Answer on Question #42091 – Math - Statistics and Probability

A bag contains 9 white and one black ball. Three of them are taken out at a time from the bag. Find the probability that all balls taken out are white.

Solution

At first we mark the balls as follows. Let 1 be the black ball; 2, 3, 4, 5, 6, 7, 8, 9, 10 be white balls.

Let $\Omega = \{(\omega_1, \omega_2, \omega_3) |\ \omega_i = \overline{1,10}, \omega_i \neq \omega_j, if\ i \neq j\}$ be the probability space.

$|\Omega| = \binom{10}{3} = C_{10}^3$ is the number of possible elements of Ω.

We consider the event

$A = \{\text{all three balls taken out at a time from the bag are white}\}$, which is represented as

$A = \{(\omega_1, \omega_2, \omega_3) \in \Omega\ |\omega_i = \overline{2,10}, \omega_i \neq \omega_j, if\ i \neq j\}, |A| = C_9^3 = \binom{9}{3}$ is the number of possible outcomes.

Using classical definition of probability, we have

$$P(A) = \frac{|A|}{|\Omega|} = \frac{C_9^3}{C_{10}^3} = \frac{\frac{9!}{6! \cdot 3!}}{\frac{10!}{3! \cdot 7!}} = \frac{9!}{6! \cdot 3!} \cdot \frac{3! \cdot 7!}{10!} = \frac{7}{10} = 0.7$$

Answer: the probability that all balls taken out are white is 0.7.