

Problem 8.18 Consider a deck of 52 cards, divided into four different suits, with 13 cards in each suit ranging from the two up through the ace. Assume that all the cards are equally likely to be drawn.

(a) Suppose that a single card is drawn from a full deck. What is the probability that this card is the ace of diamonds? What is the probability that the single card drawn is an ace of any one of the four suits?

(b) Suppose that two cards are drawn from the full deck. What is the probability that the cards drawn are an ace and a king, not necessarily the same suit? What if they are of the same suit?

Solution

(a)

$$\mathbf{P}[\text{Ace of diamonds}] = \frac{1}{52}$$

$$\mathbf{P}[\text{Any ace}] = \frac{1}{13}$$

(b)

$$\begin{aligned}\mathbf{P}[\text{Ace and king}] &= \mathbf{P}[\text{Ace on first draw}]\mathbf{P}[\text{King on second}] + \mathbf{P}[\text{King on first draw}]\mathbf{P}[\text{Ace on second}] \\ &= \frac{1}{13} \times \frac{4}{51} + \frac{1}{13} \times \frac{4}{51} \\ &= \frac{8}{663}\end{aligned}$$

$$\begin{aligned}\mathbf{P}[\text{Ace and king of same suit}] &= \frac{1}{13} \times \frac{1}{51} + \frac{1}{13} \times \frac{1}{51} \\ &= \frac{1}{663}\end{aligned}$$