

**SOLUTION 1 (18.05, SPRING 2003)**

- 2.1-1** a)  $P(A) = |A|/|S| = 12/52$ ,  
b)  $P(A \cap B) = |A \cap B|/|S| = 2/52$   
c)  $P(A \cup B) = |A \cup B|/|S| = 16/52$   
d)  $P(C \cup D) = |C \cup D|/|S| = |S|/|S| = 52/52 = 1$   
e)  $P(C \cap D) = |C \cap D|/|S| = 0/52 = 0$

- 2.1-4** a)  $P(A) = 1/4$   
b)  $P(B) = 1 - P(A) = 3/4$   
c)  $P(A \cup B) = P(A) + (1 - P(A)) = 1$

- 2.1-6** a)  $P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.4 + 0.5 - 0.3 = 0.6$   
b)  $P(A \cap B') = P(A) - P(A \cap B) = 0.4 - 0.3 = 0.1$   
c)  $P(A' \cup B') = 1 - P(A \cap B) = 1 - 0.3 = 0.7$

- 2.1-8** a)  $P(A \cap B) = P(A) + P(B) - P(A \cup B) = 0.4 + 0.5 - 0.7 = 0.2$   
b)  $P(A' \cup B') = 1 - P(A \cap B) = 1 - 0.2 = 0.8$

- 2.3-2** a)  $P(A_1) = \frac{1041}{1456}$   
b)  $P(A_1 | S_1) = \frac{392}{633} \approx 0.62$   
c)  $P(A_1 | S_2) = \frac{649}{823} \approx 0.79$   
d)  $P(A_1 | S_1) < P(A_1 | S_2)$ . Thus a random man is *less likely* to favor gun law than a random woman.

**2.3-4** a) Let  $A_1, A_2$  be events of the first and second card being hearts, respectively. Then  $P(A_1 \cap A_2) = P(A_1) \cdot P(A_2 | A_1) = \frac{13}{52} \cdot \frac{12}{51} = \frac{1}{17}$ .

b) Let  $B_2$  be an event of the second card being a club. Then  $P(A_1 \cap B_2) = \frac{13}{52} \cdot \frac{13}{51} = \frac{13}{204}$ .

c) Let  $C_2$  be an event of the second card being an ace. Observe that  $A_1$  is independent of  $C_2$ . Then  $P(A_1 \cap C_2) = P(A_1) \cdot P(C_2) = \frac{13}{52} \cdot \frac{4}{52} = \frac{1}{52}$ .

**2.3-8** a) Let  $A_1$  and  $A_2$  be the events that you like the first and second song, respectively. Then  $P(A_1 \cap A_2) = P(A_1) \cdot P(A_2 | A_1) = \frac{8}{14} \cdot \frac{7}{13} = \frac{4}{13}$ .

b)  $P(A'_1 \cap A'_2) = P(A'_1) \cdot P(A'_2 | A'_1) = \frac{6}{14} \cdot \frac{5}{13} = \frac{15}{91}$ .

c) This probability equals  $1 - P(A_1 \cap A_2) - P(A'_1 \cap A'_2) = 1 - \frac{4}{13} - \frac{15}{91} = \frac{48}{91}$ .

**2.3-12** By the symmetry,  $P(\text{sixth cartoon is sour}) = P(\text{first cartoon is sour}) = \frac{2}{10} = \frac{1}{5}$ .