What Is This Module About?

Statistics have many uses. You can use statistics to be able to control pests in your barangay, and to track the incidence of diseases, such as dengue and rabies in a given month or year. You can also use statistics to know the chances of winning in an election. Can you think of other uses of statistics?

To fully appreciate statistics, you are expected to know different statistics concepts. You should know the measures of central tendency—the mean, median and the mode and the measures of variability—the range and the variance. You should also know how to conduct a survey. You will learn more statistics concepts such as probability as you go along this module.

This module is divided into two lessons:

Lesson 1 – *Using the Measures of Central Tendency and Variability*

Lesson 2 – *Using Probability*

What Will You Learn From This Module?

After studying this module, you should be able to:

- use the measures of central tendency and variability on surveys and in everyday life;
- know how and when probability is used; and
- appreciate the use of statistics concept in answering a specific query.

Wait!

Before you go through the module, be sure to read first the following modules: (1) Statistics in Action and (2) Mean, Median, Mode & Range. It would be easier for you to understand this module if you have read the two modules mentioned.

Let's See What You Already Know

Answer first the following questions to determine how much you already know about the topics in this module.

A. Determine the appropriate measure of central tendency for the given data. Find the range first and then the center data. The first one is done for you.

1. Scores of Section A in a Math Examination

86	85	84	88	86
84	86	86	88	86
87	86	84	87	87

Range = 88 – 84 = 4

Measure of central tendency – mean

Central data = 86

Solution:

$$\frac{86+85+84+88+86+84+86+86+88+86+87+86}{15}$$

$$= \frac{1290}{15} = 86$$

2. The Choices of a Sample From Barangay Mapayapa for Barangay Captain in the Coming Elections

Respondent 1: Cruz	Respondent 16: Perez
Respondent 2: Santos	Respondent 17: Cruz
Respondent 3: Perez	Respondent 18: Cruz
Respondent 4: Cruz	Respondent 19: Perez
Respondent 5: Cruz	Respondent 20: Cruz
Respondent 6: Perez	Respondent 21: Cruz
Respondent 7: Santos	Respondent 22: Perez
Respondent 8: Cruz	Respondent 23: Santos
Respondent 9: Santos	Respondent 24: Santos
Respondent 10: Cruz	Respondent 25: Cruz
Respondent 11: Cruz	Respondent 26: Cruz
Respondent 12: Santos	Respondent 27: Perez
Respondent 13: Cruz	Respondent 28: Perez

Respondent 14: Santos
Respondent 15: Perez
Respondent 29: Cruz
Respondent 30:Cruz

Range = _____

Measure of Central Tendency – _____

Central data = _____

Solution:

3. Estimated Number of Locusts That Destroyed Farms in Some Barangays of Pampanga

Barangay 1: 15,000
Barangay 2: 13,000
Barangay 3: 5,000
Barangay 4: 20,000
Barangay 5: 17,000
Barangay 6: 16,000
Barangay 7: 4,000
Barangay 8: 19,000
Barangay 9: 18,000
Barangay 10: 17,000
Barangay 11: 3,000
Barangay 12: 19,000
Barangay 13: 14,000
Barangay 14: 17,000
Barangay 15: 16,000
Barangay 16: 15,000
Barangay 17: 14,000
Barangay 18: 18,000
Barangay 19: 19,000
Barangay 20: 20,000

Range = _____

Measure of Central Tendency – _____

Central Data = _____

Solution:

4. Number of Deaths Due to Dengue in Each Barangay

Barangay 1: 1	Barangay 11: 5
Barangay 2: 6	Barangay 12: 5
Barangay 3: 5	Barangay 13: 4
Barangay 4: 5	Barangay 14: 5
Barangay 5: 5	Barangay 15: 5
Barangay 6: 7	Barangay 16: 4
Barangay 7: 5	Barangay 17: 5
Barangay 8: 5	Barangay 18: 5
Barangay 9: 6	Barangay 19: 5
Barangay 10: 5	Barangay 20: 5

Range = _____

Measure of Central Tendency – _____

Central data = _____

Solution:

5. Average Sacks of Rice Harvested by Mang Isko Yearly

Year 1991: 200	Year 1996: 195
Year 1992: 199	Year 1997: 197
Year 1993: 198	Year 1998: 200
Year 1994: 201	Year 1999: 205
Year 1995: 202	Year 2000: 203

Range = _____

Measure of Central Tendency – _____

Central data = _____

Solution:

B. Solve the following problems:

1. There are 50 people who joined a raffle draw. If Jun was one of them, what is his chance of winning the price?

2. Mang Ambo ran for barangay captain position in the upcoming election. The estimated people who will vote for him is 2,500. If there are 5,000 voters in their barangay, what is Mang Ambo's chance of winning the election?

C. What statistics concept will you use to find the answer? Select among the choices in the box.

1. Kristine wanted to know the reaction of their barangay on the power bill that was recently passed by the Congress. What does she need to do in order to answer her query?

2. Mark made a survey on the average height of 5 year-olds in their barangay. He found out that the range of the heights was 2 inches.

3. Mang Nanding was about to buy a lotto ticket, but he first wanted to know how possible it is that he would win.

Probability	Mean
Median	Mode
Survey	

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on pages 34 and 35 to find out.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. This means that this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page and begin Lesson 1.

