

1. Suppose we roll two standard dice. What is the probability that the two numbers shown on the dice are adjacent? (Two numbers n_1 and n_2 are *adjacent* if $n_2 = n_1 + 1$ or $n_1 = n_2 + 1$.)

Solution: Each die can show six different numbers, so there are 36 possible outcomes. The event in question contains ten outcomes: $(1, 2)$, $(2, 1)$, $(2, 3)$, $(3, 2)$, $(3, 4)$, $(4, 3)$, $(4, 5)$, $(5, 4)$, $(5, 6)$, $(6, 5)$. So the probability of this event is $\frac{10}{36}$.

2. To play the Compulsive County lottery, you pay some money and fill out a card on which you select four numbers from the set $\{1, 2, 3, \dots, 20\}$. Later in the day, the lottery commission chooses four winning numbers at random from the set $\{1, 2, 3, \dots, 20\}$.

Mary Martingale plays the lottery every day, and always selects the numbers 1, 2, 3, and 4. What is the probability that *none* of Mary's numbers is among the set of winning numbers?

Solution: The number of possible sets of winning numbers is $C(20, 4) = 4845$.

The event in question is that the winning numbers all come from the set $\{5, 6, 7, \dots, 20\}$.

The number of outcomes in this event is $C(16, 4) = 1820$. So the probability is $\frac{1820}{4845}$.