

Statistics and Probability

Quarter 4 – Module 15: Illustrating the Nature of Bivariate Data



Statistics and Probability – Grade 11
Alternative Delivery Mode
Quarter 4 – Module 15: Illustrating the Nature of Bivariate Data
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Quarter 4 – Module 15: Illustrating the Nature of Bivariate Data

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.



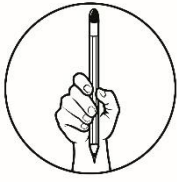
What I Need to Know

Making sound decisions is a very important skill that needs to be developed among individuals. Some people even claim that life is the product of every decision he makes. Thus, the data and variables involved should be carefully examined and studied before making decisions. In this ADM module, you will be introduced to different nature of data that we usually encounter in real life.

After going through this module, you are expected to:

1. describe the nature of bivariate data;
2. differentiate bivariate data from univariate data; and
3. determine the variables involved in the given bivariate data.

Are you ready now to study bivariate data using your ADM module? Good luck and may you find it helpful.



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Data that involve two variables are called_____.
 - a. nivariate data
 - b. bivariate data
 - c. trivariate data
 - d. multivariate data
2. Which of the following is the statistical procedure used to describe the relationship of the variables of bivariate data?
 - a. measures of variation
 - b. correlation analysis
 - c. descriptive statistics
 - d. measures of central tendency
3. Determine the variables involved in the given situation: Cardo surveyed for the daily allowance and the arm span of his 10 classmates, and he found out that there is no correlation between the variables involved.
 - a. height and arm span of students
 - b. weight and height of the student
 - c. daily allowance and height of students
 - d. Daily allowance and arm span of students
4. What do you call those data that involve one variable?
 - a. bivariate
 - b. ultivariate
 - c. trivariate
 - d. univariate
5. “A MAPEH teacher wanted to determine the students’ Body Mass Index (BMI).” What are the variables needed by the teacher?
 - a. weight of the students
 - A. height of the students
 - B. height and weight of the students
 - C. height and allowance of the students
6. “A teacher computed that the mean percentage of score of Grade 8-Integrity on their 50-item test in Mathematics is 72.50.” What type of data is illustrated on the situation?
 - a. Bivariate
 - b. Multivariate
 - c. trivariate
 - d. univariate

7. A pre-service teacher concluded that based on his study, the number of minutes a student spends in browsing Facebook is significantly related to his scores in a set of tests. How many variables are involved in the study?
 - a. one
 - b. two
 - c. three
 - d. four
8. From **question number 7**, what type of data is presented?
 - a. bivariate
 - b. multivariate
 - c. trivariate
 - d. univariate
9. "Chester's average grade from his 9 subjects is 92.38." Which of the following words will make you decide that the data presented is univariate?
 - a. Subjects
 - b. Grade
 - c. average
 - d. 92.38
10. "A nutritionist advised his patient that the more protein he consumes, the more weight he will gain." What are the variables presented on the given statement?
 - a. weight and height
 - b. weight and calorie intake
 - c. protein consumption and weight
 - d. protein consumption and visceral fat gain
11. Which of the following is not used to describe data that fall under univariate category?
 - a. mean
 - b. mode
 - c. correlation analysis
 - d. measure of dispersion
12. A grade 10 student realized from his Araling Panlipunan subject that the price of a certain good is inversely proportional to its supply. What type of data is being presented?
 - a. multivariate
 - b. univariate
 - c. trivariate
 - d. bivariate
13. According to the record of World Health Organization (WHO) on COVID-19 cases around the world, it was found out that those infected persons around 60 years old and above and those who have comorbidities or the presence of more than one disorder have high chances of succumbing to death due to the effect of the said virus. From what type of data did the conclusion come from?
 - a. Bivariate
 - b. Multivariate
 - c. trivariate
 - d. univariate
14. From an experiment conducted by a group of researchers, they found out that students who perform good in Mathematics also perform good in English based on the results of their test scores. What are the variables involved in the study?

- a. tests in Mathematics and English
 - b. insufficient information to determine
 - c. scores in Mathematics and English tests
 - d. questions on the tests in Mathematics and English
15. "Rommel got the following grades on his 9 subjects: six 90s, one 92, and two 89s. Without computing the average, he estimated that his general average would be around 90." Based on the given situation, what is/are the variable/s?
- a. 9 subjects
 - b. grades on his 9 subjects
 - c. average on his 9 subjects
 - d. his general average and his 9 subjects

Lesson 1

Illustrating the Nature of Bivariate Data

A variable is an attribute or characteristic that may take more than one value which can either be measured or classified. The height and weight of students, number of hours students spend in studying at home, and daily allowance of students are examples of variables. From such variables, information are collected and analyzed. If we are given a bivariate data, the degree of association between the two variables can be determined.