LESSON 1

Using the Measures of Central Tendency and Variability

We have already learned when and how to use measures of central tendency and variability in the past modules. In this lesson, we will discuss some of their applications in everyday life.

After reading this lesson, you should be able to:

- know how the mean, median, mode and range are used in pest management;
- apply the mean, median and mode in tracking diseases and health conditions of groups of people; and
- give examples of real-life problem solving using the measures of central tendency and variability.

Let's Learn

Have you ever experienced having pests at home? Do you know how much losses farmers experience because of pests? Pests cause harm not only to us, but also to plantations, property, and other animals. This is why we monitor and try to control their population.

How can we monitor and control pest population? How do we know when the population grows to an alarming number? Professionals who study Integrated Pest Management use different measures such as statistics in order to resolve and prevent problems on pests.

But given the statistics concepts that you learned, the mean, median, mode and range, how can you monitor and control pests?

For example, you were asked to monitor the number of cockroaches inside the houses in your barangay. You were told that the normal number of cockroaches should not exceed 100 in every house.

What is the first thing that you will do? Problems such as this one require a survey. Do you still remember how to perform a survey? Let us solve the problem using the steps in conducting a survey.

STEP 1 Your problem is to know the current number of cockroaches in every house. Since you already have a topic, you just need to select a sample.

STEP 2 Be clear with what you want to know. Be ready with the queries and questions that you want to be answered. Then, gather data.

In this problem, you just have to estimate the number of cockroaches in every house through observation.

STEP 3 The next step is analysis. For example you got the following data:

House 1: 120	House 16: 130
House 2: 90	House 17: 140
House 3: 100	House 18: 150
House 4: 90	House 19: 160
House 5: 80	House 20: 150
House 6: 70	House 21: 130
House 7: 130	House 22: 120
House 8: 150	House 23: 130
House 9: 60	House 24: 120
House 10: 150	House 25: 130
House 11: 120	House 26: 140
House 12: 130	House 27: 150
House 13: 60	House 28: 120
House 14: 100	House 29: 130
House 15: 120	House 30: 160

What is the range of the data?

Range = 160 – 60 = 100

What is the measure of central tendency that you should use to analyze the data?

A range of 100 is high relative to other data, so the measure of central tendency that you should use is the median.

What is the median?

List all data from the lowest to the highest. The middle data is the median. The median is 130.

STEP 4 We can conclude that the center data of the number of cockroaches per house is 130.

STEP 5 The use of statistics makes way for action. Through the survey, we discovered that the number of cockroaches per house exceeded the normal. What do you think should barangay officials do in order to bring down this number?

The center data 130 is very important in determining the pest control method to be used. It also informs barangay officials the urgency of the pest control method.

Can you think of other examples of pest control that use the mean, median, mode and range?

Let's Try This

A. Read the case and answer the following questions:

Mang Andoy was assigned by the barangay captain as the head of the Pest Control Committee. He has been monitoring the population of locusts in farmlands because it feeds on plantations. To control the population of locusts, they maintain a number of frogs that eat locusts. The normal number of locusts is 25 per plot of farmland while the normal number of frogs is 5 per plot of farmland.

1. What does Mang Andoy need to know?

   _____

   _____

2. How will Mang Andoy be able to know the information he needs?

   _____

   _____

3. For example, Mang Andoy gathered the data given below. What measure of central tendency should Mang Andoy use to analyze the data? Why?

   _____

   _____

   _____

   _____

Number of locusts in every plot:	
Plot 1: 45	Plot 16: 45
Plot 2: 55	Plot 17: 45
Plot 3: 45	Plot 18: 55
Plot 4: 45	Plot 19: 55
Plot 5: 55	Plot 20: 50
Plot 6: 55	Plot 21: 55
Plot 7: 50	Plot 22: 55
Plot 8: 50	Plot 23: 50
Plot 9: 45	Plot 24: 45
Plot 10: 55	Plot 25: 45
Plot 11: 50	Plot 26: 55
Plot 12: 55	Plot 27: 45
Plot 13: 45	Plot 28: 50
Plot 14: 50	Plot 29: 55
Plot 15: 50	Plot 30: 45

Number of frogs in every plot:	
Plot 1: 2	Plot 16: 2
Plot 2: 3	Plot 17: 3
Plot 3: 3	Plot 18: 1
Plot 4: 3	Plot 19: 2
Plot 5: 2	Plot 20: 2
Plot 6: 1	Plot 21: 3
Plot 7: 1	Plot 22: 1
Plot 8: 1	Plot 23: 2
Plot 9: 2	Plot 24: 3
Plot 10: 2	Plot 25: 1
Plot 11: 3	Plot 26: 2
Plot 12: 1	Plot 27: 2
Plot 13: 3	Plot 28: 1
Plot 14: 2	Plot 29: 3
Plot 15: 1	Plot 30: 2

4. What is the center data for the number of locusts? Show your solution.

5. What is the center data for the number of frogs? Show your solution.

6. What can you conclude based on the statistical analysis of the data?

_____

_____

7. Should the barangay be alarmed by the result of the survey? Why?

_____

_____

8. Give recommendations of pest control method to the barangay.

_____

_____

Have you finished answering? Compare your answers to the answers below.

