

1. Two dice are thrown. Let  $E$  be the event that their sum is odd, let  $F$  be the event that at least one of the dice lands on 1, and let  $G$  be the event that their sum is 5. Describe the events  $EF$ ,  $E \cup F$ ,  $FG$ ,  $EF^c$ , and  $EFG$ , and compute the probability of each.
2. Suppose that  $A$  and  $B$  are mutually exclusive events for which  $P(A) = 0.3$  and  $P(B) = 0.5$ . What is the probability that
  - (a) either  $A$  or  $B$  occurs?
  - (b)  $A$  occurs but  $B$  does not?
  - (c) both  $A$  and  $B$  occur?
3. A certain town with a population has 3 newspapers:  $A$ ,  $B$ , and  $C$ . The percentage of people who read these papers are as follows:

A: 10%, B: 30%, C: 5%

A and B: 8%, A and C: 2%, B and C: 4%.

A and B and C: 1%.

  - (a) Find the number of people who only read one newspaper.
  - (b) How many people read at least two newspapers?
  - (c) If  $A$  and  $C$  are morning papers and  $B$  is an evening paper, how many people read at least one morning paper plus an evening paper?
  - (d) How many people do not read any newspapers?
  - (e) How many people read only one morning paper and one evening paper?
4. If it is assumed that all  $\binom{52}{5}$  power hands are equally likely, what is the probability of being dealt
  - (a) a flush? (all 5 cards have the same suit)
  - (b) one pair? (but not, e.g., two pairs, three of a kind, etc.)
  - (c) two pairs?
  - (d) three of a kind?
  - (e) four of a kind?
5. In the game *Yahtzee*, a player begins by rolling 5 dice simultaneously. Compute the following probabilities:
  - (a)  $P(\text{no two alike})$
  - (b)  $P(\text{one pair})$
  - (c)  $P(\text{two pair})$
  - (d)  $P(\text{three alike})$
  - (e)  $P(\text{full house})$
  - (f)  $P(\text{four alike})$

(g)  $P(\text{five alike})$

Assume that an outcome like “three alike” means exactly three alike, e.g., not four alike.

6. Two symmetric dice have both had two of their sides painted, red, two painted black, one painted yellow, and the other painted white. When this pair of dice is rolled, what is the probability that both dice land with the same color face up?
7. An urn contains 3 red and 7 black balls. Players  $A$  and  $B$  withdraw balls from the urn consecutively until a red ball is selected. Find the probability that  $A$  selects the red ball. ( $A$  draws the first ball, then  $B$ , and so on. There is no replacement of the balls drawn.)
8. (a) If  $n$  people, including  $A$  and  $B$ , are randomly arranged in a line, what is the probability that  $A$  and  $B$  are next to each other?  
(b) What would the probability be if the people were randomly arranged in a circle?
9. If there are 12 strangers in a room, what is the probability that no two of them celebrate their birthday in the same month?
10. In a hand of bridge (4 people each dealt 13 cards), find the probability that you have 5 spades and your partner has the remaining 8.
11. Show that the probability that exactly one of the events  $E$  or  $F$  occurs equals  $P(E) + P(F) - 2P(EF)$ .
12. A bucket contains  $M$  white and  $N$  black balls. If a random sample of size  $r$  is chosen, what is the probability that it contains exactly  $k$  white balls?