Powder milk is packed in 1-kilogram bag. An inspector from Department of Trade and Industry (DTI) suspects that bags may not contain 1 kilogram. A sample of 40 bags produces a mean of 0.96 kilograms and standard deviation of 0.12 kilogram. In this problem, 0.96 kilogram is _____.
 - a. variance
 - b. sample mean
 - c. population mean
 - d. standard deviation
15. In symbols, what is the parameter in the given claim below?
In 2018, DepEd reported that the proportion of Grade 10 completers who proceeded to Grade 11 is 93%.
 - a. $p = 0.93$
 - b. $\sigma = 0.93$
 - c. $\mu = 0.93$
 - d. $\bar{x} = 0.93$

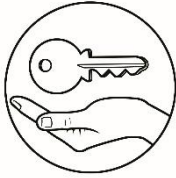


Additional Activities

Activity 5. Parameter Plus!

Directions: Determine the parameter to be tested in the given problems below.

1. An electric lamps manufacturer is testing a new method of producing lamps that will be considered acceptable in a normal population with an average life of 2,600 hours and a standard deviation equal to 350. A sample of 80 lamps produced by this method has an average life of 2,630 hours. Can the hypothesis of validity for the new manufacturing process be accepted with a risk equal to or less than 5%?
2. A car dealer claims that the average price of Honda Vios is at least ₱662,000.00. A client suspected that the claim is incorrect and found out that random sample of 15 similar vehicles has the mean price of ₱640,000.00 and standard deviation of ₱24,000.00. Is there enough evidence to reject the dealer's claim at $\alpha = 0.05$?



Answer Key

<p>What I Have Learned</p> <ol style="list-style-type: none"> 1. A parameter is any numerical quantity that characterizes a given population or some of its aspects. 2. Mean and standard deviation are two common parameters. The symbol for mean is μ while standard deviation is σ. 3. The other notations used as parameters are variance (σ^2) and proportion (p) 4. To identify the parameters to be tested: 1. Just look for mean/average, standard deviation, and variance, and proportion of population. 2. Determine the value that pertains to the given parameter, then translate them in symbols for 	<p>Assessment</p> <ol style="list-style-type: none"> 1. C 2. A 3. C 4. A 5. C 6. C 7. B 8. B 9. D 10. B 	<p>What's New</p> <p>Activity 2</p> <p>A or B and vice versa</p> <p>$\{\bar{x}, s^2, s, p\}$</p> <p>$\{\mu, \sigma^2, \sigma, p\}$</p>	<p>Additional Activities</p> <p>Activity 5</p> <ol style="list-style-type: none"> 1. average life of 2,600 hours (μ) 2. average price of Honda Vios is at least ₱662,000.00 (μ) 	<ol style="list-style-type: none"> 3. D 6. C 7. D 8. B 9. D
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What's More

Activity 3

- $\mu, 324,000$
- $\sigma, 1.5$
- $\mu =$
- $p, <$
- $\leq, 1.9$

Activity 4

- the standard deviation of children's television habits hours per week is 12.4
 $\sigma = 12.4$
- an average of 4 years to finish undergraduate degrees
 $\mu = 4$
- an average monthly salary of registered government nurse is ₱9,700
 $\mu =$
₱9,700
- proportion of 14.7% of the country's Filipino smokers maintain their smoking habits $p = 0.147$

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