1. Mang Andoy needs to know the number of locusts and frogs per plot of farmland.
2. Mang Andoy will be able to know the information he needs by performing a survey.
3. He should use the mean for both sets of data. The range of the number of locusts in each plot is 10 while the range of the number of frogs is 2, which are relatively low compared to other data.
4. Mean number of locusts per plot $= \dfrac{45+55+45+45+55+55+50+50+45+55+50+55+45+50+50+45+45+55+55+50+55+55+50+45+45+55+45+50+55+45}{30} = 50$
5. Mean number of frogs per plot $= \dfrac{2+3+3+3+2+1+1+1+2+2+3+1+3+2+1+2+3+1+2+2+3+1+2+3+1+2+2+1+3+2}{30} = 2$
6. The mean number of locusts per plot of farmland is 50 while the mean number of frogs is 2.
7. The barangay should be alarmed by the result of the survey because the number of locusts exceeded the normal by 25 while the number of frogs is below normal by 3. If there are more locusts, more plantations will be harmed, and if there are fewer frogs, the population of locusts will be harder to control because there are less frogs who will eat them.

8. The survey results show that the barangay needs to implement a pest control method that can easily kill locusts as soon as possible. The 100% excess of locusts over the normal just shows that the plantations will be extremely damaged if the barangay wastes time in planning and implementing the pest control method. One of the methods that can be used is to use an environment-friendly pesticide for a few days until the population of locusts goes down to normal. Then, the barangay should add frogs to each plot to return to the normal number, so that there will be just enough frogs to eat locusts.

Let's Learn

The mean, median, mode and range can also be applied in monitoring health conditions of people, such as tracking and preventing the incidence of diseases in an area, or researching whether a barangay eats a balanced diet.

Read the following example and let's solve the problem by performing a survey:

For example, you are a barangay health worker who is constantly monitoring the number of children who are infected with cholera. When there are more than 80 children who get infected in each month in a year, the barangay offers free medical check-up and medicines to children who are infected with cholera.

STEP 1 Your topic is the number of children who are infected with cholera in every month of the year. Since you already have a topic, the next step that you should do is to select a sample.

STEP 2 Be clear with what you want to know. Be ready with the queries and questions that you want to be answered. Then, gather data.

In this problem, you just have to count the number of infected children every month through observation.

STEP 3 The next step is analysis. For example, you gathered the following data.

January: 90	July: 190
February: 60	August: 200
March: 50	September: 190
April: 40	October: 100
May: 100	November: 100
June: 150	December: 100

What is the range of the data?

Range = 200 – 40 = 160

What is the measure of central tendency that should be used to analyze the data?

A range of 160 is high relative to other data. The best measure of central tendency that should be used is the median.

What is the median?

List the data from the lowest to the highest. The middle data is the median. The median is equal to 100.

STEP 4 We can conclude that the number of children who are infected with cholera in every month is 100.

STEP 5 The survey shows that the number of infected children exceeds the normal by 20. Because of this, the barangay would need to give free medical check-up and medicines to infected children.

Let's Try This

Read the case and answer the following questions:

Health workers wanted to research on the incidence of malnutrition in Manila. They wanted to know if children below 5 years old have vitamin or mineral deficiency.

1. What is the topic of the survey?

   _____

2. What makes up the sample?

   _____

3. For example, the health workers gathered the data shown in the next page. What is the measure of central tendency that should be used to analyze the data? Why?

   _____

4. What is the center data? Show your solution.

5. What can you conclude from the analysis?

_____

Vitamin and Mineral Deficiency of Each Child	
Child 1: Vitamin A	Child 16: Vitamin B
Child 2: Iodine	Child 17: Iodine
Child 3: Vitamin B	Child 18: Vitamin C
Child 4: Iodine	Child 19: Iodine
Child 5: Iodine	Child 20: Iodine
Child 6: Vitamin C	Child 21: Vitamin A
Child 7: Iodine	Child 22: Iodine
Child 8: Vitamin A	Child 23: Iodine
Child 9: Vitamin A	Child 24: Vitamin A
Child 10: Iodine	Child 25: Vitamin C
Child 11: Iodine	Child 26: Iodine
Child 12: Vitamin C	Child 27: Vitamin C
Child 13: Vitamin C	Child 28: Iodine
Child 14: Vitamin C	Child 29: Iodine
Child 15: Iodine	Child 30: Vitamin C

6. In this example, how did statistics help the health workers, and how can it help malnourished children in Manila?

_____

Have you finished answering? Compare your answers to the answers below.

1. The topic of the survey is the vitamin or mineral lacked most by children living in Manila.
2. The sample is made up of children below five years old who are living in Manila.
3. The measure of central tendency that should be used is the mode because the data is categorical.

4.

Vitamin/Mineral	Number of Times Answered
Vitamin A	5
Iodine	15
Vitamin B	2
Vitamin C	8

Center data = Iodine

5. Children below 5 years old who are living in Manila lack iodine.
6. Statistics helped the health workers to find the mineral that is needed most by children living in Manila. Because of this finding, the health workers might distribute iodine tablets or vitamin and mineral tablets to children in Manila. They might also propose to fortify running water with iodine.

