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Mathematics 8

Quarter 4 - Week 5 Module 5

Illustrating an Experiment, Outcome, Sample Space and Event

AIRs - LM

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Mathematics 8

Quarter 4 - Week 5 Module 5: Illustrating an Experiment, Outcome, Sample Space and Event

First Edition, 2021

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Division Region I

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Target

Good day mathematicians!

Your goal in this module is to learn and understand the key concepts of probability and the fundamental counting principle by conducting several experiments. Activities are also given to process your knowledge and skills acquired, deepen and transfer your understanding. The scope of this module enables you to use it to many different learning situations.

Before we start, let us consider first the learning competencies:

1. illustrates an experiment, outcome, sample space and event. (**M8GE-IVf-1)**
2. counts the number of occurrences of an outcome in an experiment: (a) table; (b) tree diagram; (c) systematic listing; and (d) fundamental counting principle. (**M8GE-IVg-1)**

After going through this module, you are expected to:

1. define an experiment, outcome, sample space and event.
2. understand the relation of the possible outcome to probability
3. illustrate the number of occurrences of an outcome in an experiment: (a) table; (b) tree diagram; (c) systematic listing; and (d) fundamental counting principle.
4. count the number of occurrences of an outcome in an experiment: (a) table; (b) tree diagram; (c) systematic listing; and (d) fundamental counting principle.

Before going on, check how much you know about this topic. Answer the pre-test on the next page in a separate sheet of paper.

Pre- Assessment:

Directions. Choose the letter of the correct answer. Write your answer on a separate sheet of paper.

.

____1. Which of the following is an experiment?

A. Choosing a marble from the jar.
B. Counting the number of marbles in a jar.
C. Determine the weight of the jar.
D. Measuring the volume of the jar.

____2. Which of the following is an outcome?

A. Drawing a card.
B. Getting a red marble from a jar full of different colored marbles.
C. Flipping a coin.
D. Rolling a die.

____3. A card is draw from a box containing cards numbered 2, 4, 6, …, 20 (multiples of 2). Write down the sample space S. What is the total number of possible outcomes, n(S)?

A. 2 B. 8 C. 10 D. 20

____4. Two dice are thrown and the values of both dice are multiplied. What is the total number of possible outcomes n(S)?

A. 6 B.12 C. 18 D. 36

____5. A coin is tossed three times. For each toss, the possible outcomes are H (Heads) or T (Tails). What is the sample space for this experiment?

A. S = {TTT, TTH, THT, THH, HTT, HTH, HHT, HHH}
B. S = {TTT, TTH, THT, THH}
C. S = {HTT, HTH, HHT, HHH}
D. S = {HHH, HHT, HTH, TTT, TTH, THT}

____6. What is the favorable outcome?

A. All of the Outcomes B. What can happen
C. What will happen D. What I want to Happen

____7. Possible results in a probability situation are called _____.

A. Likelihoods B. Favorable answers C. Outcomes D. Trials

____8. In order to figure out who will go first in a game, your friend asks you to pick a number between 1 and 5. What are the possible outcomes?

A. 1 B. 1,2,3,4,5 C. 3,4,5 D. 5

____9. If you flip a penny, how many possible results are there?

A. heads, tails B. 0 C. 1 D. 2

____10. In order to figure out who will go first in a game, your friend asks you to pick a number between 1 and 9. What are the favorable outcomes of choosing an even number?

A. 4 B. 1,3,5,7 C. 2,4,6,8 D. 9

____11. A bag is filled with 4 red marbles, 3 blue marbles, 3 yellow marbles, and 2 green marbles. You randomly choose one marble from the bag. Find the number of ways the event can occur.

A. 2 B. 3 C. 4 D. 12

____12. A bag is filled with 4 red marbles, 3 blue marbles, 3 yellow marbles, and 2 green marbles. You randomly choose a green marble from the bag. What are the favorable outcomes?

