

7.3: Rules of Probability

Recall:

$E \cap F = \emptyset$ means E and F are mutually exclusive.

$n(E \cup F) = n(E) + n(F) - n(E \cap F)$ if E and F are NOT mutually exclusive.

Since

$$P(E) = \frac{n(E)}{n(S)}$$

we have

$P(E \cup F) = P(E) + P(F) - P(E \cap F)$ if E and F are NOT mutually exclusive.

If E and F are mutually exclusive, then $P(E \cup F) = P(E) + P(F)$.

If E is an event of an experiment then $P(E^c) = 1 - P(E)$.

EXAMPLE 1. A single card is drawn from a standard deck of cards. Find these probabilities.

(a) $P(\text{Heart or a Queen}) =$

(b) $P(\text{not black Ace}) =$

EXAMPLE 2. Let E and F be mutually exclusive events and suppose $P(E) = 0.15$ and $P(F) = 0.55$. Find:

(a) $P(E \cap F) =$

(b) $P(E \cup F) =$

(c) $P(E^c) =$

(d) $P(E^c \cap F^c) =$

EXAMPLE 3. Let E and F be two events of an experiment with sample space S . Suppose $P(E) = 0.2$, $P(F) = 0.4$, and $P(E \cap F) = 0.1$. Compute:

(a) $P(E \cup F) =$

(b) $P(F^c) =$

(c) $P(F^c \cap E) =$

(d) $P(E^c \cap F^c) =$

EXAMPLE 4. Roll an eight sided die. Suppose that any even number is twice as likely to happen as any odd number. Find the probability distribution.

EXAMPLE 5. The quality control department of Star Communications, a manufacturer of video-game DVDs, has determined from records that 1.5% of the DVDs sold have video defects, 0.8% have audio defects, and 0.4% have both audio and video defects. What is the probability that a DVD purchased by a customer

(a) will have a video or audio defect?

(b) will not have a video or audio defect?

EXAMPLE 6. A company selected 1000 households at random and surveyed them to determine a relationship between income level and the number of television sets in a home. The information gathered is listed in the table:

<i>Annual Household Income, \$</i>	<i>0 TVs</i>	<i>1 TV</i>	<i>2 TVs</i>	<i>3 TVs</i>	<i>More than 3 TVs</i>	<i>TOTAL</i>
<i>Less than 15,000</i>	<i>0</i>	<i>38</i>	<i>53</i>	<i>11</i>	<i>0</i>	<i>102</i>
<i>15,000-29,999</i>	<i>0</i>	<i>72</i>	<i>78</i>	<i>15</i>	<i>1</i>	<i>166</i>
<i>30,000-49,999</i>	<i>2</i>	<i>112</i>	<i>130</i>	<i>80</i>	<i>12</i>	<i>336</i>
<i>50,000-74,999</i>	<i>13</i>	<i>87</i>	<i>80</i>	<i>60</i>	<i>21</i>	<i>261</i>
<i>75,000 and higher</i>	<i>27</i>	<i>35</i>	<i>28</i>	<i>25</i>	<i>20</i>	<i>135</i>
<i>TOTAL</i>	<i>42</i>	<i>344</i>	<i>369</i>	<i>191</i>	<i>54</i>	<i>1000</i>

- (a) If a respondent is selected at random, find the probability that he or she owns 0 television sets.
- (b) If a respondent is selected at random, find the probability that he or she owns a television set.
- (c) If a respondent is selected at random, find the probability that he or she is earning \$30,000 – 49,999 per year and owning one television set.
- (d) If a respondent is selected at random, find the probability that he or she is earning \$15,000 – 29,999 per year and owning at most 2 television sets.
- (e) If a respondent is selected at random, find the probability that he or she owns at least 2 television sets.