Let's Review

We have learned that the mean, median, mode and range can be used to control pests. They can also be used in tracking diseases and monitoring health conditions of people. Can you think of other applications of the mean, median, mode and range?

In using the mean, median, mode and range, you would also need to conduct a survey in order to gather data. To solve a problem or to answer a query, you just need to follow the steps in conducting a survey.

Let's See What You Have Learned

A. Read the cases and answer the questions.

1. A non-government organization (NGO) specializing in pest control is helping a small agricultural tribe in monitoring and controlling pests. One of the most harmful pests is the kuhol population. The normal and tolerable number of kuhol is 20 per plot of farmland.

   a. How will the NGO know the current number of kuhol in the farmlands of the tribe?

   _____

   b. What is the topic of the survey?

   _____

   c. What is the method of data gathering that the NGO should use?

   _____

d. If the NGO got the data shown below, what is the measure of central tendency that should be used? Why?

_____

Number of Kuhol in Every Plot		
Plot 1: 19	Plot 16: 22	Plot 2: 21
Plot 17: 21	Plot 3: 20	Plot 18: 21
Plot 4: 20	Plot 19: 20	Plot 5: 19
Plot 20: 22	Plot 6: 19	Plot 21: 21
Plot 7: 19	Plot 22: 21	Plot 8: 20
Plot 23: 19	Plot 9: 21	Plot 24: 20
Plot 10: 20	Plot 25: 19	Plot 11: 22
Plot 26: 18	Plot 12: 20	Plot 27: 18
Plot 13: 18	Plot 28: 19	Plot 14: 18
Plot 29: 22	Plot 15: 19	Plot 30: 22

e. What is the center data? Show your solution.

f. Based on the result of the survey, recommend pest control methods to the NGO.

_____

2. A non-government organization (NGO) wanted to know the number of cancer victims in Metro Manila. If the number of victims exceeds 25 per barangay, they will implement a project that will give financial and emotional support to these victims.

a. What is the topic of the survey?

_____

b. If the NGO got the data shown below, what is the measure of central tendency that should be used? Why?

_____

Number of Cancer Victim in Every Barangay	
Barangay 1: 21	Barangay 16: 36
Barangay 2: 35	Barangay 17: 41
Barangay 3: 24	Barangay 18: 38
Barangay 4: 29	Barangay 19: 27
Barangay 5: 15	Barangay 20: 28
Barangay 6: 10	Barangay 21: 26
Barangay 7: 22	Barangay 22: 29
Barangay 8: 12	Barangay 23: 30
Barangay 9: 37	Barangay 24: 32
Barangay 10: 38	Barangay 25: 33
Barangay 11: 25	Barangay 26: 29
Barangay 12: 24	Barangay 27: 28
Barangay 13: 33	Barangay 28: 26
Barangay 14: 34	Barangay 29: 27
Barangay 15: 35	Barangay 30: 31

c. What is the central data? Show your solution.

d. Based on the result, what do you think will the NGO do?

_____

Have you finished answering? Compare your answers to the *Answer Key* on pages 35–36.

Using Probability

Do you think it will rain today? How can you tell? How sure are you? Are you 90% sure or just 30% sure? Perhaps you will say that you are 90% sure if it has been raining since last week. But if it has been a fair weather all week, you may say that you are only 30% sure.

How sure are you that your favorite basketball team will win the next game? What is your chance of winning in a raffle draw? How probable is it that you will answer all the questions in the Let's See What You Have Learned portion of this lesson? These are only a few of the questions that you will be able to answer by finding probability.

After reading this lesson, you should be able to:

- know what probability is and how to get probabilities of events; and
- apply probability in everyday life.

Let's Learn

What is the chance of getting a head after tossing a coin? You might say that getting a head and a tail have equal chances of happening. But how will you represent this in number form? Is the chance of getting a head equal to $\frac{1}{4}$, $\frac{1}{3}$ or $\frac{1}{5}$?

When you toss a coin, there are <u>two</u> possible outcomes, a tail or a head. The chance that a head will occur is equal to the number heads in the coin (1) divided by the possible outcomes, which is equal to $\frac{1}{2}$.

The number $\frac{1}{2}$ represents the ***probability*** of getting a head.

What is the probability of getting a tail?

Number of heads	1
Number of tails	1
Number of possible outcomes	2

The probability of getting a tail is $\frac{1}{2}$

Let's try other examples.

EXAMPLE 1: What is the probability of getting 6 after tossing a die?

STEP 1: Determine the number of outcomes.

There can be six outcomes when you toss a die. These are 1, 2, 3, 4, 5 or 6.

STEP 2: Determine the number of 6s in the outcomes.

There's only one 6 in the outcomes.

STEP 3: Find the probability.

Probability = $\frac{1}{6}$

EXAMPLE 2: There are 3 balls in a box with different colors, red, blue and yellow. What is the probability of getting the yellow ball?

STEP 1: Determine the number of possible outcomes.

There are three possible outcomes. It is either the red, blue or yellow ball will be picked.

STEP 2: Determine the number of yellow ball(s) in the box.

There's only one yellow ball in the box.

STEP 3: Find the probability.

Probability = $\frac{1}{3}$

Let's Try This

Answer the following problems:

1. There are 5 sticks of different lengths in a box. What is the probability that the shortest will get picked?
2. In a raffle draw, there are 100 raffle tickets, and only one of which could win a prize. If Anna owns one of the raffle tickets, what is the probability that she will win the prize?