A. 2 B. green, green C. red, blue, yellow, green D. 12

____13. Which method of finding the total outcomes of an event allows you to see all possible outcomes?

A. Fundamental Counting Principle B. Theoretical Probability

C. Experimental Probability D. Tree Diagram

____14. How many outfits are possible with 5 pairs of jeans, 8 t-shirts, and 2 pairs of shoes?

A. 10 B. 15 C. 40 D. 80

____15. What define experimental probability?

A. What will happen B. What should happen

C. What will I like to happen D. All of the outcomes

Lesson

Illustrating an Experiment, Outcome, Sample Space and Event

As you go through this module, think of the following essential questions; how is the number of occurrences of an event determined? how does knowledge of finding the likelihood of an event help you in your daily life? To find the answer, perform each activity to the best of what you can.

Let's get started!

Jumpstart

Activity 1: Match Me!

Read each statement carefully. Match Colum A with Column B. Write the correct answer before each number.

COLUMN A	**COLUMN B**	
____ 1. Determine the sample space for the following experiment: Choosing one of the four possible aces from a standard deck of cards.	**H.**	{HT, TH}
____ 2. Determine the sample space for the following experiment: Choosing a club from a standard deck of cards.	**E.**	{ace of clubs, ace of diamonds, ace of hearts, ace of spades}

____ 3. Write the set for the following event:
Getting exactly one head after flipping two coins.

____4. How many possible outcomes are there for the experiment of choosing a color of the rainbow at random?

____5. How many possible outcomes are there for the experiment of choosing rock, paper, or scissors at random?

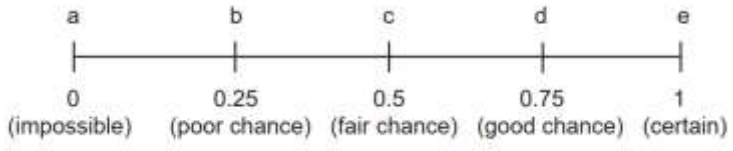
A. 3 possible outcomes

R. {ace, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K}

T. There are 7 possible outcomes

Activity 2: We are Match Made in Probability!

Match the following with each letter on the probability line. Number 1 is done for you.



__*e*__ 1. There are 7 days in a week.
____ 2. Out of 20 items, Jann got 15.
____ 3. In the Philippines, it will snow in March.
____ 4. If you flip a coin, it will come down heads.
____ 5. All months of the year have 28 days.
____ 6. It will be daylight in Manila at midnight.
____ 7. The day before Monday is Sunday.
____ 8. Of the 40 seedlings, only 10 survived.
____ 9. Next year, the month after November has 30 days.
____10. The third person to knock on the door will be a female.
____11. The chance that the last outcome in rolling a number cube is an even number.

Discover

Key Concepts of Probability

An **EXPERIMENT** is any activity with an observable result. Tossing a coin, rolling a die or choosing a card are all considered experiments.

An **OUTCOME** is a possible result of an experiment.

A **SAMPLE SPACE** is the set of all possible outcomes in the experiment. It is usually denoted by the letter **S**. Sample space can be written using the set notation, {}.

Sample space can be presented by a) systematic listing, b) table, c) tree diagram and d) Fundamental Counting Principle (FCP).

*A **tree diagram*** is a visual way to represent the total outcomes you could have. It helps you to map out the probabilities of many possibilities graphically. It has two main parts: the branches and the ends. The probability of each branch is generally written on the branches, while the outcome is written on the ends of the branches.

*A **table** of outcomes is a table where the first row and first column represent the possible outcomes in each event.*

*The outcomes for an event can be **listed (Listing)** in an organized or **systematic** way to make sure that none of the possible outcomes is missed out.*

Fundamental Counting Principle (FCP)

If you have ***a*** ways of doing event 1**,** ***b*** ways of doing event 2, and ***c*** ways of event 3, then you can find the total number of outcomes by multiplying:

a x b x c

An **EVENT** is a subset of the sample space.

