Math 1313
Experiments, Events and Sample Spaces

At the end of this recording, you should be able to define and use the basic terminology used in defining experiments.

Terminology

The next main topic in this course is probability. To begin the study of probability, you need to become familiar with some terms which we will use frequently in this chapter.

Definition: Experiment.

Example 1: These are examples of experiments we might encounter in our study of probability.

a)

b)

c)

Definition: Sample Point.

Definition: Sample Space.

Definition: Finite Sample Space.

Definition: Event.

You will see a lot of overlap between the study of sets in and the study of probability.

In studying probability, the universal set is

An event E is said to occur if

The impossible event is

The certain event is

Example 2: Suppose the experiment is rolling a fair six-sided die and observing the number on the uppermost face.

a) Suppose an event of the experiment is rolling an odd number. Define the event.

b) Suppose an event of the experiment is rolling a number greater than 10. Define the event.

c) Suppose an event of the experiment is rolling a number less than 10. Define the event.

Example 3: Suppose the experiment is rolling a fair six-sided die and observing the number on the uppermost face.

a) Describe an appropriate sample space.

b) List three events associated with this experiment.

Now we'll look at the operations we can perform on events. Since events are sets, we will draw heavily on the work we did with set operations in previous sections.

Unions, Intersections and Complements

You have already learned much about set notation and Venn diagrams.

Definition: Mutually Exclusive

Venn Diagram:

Example 4: Suppose an experiment consists of rolling a fair six-sided die and observing the number on the uppermost face.

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

Suppose E and F are events of the experiment, where

$E = \{1, 2, 3\}$

$F = \{1, 3, 5\}$

Find each of the following:

a) $E \cap F$

b) $E \cup F$

c) E^c

d) $E^c \cup F$

e) $E^c \cap F^c$

f) $(E \cup F)^c$

Are the events E and F mutually exclusive?

Now you are ready to begin looking at more complicated sample spaces. These are described in the next lecture.

More Complicated Sample Spaces

In this lesson, we will work with some more complicated sample spaces and begin answering questions using the sample spaces.

We will use a device called a tree diagram to organize the information we need to write down the sample space for some of these experiments.

A tree diagram looks like this:

Example 5: Suppose an experiment consists of flipping a coin three times and observing the sequence of heads and tails. Describe an appropriate sample space.

Determine the event *E* that exactly two tails appear.

Determine the event F that the second toss is tails and the third toss is heads.

Example 6

Example 6: Suppose an experiment consists of rolling a pair of dice and observing the number that falls uppermost on each die. Describe an appropriate sample space.

Determine the event *E* that the sum of the uppermost numbers is 6.

Determine the event *F* that the sum of the uppermost numbers is less than 5.

Example 7

Example 7: Suppose I record the number of students who actually attend my 8 a.m. class. There are 147 students enrolled in this class. Describe an appropriate sample space.

Describe the event *E* that more than 80 students actually attend the class.

Describe the event *F* that fewer than one-third of the students actually attend the class.

Example 8

Example 8: A sample of three computer games taken from a local electronics store is tested to determine whether the games were defective (d) or working (w). What is an appropriate sample space for this experiment?

Example 9

Example 9: The manager of a discount store observes the length of time it takes a customer to complete his/her purchase at the express land of the store. Describe an appropriate sample space.

Describe the event that it takes a customer between 3 and 4 minutes to complete his/her purchases at the express lane.

Example 10

Example 10: Let $S = \{p, q, r\}$ be a sample space associated with an experiment. List all events of this experiment.

How many events of the experiment contain the letter *r*?

How many events of the experiment contain either the letter *p* or the letter *q*.