Have you finished answering? Compare your answers to the answers below.

1. Number of possible outcomes = 5

Number of shortest stick(s) = 1

Probability of picking the shortest stick = $\frac{1}{5}$

2. Number of possible outcomes = 100

   Number of Anna's ticket(s) = 1

   Probability that Anna's ticket will be picked = $\frac{1}{100}$

Let's Learn

What we have discussed earlier are simple examples of getting probabilities. In this section we will be discussing more about probability. But before we go to that, let's define first some important terms.

What do you think is a sample point? A ***sample point*** is the term we use for an outcome.

Let's go back to the first example in this lesson. When you toss a coin, what are the possible outcomes? The possible outcomes are the head and the tail. The head is called a sample point and so is the tail.

The ***sample space*** is composed of all the sample points. In the example, the sample space is composed of the head and the tail. The sample space is often denoted by S.

The sample space in the example can be written as:

$$S = \{\text{head, tail}\}$$

An event is a subset of the sample space. Do you still remember what subsets are? Can you list the events or the subsets of the sample space?

Let's list some of the events. Let s denote the event or subset.

Event that you will get a head: $s_2 = \{\text{head}\}$

Event that you will get a tail: $s_3 = \{\text{tail}\}$

Note: The events that we will study in this module are simple events only. These are events with only one sample point.

Let's Study and Analyze

Now let's take a few examples. Let's find the sample points, sample space and events of the following:

EXAMPLE 1: There are three balls in a box with different colors, red, yellow and blue. You need to pick one ball form the box.

a. What are the ***sample points*****?**

red ball, yellow ball, blue ball

b. What is the ***sample space*****?**

S = {red ball, yellow ball, blue ball}

c. Give the ***simple events*** if you need to pick one ball.

s_1 = {red ball}

s_2 = {blue ball}

s_3 = {yellow ball}

EXAMPLE 2: There are three balls in a box with different colors, red, yellow and blue. You need to pick <u>two</u> balls form the box.

In the earlier example, you needed to pick only one ball. This time we need to pick two balls so the sample points, sample space and the events will differ.

a. What are the ***sample points*****?**

red and yellow, red and blue, yellow and blue

b. What is the ***sample space*****?**

S = {red and yellow, red and blue, yellow and blue}

c. Give the ***simple events*** if you need to pick two balls.

s_1 = {red and yellow ball}

s_2 = {red and blue}

s_3 = {yellow and blue}

Let's Try This

Get the sample space, sample points, and simple events.

1. There are 4 straws with different lengths, 5 cm, 6 cm, 7cm and 8 cm. You need to pick only one straw.

   a. Give the sample points.

   b. What is the sample space?

      S =

   c. Simple events

      s_1 =

      s_2 =

      s_3 =

2. There are 3 straws with different lengths, 5 cm, 6 cm and 4cm. You need to pick two straws.

   a. Give the sample points.

   b. What is the sample space?

      S =

   c. Simple events.

      s_1 =

      s_2 =

      s_3 =

Have you finished answering? Compare your answers to the answers below.

1. a. Sample points

      5 cm, 6 cm, 7 cm, 8 cm

   b. Sample space

      S = {5 cm, 6 cm, 7 cm, 8cm}

   c. Simple events

      s_1 = {5 cm}

      s_2 = {6 cm}

      s_3 = {7 cm}

      s_4 = {8 cm}

2. a. Sample points

5 cm and 6 cm, 5 cm and 7 cm, 6 cm and 7 cm

b. Sample space

S = {5 cm and 6 cm, 5 cm and 7 cm, 6 cm and 7 cm}

d. Simple events

s_1 = 5 cm and 6 cm

s_2 = 5 cm and 7 cm

s_3 = 6 cm and 7 cm

Let's Learn

Now that we have already defined sample point, sample space and events, let us give the formal definition of probability.

The ***probability of an event*** is the numerical representation of the chance that it will occur. The formula in getting probability is:

$$\text{probability of an event s} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

Let's take the following examples to understand the meaning of probability:

EXAMPLE 1: There are three balls in a box with different colors, red, blue and yellow. What is the probability of getting the red ball?

a. How many sample points are there in the event that a red ball will be picked?

There is only <u>one</u> sample point in the event.

s = {red}

b. How many sample points are there in the sample space?

There are <u>three</u> sample points in the sample space.

S = {red, yellow, blue}

c. What is the probability of getting the red ball?

$$\text{probability of the event s} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

$$= \frac{1}{3}$$

EXAMPLE 2: In a box, there are 6 balls with different colors, 3 red balls, 2 yellow balls and 1 blue ball. What is the probability of getting a red ball.

a. How many sample points correspond to the event of picking a red ball?

There are 3 sample points that correspond to the event.

s = {red ball$_1$, red ball$_2$, red ball$_3$}

b. How many sample points are there in the sample space?

There are 6 sample points in the sample space.

S = {red ball$_1$, red ball$_2$, red ball$_3$, yellow ball$_1$, yellow ball$_2$, blue ball}

c. What is the probability of getting any of the three red balls?

$$\text{probability of event s} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

$$= \frac{3}{6}$$

$$= \frac{1}{2}$$

EXAMPLE 3: A group of children are going on a field trip, and the bus that they are riding has two-seat benches. Three of the children are Anna, Jun and Marie. What is the probability that Anna and Marie will be seated together?

a. How many sample points correspond to the event that Anna and Marie are seated together?