Let's look at some do-able examples with equally likely outcomes:

Experiment/Activity	Sample space (as systematic listing)
Tossing a Coin (simple event)	There will be **2 outcomes** in the **sample space,** **S = {Heads, Tails}**
Rolling a Die (simple event) Draw a Card from a Standard Deck (simple event)	There will be **6 outcomes** in the **sample space**, **S = {1, 2, 3, 4, 5, 6}** There will be **52 outcomes** in the **sample space:** **S = {13 Spades: 2,3,4,5,6,7,8,9,10, ace, jack queen, king,** **13 Clubs: 2,3,4,5,6,7,8,9,10, ace, jack, queen, king,** **13 Diamonds: 2,3,4,5,6,7,8,9,10, ace, jack, queen, king,** **13 Hearts: 2,3,4,5,6,7,8,9,10, ace, jack, queen, king}**
Rolling a Pair of Die (simple event)	There will be **36 outcomes** in the **sample space:** **S = {(1,1) (1,2) (1,3) (1,4) (1,5) (1,6),** **(2,1) (2,2) (2,3) (2,4) (2,5) (2,6),** **(3,1) (3,2) (3,3) (3,4) (3,5) (3,6),** **(4,1) (4,2) (4,3) (4,4) (4,5) (4,6),**

	(5,1) (5,2) (5,3) (5,4) (5,5) (5,6), (6,1) (6,2) (6,3) (6,4) (6,5) (6,6)}
Choose outfit: Brown jacket, Red jacket, jeans, boots, sneakers (simple event)	There will be **4 possible outfit combinations (outcomes)** in the **sample space:** **S = {brown jacket, jeans, boots; brown jacket, jeans, sneakers; red jacket, jeans, boots; red jacket, jeans, sneakers}**

The sample space for rolling a pair of die and tossing two coins can be represented by **chart or table** for an organized view of the sample space.

Die1/Die 2	1	2	3	4	5	6
1	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)
2	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)
3	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)
4	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)
5	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)
6	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)

Coin1/Coin 2	H	T
H	H,H	T,H
T	H,T	T,T

For the **event** that doubles will come out the sample space would be S = {1,1; 2,2; 3,3; 4,4; 5,5; 6,5). There will be **6 outcomes.**

When performing an experiment like rolling a die 15 times, a sample space can be represented in a "table" to determine the frequency of the observations, recorded with tally marks.

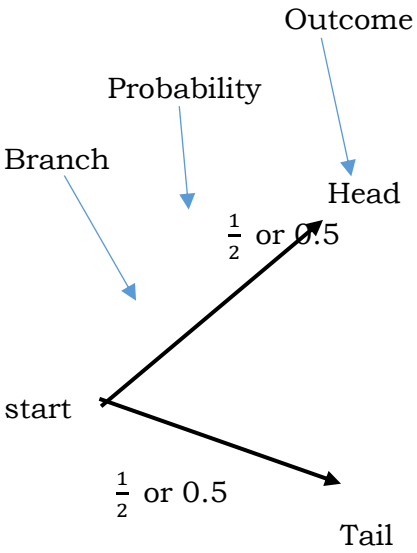
Roll of die	Tally mark	Frequency
1	| |	2
2	| | | |	4
3	|	1
4	| | |	3

5	| |	2
6	| | |	3

When attempting to determine a **sample space**, it is often helpful to draw a tree diagram which illustrates how to arrive at the answer. A tree diagram is a drawing with "line segments" pointing out all of the different possible "paths" for the outcomes. The tree diagram can be used to determine the *probability* of individual outcomes within the sample space.

The **probability** of any outcome in the sample space is the product (multiplication) of all probabilities along a path that represents that outcome on the tree diagram.

Here is the tree diagram for the toss of a coin:



There are two "branches" (Head and Tails)

- The probability of each branch is written on the branch

The outcome is written at the end of the branch

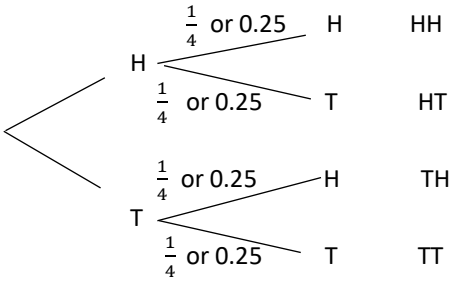
The outcome for head is and the outcome for tail is also 1. The total outcome will be 2.

