

Probabilities Using Counting Techniques

$$P(E) = \frac{n(E)}{n(S)} \quad \frac{\text{event}}{\text{total}}$$

Probabilities Using Permutations

Two cards are drawn at random from a standard deck of 52 cards, without replacement. What is the probability that both cards drawn are queens?

event = the way to draw 2 cards out of 4 queens
total = the way to draw 2 cards from a deck of 52

$$\begin{aligned} &= \frac{4P_2}{52P_2} \\ &= \frac{12}{2652} \\ &= \frac{1}{221} \end{aligned}$$

Probabilities Using Permutations

Mrs. Smith has to correct papers for three different classes: Course I, Course II, and Course III. If Mrs. Smith corrects the papers for each class at random, what is the probability she corrects Course I papers first?

$$\frac{1 \cdot \frac{2P_1}{2} \cdot \frac{1P_1}{1}}{3P_3} \rightarrow = \frac{2}{6} = \frac{1}{3}$$

Probabilities Using Permutations

Exactly Three People form a line at a grocery store. What is the probability that they will line up in descending order of age? (i.e. oldest, middle and youngest)

$$\frac{1 \times 1 \times 1}{{}_3P_3} = \frac{1}{6}$$

Probabilities Using Combination

A jar contains 3 white and 6 red marbles, all of equal size. Three marbles are drawn at random without replacement. What is the probability that at least 2 marbles drawn are red?

Case 2 red + Case 3 red

$$\frac{{}^6C_2 \times {}^3C_1 + {}^6C_3 \times {}^3C_0}{{}^9C_3}$$

Probabilities Using Combination

A bag of cookies contains 6 chocolate chip, 5 peanut butter, and 1 oatmeal. Brandon selects 2 cookies at random. Find the probability that Brandon selected :

a) 2 chocolate chip cookies

$$\frac{6C_2}{12C_2} = \frac{15}{66} = \frac{5}{22} \text{ or } 0.23$$

b) 1 chocolate chip and 1 peanut butter

$$\frac{6C_1 \cdot 5C_1}{12C_2} = \frac{6 \cdot 5}{\cancel{66} \parallel 11} = \frac{5}{11} = 0.45$$

Probabilities Using _____

Three cards are drawn randomly from a hat containing cards with the twenty-six letters of the alphabet on them. Determine the probability of selecting A and B.

$$\frac{1C_1 \times 1C_1 \times 24C_1}{26C_3} = \frac{24}{2600} = 0.0092 = \frac{3}{325}$$

Probabilities Using Permutation

Six students are asked to secretly choose a number from 1 to 15.
Determine the probability that at least two students choose the same number to the nearest thousandth.

$$\begin{aligned} P(A) &= 1 - P(A') \\ &= 1 - \frac{{}^{15}P_6}{15^6} \rightarrow \frac{15}{15} \times \frac{14}{15} \times \frac{13}{15} \times \frac{12}{15} \times \frac{11}{15} \times \frac{10}{15} \\ &= 1 - 0.316365432 \\ &= 0.684 \end{aligned}$$