There is only one sample point corresponding to the event.

s = {Anna and Marie}

b. How many sample points are there in the sample space?

There are three sample points in the sample space.

S = {Anna and Jun, Anna and Marie, Jun and Marie}

c. What is the probability of the event that Anna and Marie will be seated together?

$$\text{probability of the event} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

$$= \frac{1}{3}$$

Let's Try This

Solve the following problems. Show your solution.

1. In a raffle draw, there are 100 raffle tickets, and only one winner will be picked. If Joy has 25 tickets in the raffle draw, what is her chance of winning?
2. If you toss two coins, what is the probability of getting 2 heads?
3. The word P O T has only three letters. If you shuffle the letters, what is the probability of getting an arrangement with P in the middle? (Example: O P T)

Have you finished answering? Compare your answers to the answers below.

1. s = {Joy's tickets}

   Number of sample points in s = 25

   S = {all the tickets in the raffle}

   Number of sample points in S = 100

   $$\text{Probability} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

   $$= {}^{25}\!/_{100} = {}^{1}\!/_{4}$$

2. s = {head and head}

   Number of sample points in s = 1

   S = {head and head, head and tail, tail and tail}

   Number of sample points in S = 3

   $$\text{Probability} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

   $$= {}^{1}\!/_{3}$$

3. s = {O P T, T P O}

   Number of sample points in s = 2

   S = {T O P, O T P, O P T, P O T, P T O, T P O}

   Number of sample points in S = 6

   $$\text{Probability} = \frac{\text{sample points in s}}{\text{sample points in S}}$$

   $$= {}^{2}\!/_{6} = {}^{1}\!/_{3}$$

Let's Learn

Now that you have already learned how to get probability, can you think of some applications of probability in your daily life? Remember that probability represents the chance that an event will occur. We use probability when we are dealing with uncertain events or when we do not know whether the event will happen or not. Can you give examples of uncertain events?

If you want to know whether the average crop yield per farmland will be 100 sacks of rice, you would use probability because you need to guess how possible the event is. You are still unsure if the event will occur, but you can know how possible it is by finding its probability.

You may also use probability if you want to know the chance of winning in the lottery or the chance of a politician in winning the senatorial election.

The application of probability does not stop in getting the numerical value. We can also use probability to determine what we should do. If you know that you have 1/100,000,000 probability of winning the lottery, would you still want to join? If your barangay only has a $\frac{1}{2}$ chance of yielding 100 sacks of rice per farmland, what should the barangay do in order to meet 100 sacks?

In this section, we will examine some examples of the application of probability. Read each one carefully.

EXAMPLE 1: Mr. Fernandez wants to run for the position of Barangay Captain in the upcoming elections. In a survey of 1,000 respondents, 700 voted for him.

a. What is the probability that Mr. Fernandez will win the elections?

$$\text{Probability} = \frac{700}{1{,}000} = \frac{7}{10}$$

b. Is it advisable for Mr. Fernandez to run for the position? Why?

It is advisable for Mr. Fernandez to run for the position because he has $\frac{7}{10}$ chance of winning the election, which means that he has the majority of the votes.

EXAMPLE 2: In the past years, Barangay San Pedro had been planting two crops for their livelihood – kamote and gabi. Every year, they experience losses in crops because some kamote and gabi plants produce defective crops. This year, farmers wanted to plant only one crop. Refer to the table below to know the number of plants planted and the number that produce defective crops.

	KAMOTE PLANTS per plot of farmland	GABI PLANTS per plot of farmland
Total Number of Plants	10,000	15,000
Number of Plants That Produce Defective Crops	2,000	5,000

a. If the farmers decide to plant kamote plants this year, what is the probability that the plants will produce defective crops?

$$\text{Probability} = \frac{2{,}000}{10{,}000} = \frac{1}{5}$$

b. If the farmers decide to plant gabi plants this year, what is the probability that the plants will produce defective crops?

$$\text{Probability} = \frac{5{,}000}{15{,}000} = \frac{1}{3}$$

c. If kamote and gabi plants yield crops that can be sold at the same price, which do you think is the better choice for planting this year? Why?

It is better for farmers to plant kamote plants this year because it is less probable to produce defective crops than gabi plants.

Let's Try This

Solve the following problems by answering the questions.

1. Your father wants to buy a raffle ticket. He can choose to buy a ticket from Raffle Draw A or Raffle Draw B. Both raffle draws sells tickets for P100 and gives one million pesos as a prize. There are 10,000 who joined Raffle Draw A and 50,000 who joined Raffle Draw B.

a. What is the probability that your father will win in Raffle Draw A?

b. What is the probability that your father will win in Raffle Draw B?

c. From which raffle draw should your father buy a ticket? Why?

2. An appliance store went on sale, and you wanted to buy a television set. There are 100 television sets for sale in the store but you found out that 70 of the television sets are of low quality and may become defective after a year.

   a. What is the probability that you will buy a high-quality television set?

   b. Will you buy a television set from this appliance store? Why?