The probability of each outcome:

$$P(\text{head}) = \frac{number\ of\ possible\ outcome}{total\ number\ of\ outcome}$$

$$= \frac{1}{2} \text{ or } 0.5$$

Another example: Two coins are tossed



For more complex probability problems, we will use a formula known as the **fundamental counting principle (FCP)** to easily determine the total outcomes for a given problem.

Example: A new restaurant has opened and they offer lunch combos for Php250. With the combo meal you get 1 sandwich, 1 side and 1 drink. The choices are below. Determine the total number of outcomes using FCP.

Sandwiches: Chicken Salad, Turkey, Grilled Cheese

Sides: Chips, French Fries, Fruit Cup

Drinks: Soda, Water

Solution:

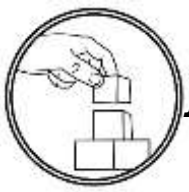
To find the total number of outcomes for the scenario, multiply the total outcomes for each individual event.

Event a **= 3** choices of sandwiches

Event b =**3** choices of sides

Event c =**2** choices of drinks

total outcomes = a x b x c = 3 • 3 • 2 = 18



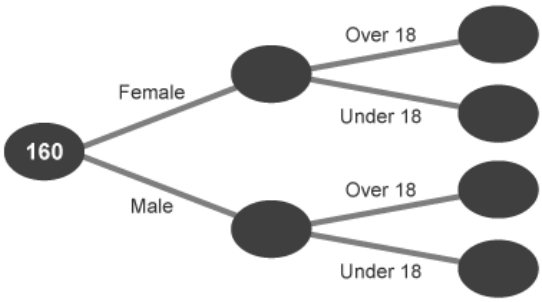
Explore

Activity 3: What's my Sample Space?

1. Two fair dice are rolled at the same time and their scores are added together. Represent the sample space by using a "table". Write the outcomes by "listing". Find the probability of the sum of the two dice equaling 7.
2. Show the sample space for tossing one coin and rolling one die.
3. A running club has 160 members. 74 of the club members are female. 58 of the female members are over 18. 21 of the male club members are under 18.

Complete the tree diagram to show this information.

Find the probability that a member of the club chosen at random is under 18.



For you to understand the lesson well, do the following activities.

Have fun and good luck!

Deepen

Activity 4: Represent me!

Directions: Find the number of possible combinations of menu by a) listing, b) table, c) tree diagram and d) Fundamental Counting Principle.

1. A school canteen serves lunch for students. For rice: the choices are fried rice and steamed rice, for viand: chicken adobo and pinakbet, for drinks: pineapple juice and orange juice.
2. You are ordering pizza. You can choose a small, medium or large pizza and you can choose cheese or pepperoni.
3. A restaurant has 4 entrees, 5 appetizers, 8 side dishes, and 10 beverages. How many possible meals are there?

Congratulations for reaching this far! You are now ready to take the assessment test. Good luck!

Gauge

Post Assessment: Read each item carefully. Identify the choice that best completes the statement or answers the question

____1. An even in which the probability is 1; e.g., spinning a spinner with the colors red, green and blue and getting P (not purple) = 1.

A. Certain Event B. Likely Event
C. Possible Event D. Probable Event

____2. What is the correct definition of outcome?

A. The number of observations of a data value in a experiment
B. An experiment in which the probability of each outcome is the same
C. All the possible results of an activity or experiment
D. A probability model in which the outcomes do not necessarily have equal probabilities

