Module 5: Making Informed Decisions

TOPIC 1: INDEPENDENCE AND CONDITIONAL PROBABILITY

In this topic, students investigate compound probability with an emphasis toward modeling and analyzing sample spaces to determine rules for calculating probabilities in different situations. Students explore various probability models and calculate compound probabilities with independent and dependent events in a variety of problem situations. Students use technology to run experimental probability simulations.

Where have we been?

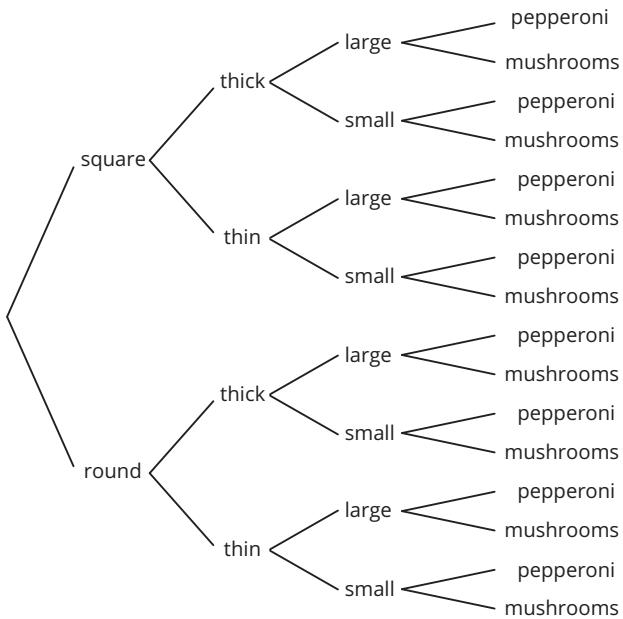
In grade 7, students learned about probability involving simple events and described the probabilities of those events both informally and formally. Students have also explored both experimental and theoretical probability and sample spaces for compound events.

Where are we going?

Students formalize notions about probability and broaden the complexity of their understanding of both probability and samples spaces to include combinations, permutations, and expected value. Probabilistic reasoning is an important component of statistical reasoning as students work with randomness in more advanced courses.

Using a Tree Diagram to Determine a Sample Space

A tree diagram can be used to determine a sample space for compound events. For example, at Mario's Pizzeria, you can choose a round or square pizza, thick crust or thin crust, a large size or small size, and pepperoni or mushrooms.



Let's Make a Deal!

There are three doors. Behind one door is a prize. Behind the other two doors are donkeys. You choose one door. The game show host opens one of the doors that you did not choose to reveal a donkey. Then, the host asks you if you would like to stay on the door you chose or switch to the other unopened door. Should you stay or switch? Or does it matter?

This famous probability problem is known as the Monty Hall problem—named after the host of the game show Let's Make a Deal, which featured this problem.

Can you figure out what you should do? What if you had 100 doors to choose from and, after you made your choice, the game show host opened 98 doors to reveal 98 donkeys?

Talking Points

It can be helpful to understand probability for college admissions tests.

Here is an example of a sample question:

A teacher hands out gumballs from a jar randomly to her class. If the jar has 50 gumballs in all—15 licorice, 10 banana, 20 watermelon, and 5 grapefruit— what is the probability that the first three gumballs picked out are licorice flavored?

The probability of choosing a licorice-flavored gumball on the first draw is $\frac{15}{50}$. On the next draw, there are 49 gumballs and 14 licorice-flavored ones, so the probability on the second draw is $\frac{14}{49}$. The probability on the third draw is $\frac{13}{48}$.

We can see that this is "and" probability, so multiply all the probabilities:

$$\frac{15}{50} \times \frac{14}{49} \times \frac{13}{48} = \frac{2730}{117{,}600} = \frac{13}{560}$$

Key Terms

uniform probability model

In a uniform probability model, the probabilities for each outcome are equal.

non-uniform probability model

When the probabilities of the outcomes are not all equal, the model is a non-uniform probability model.

Counting Principle

The Counting Principle states that if an action A can occur in m ways and for each of these m ways an action B can occur in n ways, then actions A and B can occur in $m \cdot n$ ways.

Addition Rule for Probability

The Addition Rule for Probability states that the probability that Event A occurs or Event B occurs is the probability that Event A occurs plus the probability that Event B occurs minus the probability that both A and B occur.