7.4: Using Counting Techniques in Probability

Let \( E \) be any event of a uniform sample space \( S \). Then,

\[
P(E) = \frac{n(E)}{n(S)} = \frac{\text{Number of Outcomes in } E}{\text{Number of Outcomes in } S}
\]

**It is sometimes necessary to use counting techniques to determine \( n(E) \) and \( n(S) \).**

**Ex:** You toss a fair coin 10 times. What is the probability that you get

(a) No tails?

(b) At least 1 tail?

(c) Exactly 3 tails?

**Ex:** You are dealt five cards from a well-shuffled standard 52-card deck. What is the probability that you are dealt

(a) No face cards?

(b) Four Aces?

(c) Exactly 2 hearts?

(d) At least 3 Kings?
Ex: Lightbulbs are shipped in boxes of 100. Before shipping quality control randomly selects 10 lightbulbs from each box for testing. If the sample contains any defective lightbulbs, the entire box does not pass inspection and all the lightbulbs in the box are not shipped. What is the probability that a box containing exactly 8 defective lightbulbs will still be shipped?

Ex: You randomly choose a sample of 4 marbles from a box containing 4 red, 5 purple, 2 yellow, and 3 green marbles. What is the probability that you choose

(a) No yellow marbles?

(b) Exactly 2 purple and exactly 2 red marbles?

(c) Exactly 1 red or exactly 3 purple marbles?

(d) Exactly 3 marbles of the same color?