Independent & Dependent Events

Ch9.7
OBJECTIVE

- To find the probability of independent events
- To find the probability of dependent events
Key Concept: Probability of Independent Events

Words: The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Symbols: \[ P(A \text{ and } B) = P(A) \cdot P(B) \]
One letter tile is selected and the spinner is spun. What is the probability that both will be a vowel?

**Method 1**

Make a Tree Diagram

<table>
<thead>
<tr>
<th>Tile</th>
<th>Spinner</th>
<th>Sample Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>A</td>
<td>G, A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>G, B</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>G, C</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>B, A</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>B, B</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>E, A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>E, B</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>E, C</td>
</tr>
<tr>
<td>E</td>
<td>A</td>
<td>A, A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>A, B</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>A, C</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

There are 12 outcomes. Two outcomes contain only vowels. The probability that both will be a vowel is \( \frac{2}{12} \) or \( \frac{1}{6} \).
**Example 1b**

One letter tile is selected and the spinner is spun. What is the probability that both will be a vowel?

**Method 2** Use Multiplication

\[ P(\text{selecting a vowel}) = \frac{2}{4} \text{ or } \frac{1}{2}. \quad P(\text{spinning a vowel}) = \frac{1}{3}. \]

\[ P(\text{both vowels}) = \frac{1}{2} \cdot \frac{1}{3} \text{ or } \frac{1}{6}. \quad \text{Multiply the probabilities.} \]

So, using either method the probability is \( \frac{1}{6} \).
The spinner and number cube shown are used in a game. What is the probability of a player not spinning blue and then rolling a 3 or 4?

First, find the probability of each event:

- P(3 or 4) = \( \frac{2}{6} = \frac{1}{3} \)
- P(not blue) = \( \frac{3}{6} = \frac{1}{2} \)

Multiply the probabilities of independent events occurring:

\[ P(A \text{ and } B) = P(A) \cdot P(B) \]

\[ P(A \text{ and } B) = \frac{1}{3} \cdot \frac{1}{2} = \frac{1}{6} \]

Therefore, the probability of a player not spinning blue and then rolling a 3 or 4 is \( \frac{1}{6} \).
Key Concept: Probability of Dependent Events

**Words**
If two events $A$ and $B$ are dependent, then the probability of both events occurring is the product of the probability of $A$ and the probability of $B$ after $A$ occurs.

**Symbols**
$$P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$$
Example Practice

There are 4 oranges, 7 bananas, and 5 apples in a fruit basket. Ignacio selects a piece of fruit at random and then Terrance selects a piece of fruit at random. Find the probability that two apples are chosen.

Since the first piece of fruit is not replaced, the first event affects the second event. These are dependent events.

\[
P(\text{first piece is an apple}) = \frac{5}{16} \leftarrow \text{number of apples} \quad \frac{1}{12} \leftarrow \text{total pieces of fruit}
\]

\[
P(\text{second piece is an apple}) = \frac{4}{15} \leftarrow \text{number of apples left} \quad \frac{1}{12} \leftarrow \text{total pieces of fruit left}
\]

\[
P(\text{two apples}) = \frac{1}{16} \cdot \frac{4}{15} \quad \text{or} \quad \frac{1}{12}.
\]
Practice Problem

There are 4 oranges, 7 bananas, and 5 apples in a fruit basket. Ignacio selects a piece of fruit at random and then Terrance selects a piece of fruit at random. Find the probability that two apples are chosen.

Refer to the situation above. Find each probability.

b. $P$(two bananas)  

$\frac{7}{40}$

c. $P$(orange then apple)  

$\frac{1}{12}$
Practice Problems

A penny is tossed and a number cube is rolled. Find each probability.

1. $P($tails and 3$)$

2. $P($heads and odd$)$

3. Cards labeled 5, 6, 7, 8, and 9 are in a stack. A card is drawn and not replaced. Then, a second card is drawn at random. Find the probability of drawing two even numbers.
HOMEWORK

Pg. 779 - 780,
#1 - 15 all