

7.4: Use of Counting Techniques in Probability

RECALL: The **probability** of an event E happening is the number of ways that specific event can happen divided by the number of possible outcomes in the whole experiment, i.e.

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}.$$

EXAMPLE 1. *A fair coin is tossed seven times. Find the probability that the coin lands on tails*

(a) *at most 4 times.*

(b) *on the first toss and the last toss.*

EXAMPLE 2. *A type of license plate has three letters followed by three digits. If one of these plates is select at random, find the probability that*

(a) *The license plate has all vowels.*

(b) *The letters are selected from the set A, B, C, D, E, F, G , the digit zero is not used and no letter is repeated.*

EXAMPLE 3. *Three cards are drawn at random from a deck of 52 cards. What is the probability that:*

(a) *all three cards are jacks*

(b) *at least two of the cards are jacks*

EXAMPLE 4. *A box contains 8 red, 7 white, and 6 yellow chalks. What is the probability that in a sample of 7*

(a) *all the chalks are the same color.*

(b) *exactly 3 red and at least 3 white chalks were chosen?*

EXAMPLE 5. *Five cards are selected at random without replacement from a well-shuffled deck of 52 playing cards. Find the probability of the cards being in the same suit.*

EXAMPLE 6. *Twenty cards are selected at random without replacement from a well-shuffled deck of 52 playing cards. Find the probability of the cards being in the same suit.*

EXAMPLE 7. *An exam consist of 21 questions in which 12 of them must be answered. What is the probability that a student answered at least 4 of the first 7 questions and exactly 3 of the last 7 questions?*

EXAMPLE 8. (a) *What is the probability that at least two of 9 people were born in a different days of the year? (Assume that none of the 9 people was born on February 29 of a leap year and that each of them is equally likely to have any of the 365 days of a year as his or her birthday.)*

(b) *What is the probability that at least two of 9 people have the same birthday?*

EXAMPLE 9. *A shelf in Office Max contains 80 cartridges for HP printer. Six of the cartridges are defective. If a customer select 2 cartridges at random from the shelf, what is the probability that both are defective?*