In this lesson, we will deal with the nature of variables and data collected.



What's In

Where Am I Now?

Identify the variables involved in the following situations.

Situation	Variable/s Involved
Example: <i>Luffy measured the height of his 10 classmates and determined their average height.</i>	<i>Height</i>
1. Zorro surveyed his cousins' shoe sizes and weight.	

2. Nami conducted a survey to determine the number of household members in their barangay.	
3. Sanji interviewed 10 students about their daily money allowance and weight.	
4. Teacher Kim recorded his students' scores from IQ and math tests.	
5. Karina recorded her daily profit in selling cassava cake.	

From the activity, answer the following questions.

1. Are there situations that involve one variable? two variables?

2. Do you think there are situations that could involve more than two variables?

3. If a situation involves two variables, is it necessary for the variables to be related?



Notes to the Teacher

Check the student's level of readiness for the next topic. If s/he did not answer most of the items and the guide questions correctly, you may provide another review activity on identifying variable/s in a given situation.



What's New

Math Analogy!

Examine the following sets of words or phrase. Look at the first pair and examine how the two concepts relate to each other. Then, select the best word/phrase that would complete the second pair to show the same relationship.

1. one-wheeled bike: unicycle:: **horse with a horn:** _____
a. griffin b. merlion c. Pegasus d. unicorn
2. **two-wheeled bike:** _____:: single-variable data: univariate data
a. bicycle b. jeepney c. motorboat d. tricycle
3. three- wheeled vehicle: tricycle:: **two variables:** _____
a. bivariate b. multivariate c. non-variate d. univariate
4. bivariate: correlation analysis:: **univariate:** _____
a. t-test c. Pearson r
b. z-test d. mean, mode, median
5. height of students: univariate:: **IQ scores and test scores:** _____
a. bivariate c. non-variate
b. multivariate d. univariate

Guide Questions:

1. How is the word “variable” related to the given activity?

2. How are you going to describe bivariate data?

3. Is there a method or way to determine whether a relationship exists between the variables in a bivariate data? How?



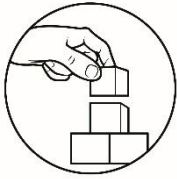
What is It

Data that involve one variable is called **univariate data**. Univariate data are often described using the measures of central tendency (mean or average, mode, and median), variations, or other descriptive statistics. Here are examples of univariate data:

Examples	Variable involved
Department of Health (DOH) recorded the number of infected COVID-19 cases from April 14 to May 21, 2020 in the Philippines.	number of infected cases
World Health Organization (WHO) summarized the number of COVID-19 recoveries around the world.	number of COVID-19 recoveries

Data that involve two variables are called **bivariate data**. The statistical procedure used to determine and describe the relationship between two variables is called **correlation analysis**.

Examples	Variables involved
In Tayabas City public market, a consumer observed that the fewer the supply of vegetables is, the higher the price gets.	supply and price of vegetable
The Quezon provincial government gave emphasis that limiting the number of household members going outside to purchase essential goods will help decrease the rate of COVID -19 infection in the province.	number of household members and rate of COVID-19 infection



What's More

Activity 1.1

Determine the number of variables involved in the following situations.

Situation	Number of Variables Involved
1. Mr. Gonzales will donate face masks to the people in his barangay. He asked a health worker to survey the number of family members living in each house on his barangay.	
2. To properly compensate an employee, the administrative aid records the number of hours their employees are working and their respective take home pay.	
3. A school nurse finds out the number of hours of sleep of 20 students and their weight in kilograms.	
4. A doctor's secretary records the number of minutes a patient spends for a medical check-up.	
5. A nursing student investigates the number of hours of sleep of 20 patients and their red blood cells count.	

Activity 1.2

Identify the variable/s in each situation below.

Situation	Variable/s
1. Jake, a STEM student, was tasked to conduct a survey on the number of hours students spend in playing online games like Mobile Legends.	
2. Reid, an Accountancy and Business Management student, wanted to determine his classmates' average daily allowance and their weight in kilogram.	
3. Mea recorded the height of her 8 classmates.	
4. Robin asked the height of his friends and their mothers.	

