Mutually Exclusive and Inclusive Events

CCM2 Unit 1: Probability
Mutually Exclusive Events

• Suppose you are rolling a six-sided die. What is the probability that you roll an odd number or you roll a 2?
  • Can these both occur at the same time? Why or why not?

• **Mutually Exclusive Events (or Disjoint Events):** Two or more events that cannot occur at the same time.
Probability of the Union of Two Events: The Addition Rule

Addition Formula:

\[ P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B) \]
If you randomly chose one of the integers 1 – 10, what is the probability of choosing either an odd number or an even number?

2. Are these mutually exclusive events? Why or why not?

3. $P(\text{odd})$?
   \[ \frac{1}{2} \]

4. $P(\text{even})$?
   \[ \frac{1}{2} \]

5. $P(\text{odd and even})$?
   0
6. Calculator $P$(odd or even) using the formula

$$P(\text{Odd or Even}) = P(\text{Odd}) + P(\text{Even}) - P(\text{O} \cap \text{E})$$

$$= \frac{1}{2} + \frac{1}{2} - 0$$

$$= \frac{2}{2} = 1 = 100\%$$

7. Does this answer make sense?

YES!! 100% chance of getting even or odd #
Two fair dice are rolled. What is the probability of getting a sum less than 7 or a sum equal to 10?

8. Are these events mutually exclusive?

9. Complete the following table using the sums of two dice:

<table>
<thead>
<tr>
<th>Die</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
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<td>3</td>
<td>4</td>
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<td>6</td>
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<td></td>
</tr>
</tbody>
</table>
10. P(getting a sum less than 7 OR sum of 10)
   = P(sum <7) + P(sum = 10) – P(sum <7 and sum=10)
   = 15/36 + 3/36 - 0
   = 18/36
   = ½

11. The probability of rolling a sum less than 7 or a sum of 10 is ½ or 0.5 or 50%.
Mutually Inclusive Events

Suppose you are rolling a six-sided die. What is the probability that you roll an odd number or a number less than 4?

12. Can these both occur at the same time? If so, when?

**Mutually Inclusive Events:** Two events that can occur at the same time.
13. What is the probability of choosing a card from a deck of cards that is a club or a ten?

\[ P(\text{choosing a club or a ten}) = P(\text{club}) + P(\text{ten}) - P(10 \text{ of clubs}) \]

\[ = \frac{13}{52} + \frac{4}{52} - \frac{1}{52} \]

\[ = \frac{16}{52} \]

\[ = \frac{4}{13} \text{ or } .308 \text{ or } 30.8\% \]
14. What is the probability of choosing a number from 1 to 10 that is less than 5 or odd?

\[
P(<5 \text{ or odd})
\]

\[
= P(<5) + P(\text{odd}) - P(<5 \text{ and odd})
\]

\(<5 = \{1,2,3,4\} \quad \text{odd} = \{1,3,5,7,9\}\)

\[
= 4/10 + 5/10 - 2/10
\]

\[
= 7/10 \text{ or } 0.7 \text{ or } 70%
\]
15. A bag contains 26 tiles with a letter on each, one tile for each letter of the alphabet. What is the probability of reaching into the bag and randomly choosing a tile with one of the first 10 letters of the alphabet on it or randomly choosing a tile with a vowel on it?
15. continued

First 10 letters: A, B, C, D, E, F, G, H, I, J,
Vowels: A, E, I, O, U

\[
P(\text{one of the first 10 letters or vowel}) = P(\text{first 10 letters}) + P(\text{vowel}) - P(\text{first 10 and vowel})
\]

\[
= \frac{10}{26} + \frac{5}{26} - \frac{3}{26}
\]

\[
= \frac{12}{26} \text{ or } \frac{6}{13} \text{ or } .462 \text{ or } 46.2\
\]
4. A bag contains 26 tiles with a letter on each, one tile for each letter of the alphabet. What is the probability of reaching into the bag and randomly choosing a tile with one of the last 5 letters of the alphabet on it or randomly choosing a tile with a vowel on it?

\[
P(\text{one of the last 5 letters or vowel}) = P(\text{one of the last 5 letters}) + P(\text{vowel}) - P(\text{last 5 and vowel})
\]

\[
= \frac{5}{26} + \frac{5}{26} - 0
\]

\[
= \frac{10}{26} \text{ or } \frac{5}{13} \text{ or } .385 \text{ or } 38.5\%
\]
Check Your Understanding (CYU)

Given the situation of drawing a card from a standard deck or cards, calculate the probability of the following:

1. Drawing a red card or a king
2. Drawing a ten or a spade
3. Drawing a four or a queen
4. In a math class of 32 students, 18 boys and 14 are girls. On a unit test, 5 boys and 7 girls made an A. What is the probability of choosing a girl or an A student?