Recall from 11.4: The sum of the probabilities of all possible outcomes in any situation is 1. Therefore,

\[ P(E) + P(\text{not } E) = 1 \]

\[ P(E \cup E') = 1 \]

\[ P(\text{rain}) = 0.75 = \frac{3}{4} \]

\[ P(\text{not rain}) = 0.25 = \frac{1}{4} \]

The event “not E” is the complement of E.

**Complement Rules of Probability**

\[ P(\text{not } E) = 1 - P(E) \]

\[ P(E) = 1 - P(\text{not } E) \]

ex. If 2 dice are rolled, find the probability of not rolling a 12.

\[ P(\text{roll 12}) = \frac{1}{36} \]

\[ P(\text{not 12}) = 1 - P(12) = 1 - \frac{1}{36} = \frac{35}{36} \]
Recall: Formula for Cardinal Number of the Union of Two Sets:

\[ n(A \cup B) = n(A) + n(B) - n(A \cap B) \]

\[ U = \{1, 2, 3, 4, 5, 6, 7, 8\} \]
\[ A = \{1, 2, 3\} \]
\[ B = \{2, 3, 4, 5\} \]

\[ n(A \text{ or } B) = 3 + 4 - 2 = 5 \]

"Or" Probabilities

If A and B are any two events,

\[ P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \]
ex. One card is randomly selected from a 52-card deck. Find the probability of selecting a heart or a king.

\[ P(\text{H or K}) = \frac{16}{52} = \frac{4}{13} \]

Recall: Sets can be disjoint.

\[ U = \{1, 2, 3, 4, 5, 6, 7, 8\} \]

\[ A = \{1, 2, 3, 4\} \]

\[ B = \{5, 6, 7\} \]

\[ n(A \text{ or } B) = 4 + 3 - 0 = 7 \]

Mutually Exclusive

events cannot occur simultaneously.

If events A and B are mutually exclusive, \( P(A \text{ or } B) = P(A) + P(B) \).

ex. One card is randomly selected from a 52-card deck. Find the probability of selecting a heart or a club.

\[ P(\text{H or C}) = \frac{26}{52} = \frac{1}{2} \]

STOP Here for the TEST
ex. A single die is rolled. Find the probability of rolling a number greater than 3 or an even number.

Hw.#40: A student is selected at random from a group of 200 students in which 135 take math, 85 take English, and 65 take both math and English. Find the probability that the selected student takes math or English.
Hw.#44: Educational Attainment, in Millions, of U.S. Population, Ages 25 and Over

<table>
<thead>
<tr>
<th></th>
<th>Less Than 4 Years High School</th>
<th>4 Years High School Only</th>
<th>Some college (Less than 4 years)</th>
<th>4 Years College (or More)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>14</td>
<td>25</td>
<td>20</td>
<td>23</td>
<td>82</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>31</td>
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<tr>
<td>Total</td>
<td>29</td>
<td>56</td>
<td>44</td>
<td>45</td>
<td>174</td>
</tr>
</tbody>
</table>

Find the probability that a randomly selected American, aged 25 and over has completed less than four years of high school or four years of high school only.
Odds

Odds are ratios. Odds are denoted a to b, a : b, or \( \frac{a}{b} \). All are read "a to b".

**Odds in favor of E:** favorable: unfavorable

**Odds against E:** unfavorable: favorable

ex. If you guess the answer to an A,B,C,D multiple choice question, what are the odds in favor of getting it right?

What are the odds against getting it right?
Converting Probability to Odds and Vice Versa

The "odds triangle" converts probability to odds or odds to probability.

ex. The odds against Sloppy Joe winning the race are 5:2. What is the probability he'll win the race?
ex. Suppose the probability of rain today is 30%. What are the odds in favor of rain today?

ex. The odds in favor of a team winning the next National League pennant are 1 to 10. What is the probability of that team winning the pennant?

See text ex. 1 - 9.