Name _____

6-6 **Lesson Master**   **Questions on SPUR Objectives**
See Student Edition pages 432–435 for objectives.

SKILLS Objective D

1. A and B are two events in an experiment where $P(A) = 0.6$ and $P(A \cap B) = 0.2$. Find $P(B \mid A)$.

   $\dfrac{P(A \cap B)}{P(A)} = \dfrac{0.2}{0.6} = 0.\overline{3}$

2. A pair of fair 6-sided dice is tossed. Let $A = \{$the sum is 7$\}$ and $B = \{3$ appears on at least one die$\}$.
   Find: $A: 7 \{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\}$
   $B: 3 \{(3,1)(3,2)(3,3)(3,4)(3,5)(3,6)(1,3)(2,3)(4,3)(5,3)(6,3)\}$

   a. $P(A)$ __$\dfrac{6}{36} = \dfrac{1}{6}$__

   b. $P(B)$ __$\dfrac{11}{36}$__

   c. $P(A \cap B)$ __$\dfrac{2}{36} = \dfrac{1}{18}$__

   d. $P(B \mid A)$ $\dfrac{P(B \cap A)}{P(A)} = \dfrac{2/36}{6/36} \cdot \dfrac{36}{6} = \dfrac{2}{6} = \dfrac{1}{3}$

   e. $P(A \mid B)$ $\dfrac{P(A \cap B)}{P(B)} = \dfrac{2/36}{11/36} \cdot \dfrac{36}{11} = \dfrac{2}{11}$

USES Objective I

In 3–5, a weighted die results in the following probability distribution.

Number	1	2	3	4	5	6
Probability	0.15	0.10	0.20	0.10	0.30	0.15

Let $A = \{1, 3, 5\}$, $B = \{2, 3, 4\}$, and $C = \{1, 3, 6\}$.

3. a. $P(A \mid C)$ $\dfrac{P(A \cap C)}{P(C)} = \dfrac{0.15 + 0.20}{0.15 + 0.20 + 0.15} = \dfrac{.35}{0.5} = \boxed{0.7}$

   b. $P(C \mid A)$ $\dfrac{P(C \cap A)}{P(A)} = \dfrac{0.15 + 0.20}{0.15 + 0.20 + 0.30} = \dfrac{0.35}{0.65} = \boxed{0.54}$

4. a. $P(B \mid C)$ $\dfrac{P(B \cap C)}{P(C)} = \dfrac{0.20}{0.15 + 0.20 + 0.15} = \dfrac{0.20}{0.50} = \boxed{0.4}$

   b. $P(C \mid B)$ $\dfrac{P(C \cap B)}{P(B)} = \dfrac{0.20}{0.10 + 0.20 + 0.10} = \dfrac{0.20}{0.40} = \boxed{0.5}$

5. a. $P(A \mid B)$ $\dfrac{P(A \cap B)}{P(B)} = \dfrac{0.20}{0.10 + 0.20 + 0.10} = \dfrac{0.20}{0.40} = \boxed{0.5}$

   b. $P(B \mid A)$ $\dfrac{P(B \cap A)}{P(A)} = \dfrac{0.20}{0.15 + 0.20 + 0.30} = \dfrac{0.20}{0.65} = \boxed{0.31}$

6. A software company's spam filter has a 98% accuracy identifying spam and a 93% accuracy identifying non-spam messages. The company estimates that 70% of all emails are spam.

   a. Make a contingency table for this situation.

	SPAM (70%)	NON-SPAM (30%)
ID'd AS SPAM	98% $0.98 \cdot 0.7 = 0.686$	*7% $0.30 - .07 = 0.021$
ID'd AS non-SPAM	2% $0.70 \cdot .02 = 0.014$	93% $0.30 \cdot 0.93 = 0.279$
Total	100%	100%

   b. A false positive results when the software identifies a legitimate e-mail message as spam. Find the probability a message is not spam even though it was identified as spam by the software.

   $\dfrac{P(B \cap A)}{P(G \cup A)} = \dfrac{0.30 \cdot 0.07}{(0.98 \cdot 0.7) + (0.30 + 0.07)}$

   $P(\text{not spam given ID'd as spam}) = \dfrac{0.021}{0.707}$

   $= 0.0297$

   $= 2.97\%$