   Have you finished answering? Compare your answers to the answers below.

1. a. Probability $= \frac{1}{1{,}000}$

   b. Probability $= \frac{1}{50{,}000}$

   c. Your father should buy a ticket from Raffle Draw A because the probability of winning in Raffle A is greater than the probability of winning in Raffle Draw B.

2. a. Since 70 are of low quality, then 30 are of high quality.

   Probability of getting a high quality tv set $= \frac{30}{100} = \frac{3}{10}$

   b. It is not advisable to buy a television set from the appliance store because there's a small probability that the television set you will buy is of high quality.

Let's Remember

- A sample point is a possible outcome.
- A sample space is a set of all sample points.
- An event is a subset of the sample space.
- The probability is a numerical representation of the chance that an event will occur.
- Probability of an event $= \dfrac{\text{sample points in s}}{\text{sample points in S}}$

Let's See What You Have Learned

A. Write T if the statement is true or F if the statement is false.

1. ____ A sample point is an element of the sample space.
2. ____ The set s = { } is an event.
3. ____ An event is a subset of the sample space.
4. ____ The probability represents the chance of the occurrence of an event.
5. ____ The lower the probability, the more possible the event is.

B. Solve the following problems.

1. A basketball player attempted 100 shots in the game, but missed 30 shots. What is the probability that his next shot will be successful?
2. There are three candies in a jar with different flavors – strawberry, orange and lemon. If you pick two candies, what is the probability that you'll get lemon and strawberry?

C. Read the case and answer the following questions:

A group of researchers tested the effectivity of the use of an earth-friendly pesticide or the use of lizards in killing beetles, which are the primary pests in their town. The researchers were tasked to determine which could be better used by farmers. They gathered the following information after using each method in some farms.

	Pesticide	Lizards
Estimated number of beetles killed	5,000	3,000
Estimated number of beetles	10,000	15,000

a. If farmers use the pesticide, what is the probability that the method will kill beetles?

b. If farmers use lizards, what is the probability that the method will kill beetles?

c. Which pest control method is better? Why?

Have you finished answering? Compare your answers to the *Answer Key* on pages 36–37.

Let's Sum Up

- We can use the mean, median, mode and range to our advantage.
  - — The mean, median, mode and range can be used to monitor and control pest population.
  - — The mean, median, mode and range can be used to monitor health conditions of people and to monitor and prevent the incidence of diseases.
- The probability is a numerical representation of the chance that an event will occur.
  - — Probability of an event $= \frac{\text{sample points in s}}{\text{sample points in S}}$

What Have You Learned?

A. Read the cases and answer the following questions.

1. The barangay kagawad of Barangay Kalinisan is responsible for monitoring and controlling the population of rats in the barangay. If the population exceeds 30 per home, the barangay kagawad requires a general clean up of the homes, roads and drainage of the whole barangay.

   a. How will the barangay kagawad determine the number of rats in every home?

   b. If the barangay kagawad gathered the following data, what is the appropriate measure of central tendency to use? Why?

Number of Rats in Every Home	
House 1: 10	House 16: 80
House 2: 15	House 17: 30
House 3: 25	House 18: 20
House 4: 70	House 19: 20
House 5: 40	House 20: 15
House 6: 15	House 21: 10
House 7: 15	House 22: 15
House 8: 20	House 23: 10
House 9: 30	House 24: 20
House 10: 35	House 25: 25
House 11: 80	House 26: 30
House 12: 15	House 27: 25
House 13: 10	House 28: 30
House 14: 20	House 29: 20
House 15: 30	House 30: 20

   c. What is the central data?

   d. Based on the survey result, what should the barangay kagawad do?

2. Your barangay health center wanted to know the disease that causes the most deaths in your barangay. They took a sample from the people who died five years ago until now. The result would help them determine the projects that the health center would implement in the following year.

   a. Who compose the sample?

   b. If the health center gathered the following data, what is the best measure of central tendency that should be used?

Diseases that Caused the Respondent's Death	
Respondent 1: Heart disease	Respondent 16: Cancer
Respondent 2: Cancer	Respondent 17: Diabetes
Respondent 3: Heart disease	Respondent 18: Tuberculosis
Respondent 4: Tuberculosis	Respondent 19: Cancer
Respondent 5: Cancer	Respondent 20: Cancer
Respondent 6: Heart disease	Respondent 21: Heart disease
Respondent 7: Diabetes	Respondent 22: Cancer
Respondent 8: Cancer	Respondent 23: Tuberculosis
Respondent 9: Cancer	Respondent 24: Heart disease
Respondent 10: Heart disease	Respondent 25: Cancer
Respondent 11: Diabetes	Respondent 26: Diabetes
Respondent 12: Heart disease	Respondent 27: Tuberculosis
Respondent 13: Cancer	Respondent 28: Heart disease
Respondent 14: Tuberculosis	Respondent 29: Cancer
Respondent 15: Cancer	Respondent 30: Cancer

   c. What is the center data? Show your solution.

   d. Based on the survey result, what do you think will the health center do?