____3. A collection of outcomes from an activity. Which word means this?

A. Complementary Events B. Event
C. Theoretical Probability D. Uniform Probability Model

____4. A description of how likely an event is to occur. Which word means this?

A. Non-Uniform Probability Model B. Observed Frequency
C. Probability D. Venn Diagram

____5. These are events that have the same probability of occurring?

A. Dependent Events B. Equally Likely Events
C. Even Chance D. Independent Events

____6. What is it that refers to an event which will never happen?

A. Certain B. Likely C. Impossible D. Unlikely

____7. Which refers to something which is not likely to occur, not likely to be true or be believed?

A. Certain B. Likely C. Impossible D. Unlikely

____8. It refers to something which is likely to change, and therefore not reliable or stable.

A. Certain B. Likely C. Impossible D. Uncertain

____9. If the event will _____, then its probability is 0.

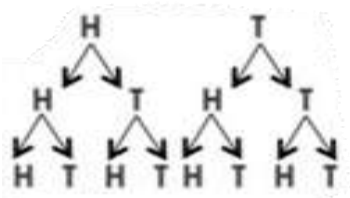
A. Happen B. Never Happen C. Not occur D. Occur

____10. What principle that states: If there are two or more stages of an activity, the total number of possible outcomes is the product of the number of possible outcomes for each stage of the activity?

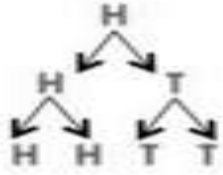
A. Compound event B. Fundamental Counting principle
C. Intercepts D. Maximum point

____11. Ricardo flips a quarter three times. Which of the following tree diagrams represents the sample space of three tosses?

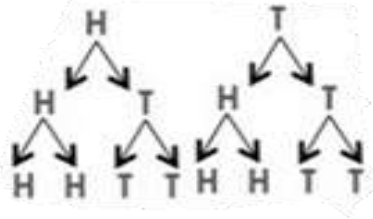
A.



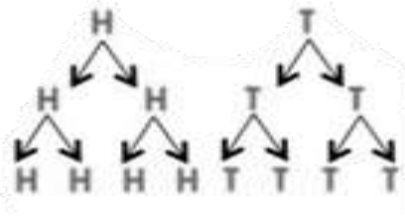
B.



C.



D.



____12. An ice cream shop has a special sundae. The sundae could have chocolate ice cream or strawberry ice cream. It also includes either hot fudge, caramel, or strawberry sauce. Which of the following shows all the possible outcomes of the special sundae?

A. *S* = {chocolate, strawberry, hot fudge, caramel, strawberry sauce}

B. *S* = {(chocolate, strawberry, hot fudge), (strawberry, caramel), (chcolate,strawberry sauce)}

C. *S* = {(chocolate, hot fudge), (chocolate, caramel), (chocolate,strawberry sauce), (strawberry, hot fudge), (strawberry, strawberry sauce)}

D. *S* = {(chocolate, hot fudge), (chocolate, caramel), (chocolate,strawberry sauce), (strawberry, hot fudge), (strawberry, caramel), (strawberry, strawberry sauce)}

____13. Sarah has a bag with 2 blue tiles, 1 red tile, 2green tiles and 1 orange tile. Which of the following represents all possible unique outcomes if Sarah chooses 3 tiles at one time from her bag?

A.
Green, Blue, Red
Orange, Blue, Red
Blue, Orange, Green
Red, Green, Blue

B. Green, Green, Red
Green, Green, Orange
Green, Green, Blue
Green, Blue, Blue
Green, Blue, Orange
Green, Blue, Red
Green, Orange, Red
Blue, Blue, Blue
Blue, Orange, Red

C. Green, Green, Red
Green, Green, Orange
Green, Green, Blue
Green, Blue, Blue
Green, Blue, Orange
Green, Blue, Red
Green, Orange, Red
Blue, Blue, Red
Blue, Blue, Orange
Blue, Orange, Red

D. Green, Blue, Red
Green, Blue, Orange
Green, Red, Blue
Green, Blue, Green
Blue, Green, Red
Blue, Red, Orange
Blue, Orange, Red

____14. What percentage of girls have blonde hair?

Hair colour	Boys	Girls
Black	4	5
Blonde	4	6
Brown	10	8
Red	2	1

A. 29% B. 30% C. 32% D. 40%

____15. A menu has 6 different sandwiches, with 3 choices of potato chips, 3 types of salad and 5 different beverages. How many different lunch combinations consisting of a sandwich, chips and beverage can be ordered?

A. 17 B. 30 C. 90 D. 270

Great job! You are awesome! You are almost done with this module.

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