7-8-2012. Probability involving NOT and OR, conditional probability and independence

- The probability that an event E will not occur is ____________________________

__________________________________________________________________________

- Example 2. A single card is drawn from a standard deck of 52 cards. What is the probability it is not a king?

- Example 3. Five fair coins are tossed. What is the probability that at least two turn up heads?

- Addition Rule for Probability: If A and B are events, then

__________________________________________________________________________

- Example 4b. One number is randomly selected from \{1,2,3,...,10\}. What is the probability it is odd or a multiple of 3?

- Example 5. A single card is drawn from a standard deck of 52 cards. What is the probability it is a spade or a red card?
Example 8. Emily must choose one of 20 elective courses, of which 8 are recreational, 9 are interesting, and 3 are both recreational and interesting. If she selects a course at random, what is the probability it will have at least one of these attributes?

- Two events that cannot occur simultaneously are _________________________________

Example 6. Each evening, Amy spends 1 to 6 hours on her homework. The probability \( P(x) \) that Amy will work on homework \( x \) hours on a particular evening is shown in the table below.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>0.10</td>
</tr>
<tr>
<td>3</td>
<td>0.20</td>
</tr>
<tr>
<td>4</td>
<td>0.40</td>
</tr>
<tr>
<td>5</td>
<td>0.10</td>
</tr>
<tr>
<td>6</td>
<td>0.15</td>
</tr>
</tbody>
</table>

(a) \( P(x < 3) = \)

(b) \( P(x > 2) = \)

(c) \( P(1 < x \leq 5) = \)

(d) \( P(x < 5) = \)
• The probability that event B will occur, given that event A has already occurred, denoted by \( p(B|A) \), is called the ____________________________

  o Example 1. A number is randomly selected from the set \( S = \{1,2,3,...,10\} \).
  Event O: The number is odd. Event M: The number is a multiple of 2.

  (a) \( P(O) = \)

  (b) \( P(M) = \)

  (c) \( P(O \cap M) = \)

  (d) \( P(M|O) = \)

• Conditional probability formula:________________________________________________________

  o Example 2. A family has two children.
  (a) What is the probability that both are girls, given that one is a girl.
  Strategy A: Restrict the sample space.

  Strategy B: Apply the conditional probability formula.
(b) What is the probability that both are girls, given that the first born is a girl.

**Strategy A:** Restrict the sample space.

**Strategy B:** Apply the conditional probability formula.

- Two events A and B are **independent** if

  
  \[P(A \cap B) = P(A)P(B)\]

- **Example 3.** A single card is drawn from a standard deck of 52 cards.
  Event A: The selected card is a face card. Event B: The selected card is black.

  (a) \(P(B) = \)

  (b) \(P(B \mid A) = \)

  (c) Are A and B independent?

- **Multiplication rules for probability:** Let A and B be events.

  \[P(A \cap B) = \]
Example 4. Jacqui has categorized the 20 books in her library as follows:

<table>
<thead>
<tr>
<th></th>
<th>Fiction (F)</th>
<th>Nonfiction (N)</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardcover (H)</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Paperback (P)</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Totals</td>
<td>11</td>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

She selects a book at random.

(a) \( P(H) = \)  

(b) \( P(H \cap F) = \)  

(c) \( P(F|H) = \)  

Example 8. An urn contains 4 red, 2 blue, and 5 yellow balls. Three balls are drawn without replacement. Find the probability that the first ball is red (R), the second is yellow (Y), and the third is blue (B).