5. Jacent interviewed 5 of her students on the number of hours they spend in studying a lesson and their grade in Mathematics 11.	
6. An ABM student surveyed his teachers' monthly salary and their weight.	
7. A Grade 7 student interviewed 10 teachers about their number of years in service.	
8. A student determined his classmates' weight and their mothers' weight.	
9. A school nurse recorded the age and the blood pressure of the teachers.	
10. A HUMMS student surveyed Grade 8 students on the number of hours spent in using Facebook.	

Activity 1.3: Univariate or Bivariate?

Determine whether the following situations involve **univariate** or **bivariate data**.

1. A secretary recorded the daily number of patients a doctor has for a month during the General Community Quarantine.
2. A researcher observed the number of minutes it takes for students to answer a worded problem in Math and the number of hours they spend in studying the subject for a grading period.
3. A researcher records the number of infected COVID-19 patients and the number of days they spent in the hospital before recovering from the disease.
4. A housewife finds out that their average electric consumption during the quarantine period costs P 1,230.00.
5. A group of researchers found out that long hours spent by students in browsing the Facebook application has negative effect on their academic grades.

Activity 1.4:

Determine the variables in the following situations and identify whether they involve univariate or bivariate data.

Situation	Variable/s	Univariate or Bivariate
1. A security guard of a supermarket estimates that on the average, the number of customers entering the supermarket's premises is 85.		
2. A student researcher concluded that the number of hours of sleep is highly related to the blood count of the students.		

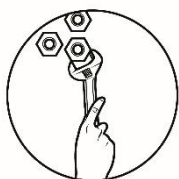
3. A mother asked her daughters to minimize their electric consumption so their monthly electric bill will not be high.		
4. A nutritionist advised her patient that few hours of sleep results to unhealthy weight gain.		
5. A school teacher finds out that on the average, only 30% in each class has internet access in their homes.		



What I Have Learned

Complete the following statements. Write the answers in your notebook.

1. Univariate data consist of only _____ variable.
2. Data that involve two variables are called _____.
3. The statistical treatments used to describe univariate data are measure of variation and measure of _____ tendency.
4. The statistical analysis that can be used in bivariate data is _____.
5. If the data given in an experiment can only be described by the measure of central tendency and variation, then the type of data given is _____.



What I Can Do

Create/cite three (3) examples of situations observable in your community that involve bivariate data. Then, answer the questions below.

1. What are the variables present in your examples?
2. Describe the relationship of the variables involved in your examples.



Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What do you call a set of data that involves 2 variables?
 - a. Univariate
 - b. Bivariate
 - c. trivariate
 - d. multivariate
2. Which of the following situations involve bivariate type of data?
 - a. Joan recorded the daily allowance of her 50 classmates.
 - b. Kassandra recorded the number of minutes 25 gym enthusiasts spend doing their work-out routines.
 - c. Zoe estimated that the average number of students with internet connection in a class of 50 students is 17.
 - d. Cedrick surveys the purchasing power and the number of hours spent for overtime work of 50 employees of a certain company.
3. In a Zumba class, an instructor recorded the number of minutes spent by the 15 participants and the number of calories they burned within the month. What are the variables presented in the situation above?
 - a. number of minutes spent and the burned calories
 - b. number of sessions attended and the burned calories
 - c. burned calories and number of days spent in the session
 - d. number of minutes spent and number of days present during the class
4. A health enthusiast finds out that the volume of water intake of an individual has an inverse effect on the accumulation of fats in his body. Does the situation presented involve bivariate data?
 - a. No, because there are four variables involved.
 - b. Yes, because there are two variables involved.
 - c. No, because there are three variables involved.
 - d. No, because there is only one variable involved.
5. Determine the variables involved in the situation below:

“Asta’s goal for the summer vacation is to have a healthy and fit body. He recorded the number of minutes he spends daily in doing abdominal exercises and his weight for 30 days. He found out that the longer he does abdominal exercise, the more weight he loses.”

 - a. Asta’s weight
 - b. Number of days spent and weight
 - c. Number of minutes doing abdominal exercise and weight
 - d. Number of minutes doing abdominal exercise and weight loss

6. "A teacher computed that the mean percentage of score of his advisory class in their Achievement Test in Mathematics is 81.70." What type of data is illustrated in the situation?

- e. bivariate
- f. multivariate
- c. trivariate
- d. univariate

7. A teacher concluded in his study that the scores obtained by his 50 students in Mathematics and Science examinations are positively related. How many variables are involved in the study?

- a. one
- b. two
- c. three
- d. four

8. Zorro is a hardworking student who supports his study by selling cooking oil. Zorro's average income in selling cooking oil for the past 10 days is Php340. Which of the following will make you decide that the data is univariate?

