

Section 6.1 Experiments, Sample Spaces, and Events

An **experiment** is an activity with observable results (outcomes). *ex tossing coin, rolling die*

A **sample point** is an outcome of an experiment. *{H, T}; {1}, {2}, ..., {6}*

A **sample space** is a set consisting of all possible sample points of an experiment. *{H, T}*
{1, 2, 3, 4, 5, 6}

A **Finite Sample Space** is a sample space with finitely many outcomes.

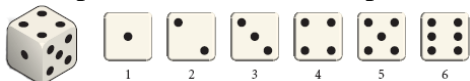
An **event** is a subset of a sample space of an experiment.

Since an event is defined in terms of a set, it should make sense that we will use what we covered in Chapter 5 in our study of experiments and events.

The **union and intersection** of two events (sets) is defined the same as before.

If the **intersection between two events is equal to the \emptyset** , then E and F are called **mutually exclusive**.

Example 1: Consider the experiment of tossing a six-sided die.



a. Describe the sample space, S, of this experiment.

$$S = \{1, 2, 3, 4, 5, 6\}$$

b. Describe the event E that an even number is tossed and describe the event F that a multiple of 3 is tossed.

$$E = \{2, 4, 6\} \quad F = \{3, 6\}$$

$$E \cap F = \{6\} \quad E \text{ \& F are not mutually exclusive}$$

c. Use part b to describe the event that **E occurs but F does not occur**. Then state the number of sample points in that set.

$$E \cap F^c = \{2, 4, 6\} \cap \{1, 2, 4, 5\} = \{2, 4\}$$

$$\underline{2} \cdot \underline{2} = 4 \text{ outcomes}$$

Example 2: An experiment consists of tossing a fair coin twice. How many outcomes contain at least one tail?

H H
 T T
 T H
 T T
 |

$$S = \{H, T\}$$

1T or 2T

$$C(2,1) + C(2,2) = 2 + 1 = 3$$

Example 3: An experiment consists of selecting a letter at random from the letters in the word CONSONANT.













a. What is an appropriate sample space for this experiment?

$$S = \{C, O, N, S, A, T\}$$

b. Describe the event "the letter selected is a vowel."

$$V = \{O, A\}$$

Example 4: An experiment consists of rolling a pair of fair dice and observing the numbers that are on the uppermost surface of each die. Its sample space follows:

						
	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)
	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)
	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)
	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)
	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)
	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)

$$E + E = E$$

$$O + O = E$$

$$O + E = O$$

a. How many sample points have an odd sum?

$$\begin{array}{l} (O, E) \quad 3 \cdot 3 = 9 \\ (E, O) \quad 3 \cdot 3 = 9 \end{array} \quad \left. \vphantom{\begin{array}{l} (O, E) \\ (E, O) \end{array}} \right\} 18$$

b. Describe the event that the sum of the outcomes is at most 3.

$$E = \{(1,1), (1,2), (2,1)\}$$