B. Read the case and answer the questions. Encircle the letter of the correct answer.

You have three coins, and each coin has a head and tail side. If you toss them altogether, what is(are) the:

1. sample points
   a. H H H, H H T, H T T, T T T
   b. H H H, T T T, H H T, H T T, H T H
   c. None of the above, the answer is _____.
2. sample space
   a. S = {H H H, T T T, H H T, H T T, H T H}
   b. S = {H H H, H H T, H T T, T T T}
3. examples of possible events after tossing all three coins
   a. s = {H H H} and s = { }
   b. s = {H H H, H H T} and s = {H T T}
   c. s = {H H H} and s = {T T H}

C. Read the problem and answer the question. Show your solution.

1. A canister has 6 color pencils. 2 of the pencils are pink, 2 are yellow, 1 is violet and another one is blue. What is the probability of getting a pink?

2. The word C A N has three letters. If you shuffle the letters, what is the probability that the arrangement would still start with C?

3. Two companies decided to have a research on the satisfaction of consumers on their juices: Fruit Juice A and Fruit Juice B. Fruit Juice A's 500 consumers out of 600 were satisfied. Fruit Juice B's 800 consumers out of 1,000 were satisfied. Which would be a better choice? Why?

Have you finished answering? Compare your answers to the *Answer Key* on pages 37–38.

Answer Key

A. Let's See What You Already Know *(pages 2–5)*

A. 2. Range = The data is categorical so it does not have any range.

Measure of Central Tendency – Median

Central Data = Cruz

Solution:

Cruz = 15
Santos = 7
Perez = 8

3. Range = 20,000 – 3,000 = 17,000

Measure of Central Tendency = Median

Central Data = (16,000 + 17,000) ÷ 2 = 16,500

Solution:

3,000	17,000
4,000	17,000
5,000	17,000
13,000	18,000
14,000	18,000
14,000	19,000
15,000	19,000
15,000	19,000
16,000	20,000
16,000	20,000

4. Range = 7 – 1 = 6

Measure of Central Tendency = Mode

Central Data = 5

Solution:

1 – 1
6 – 2
7 – 1
5 – 14
4 – 2

5. Range = 205 – 195 = 10

   Measure of Central Tendency = Mean

   Central Data = 200

   Solution:

$$\text{Mean} = \frac{200+199+198+201+202+195+197+200+205+203}{10}$$

$$= 2000/10 = 200$$

1. Probability = 1/50
2. Probability = 2,500/5,000 = 1/2

C. 1. Survey

2. Mean

3. Probability

B. Lesson 1

Let's See What You Have Learned (pages 14–16)

A. 1. a. The NGO will know the current number of kuhol by conducting a survey.

b. The topic of the survey is the current number of kuhol.

c. Observation should be used to gather data.

d. The measure of central tendency that should be used is the mean because the range is relatively low. Range = 22 – 18 = 4

e. $$\text{Mean} = \frac{19+21+20+22+19+19+20+18+18+22+22+20+20+19+21+21+19+20+19+19+21+21+19+21+20+20+22+18+18+22}{30}$$

$$= 600/30 = 20$$

f. There are no further recommendations for pest control method because the normal number of kuhol was met.

2. a. The topic of the survey is the number of cancer victims in every barangay of Metro Manila.

   b. The measure of central tendency that should be used is the median because the range of the data is relatively high. Range = 41 – 10 = 31

   c. Median = (29 + 29) ÷ 2 = 29

10	29
12	29
15	30
21	31
22	32
24	33
24	33
25	34
26	35
26	35
27	36
27	37
28	38
28	38
29	41

   d. Since the cancer victims exceeded 25, the NGO will give financial and emotional support to cancer victims in Metro Manila.

C. Lesson 2

Let's See What You Have Learned (page 29)

A. 1. **T**

2. **T**

3. **T**

4. **T**

5. **F**

B. 1. Probability = 70/100 = 7/10

2. Probability = 1/3

C. a. Probability = 5,000/10,000 = 1/2

b. Probability = 3,000/15,000 = 1/3

c. If there are no other choices except for the use of pesticide and lizards, then the better method is the use of pesticide because it is probable to kill more pests than the use of lizards.

D. What Have You Learned? *(pages 31–33)*

A. 1. a. The barangay kagawad will know the number of rats in each home by conducting a survey.

b. The appropriate measure of central tendency for the data is the median because the data has a relatively high range. Range = 80 – 10 = 70

c. Median = (20 + 20) ¸ 2 = 20

10	20
10	20
10	25
10	25
15	25
15	30
15	30
15	30
15	30
15	30
20	35
20	40
20	70
20	80
20	80

d. The barangay kagawad does not need to implement a general clean up in the barangay because the population of rats is far below the normal.

2. a. The sample is composed of people who died five years ago until now.

   b. The best measure of central tendency is the mode because the data is categorical.

   c. Mode = Cancer

      Heart disease = 8

      Cancer = 13

      Diabetes = 4

      Tuberculosis = 5

   d. The health center might implement a project that would help prevent cancer, or they may raise the cancer awareness of citizens.

B. 1. a

   2. b

   3. c

C. 1. Probability = 2/6 = 1/3

   2. Probability = 2/6 = 1/3

   3. Fruit Juice A is a better choice because it is more probable to satisfy consumers than Fruit Juice B.

      Probability that Fruit Juice A will satisfy consumers = 500/600

      = 5/6

      Probability that Fruit Juice B will satisfy consumers = 800/1,000

      = 4/5