

1. A bowl contains ten red M&Ms, twelve brown M&Ms, and six blue M&Ms. Three M&Ms, selected at random, are taken from the bowl. What is the probability that the three selected M&Ms are all of different colors?

Solution: The experiment is to draw 3 objects from a collection of 28, so there are  $C(28, 3) = 3276$  possible outcomes.

To draw 3 different-colored M&Ms, we have to choose one red one (there are 10 ways to do this), one brown one (twelve ways), and one blue one (6 ways). The size of the event is thus  $10 \times 12 \times 6 = 720$ . The probability of this event is

$$\frac{720}{3276} \approx 21.98\%.$$

2. Five cards are drawn at random from a standard deck of cards to form a poker hand. What is the probability that the poker hand contains three kings and two aces?

Solution: The number of outcomes is  $C(52, 5) = 2\,598\,960$ .

For this event, we have to choose three of the four kings ( $C(4, 3)$ ) and two of the four aces ( $C(4, 2)$ ). The size of the event is thus

$$C(4, 3) \times C(4, 2) = 24.$$

The probability of the event is  $24/2\,598\,960 \approx 0.000923\%$ .

3. In the card game blackjack, an ace has a value of 1 or 11, every face card has a value of 10, and all other cards have values equal to their rank. A blackjack hand consists of two (unordered) cards, and the value of the hand is the sum of the values of the two cards.

Using a standard deck of 52 cards, how many blackjack hands can be formed that have a value of 18?

Solution: There are four possibilities:

A + 7, which can occur in  $4 \times 4 = 16$  ways;  
(face) + 8, which can occur in  $12 \times 4 = 48$  ways;  
10 + 8, which can occur in  $4 \times 4 = 16$  ways;  
9 + 9, which can occur in  $C(4, 2) = 6$  ways.

The total number of such hands is  $16 + 48 + 16 + 6 = 86$ .