- a. 10 days
- b. Php340
- c. cooking oil
- d. average income

9. A nutritionist advised his patient that few hours of sleep makes a person heavier according to studies. What are the variables presented?

- a. hours of sleep
- b. weight and calorie intake
- c. hours of sleep and weight
- d. protein consumption and visceral fat gain

10. Which of the following can be used to describe data that fall under univariate category?

- a. scatter plot
- b. scatter diagram
- c. correlation analysis
- d. measure of central tendency

11. A Grade 11 student learned from his Economics subject that when the supply of a product is limited, its price gets higher than the average price. On the other hand, if there is an increase in supply, its price gets lower. What type of data is being presented?

- a. bivariate
- b. multivariate
- c. trivariate
- d. univariate

12. "A teacher found out that 80% to 90% of the students in class decided to enroll for the incoming school year despite the threat of COVID-19 infections in their city." What type of data is presented above?
- bivariate
 - univariate
 - multivariate
 - cannot be determined due to lack of data
13. From an experiment conducted by a group of researchers, they found out that those students who perform well in English may not perform well in Mathematics based on the results of their test scores. What are the variables involved in the study?
- tests in Mathematics and English
 - scores in Mathematics and English tests
 - scores in the test and the test questions
 - test questions in Mathematics and English
14. "Carla got the following grades on her 8 subjects: three 87s, one 90, two 89s, and two 85s. Without computing the average, she estimated that his general average would be around 87." Based on the given situation, what type of data is presented?
- Bivariate
 - Multivariate
 - trivariate
 - univariate
15. "A student asked his 30 classmates their Body Mass Index (BMI) and the number of glasses of water they drink daily. He found out that those students who consume 8-12 glasses of water daily have normal BMI." What type of data is presented on the situation above?
- bivariate
 - multivariate
 - trivariate
 - univariate



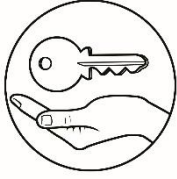
Additional Activities

Complete the statements below.

Data collected from surveys, studies, and the likes can involve one, two, or more variables. These quantitative variables are anything measurable like the height of students, weight, test scores, and many more. If data involves only one variable, it is called ____ (1) ____ data, while if data involve two variables, it is called ____ (2) ____ data.

Data that involves one variable is usually described using the measures of central tendency, namely ____ (3) ____, median, and mode. This type of data can also be described using the measures of dispersion.

Data that involve two variables are usually described through the use of ____ (4) ____ analysis and graphs like scatterplot or scatter diagram.



Answer Key

<p>What I Know</p> <ol style="list-style-type: none"> 1. B 2. B 3. D 4. D 5. C 6. D 7. B 8. A 9. C 10. C 11. C 12. D 13. D 14. C 15. B 	<p>What's In</p> <ol style="list-style-type: none"> 1. shoe sizes and weight 2. number of household members 3. daily money allowance and members 4. IQ and Math test scores 5. daily profit 	<p>What I Know</p> <ol style="list-style-type: none"> 1. B 2. B 3. D 4. D 5. C 6. D 7. B 8. A 9. C 10. C 11. C 12. D 13. D 14. C 15. B
<p>What I Have Learned</p> <ol style="list-style-type: none"> 1. one 2. bivariate 3. central 4. correlation analysis 5. univariate 	<p>Activity 1.2</p> <ol style="list-style-type: none"> 1. number of hours in playing ML 2. average daily allowance and weight 3. height of students 4. height of students and height of their mother 5. number of hours spent in studying and grade in Math 11 6. monthly salary and weight 7. number of years in service 8. students' weight and mothers' weight 9. age and blood pressure 10. number of hours in using Facebook 	<p>What's More</p> <p>Activity 1.1</p> <ol style="list-style-type: none"> 1. one 2. two 3. two 4. one 5. two

Assessment

1. B
2. D
3. A
4. B
5. C
6. D
7. B
8. D
9. C
10.D
11.A
12.B
13.B
14.D
15.A

What I Can Do

The students' answers may vary.

What I Have Learned

1. one
2. bivariate
3. central
4. correlation
5. univariate analysis

Additional Activity

1. univariate
2. bivariate
3. mean
4. correlation

Activity 1.3

1. univariate
2. bivariate
3. bivariate
4. univariate
5. bivariate

Activity 1.4

1. number of consumer-univariate
2. number of hours and blood count – bivariate
3. electric consumption and electric bill – bivariate
4. number of sleep and weight – bivariate
5. number of students – univariate

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