# Answer on Question #64948 – Math – Statistics and Probability

## Question

3 batteries are chosen at random from 15 batteries from which 5 are defective. Find the probability that:

**A)** none of the three are defective;
**B)** exactly one is defective;
**C)** 2 defective and one nondefective;
**D)** at least one is nondefective.

## Solution

**A)** Let's take the first battery from 15 batteries and denote the event by A. The probability of chosen battery not being defective will be 10/15.
Let's take the next battery from other 14 batteries and denote the event by B. The probability of chosen battery not being defective will be 9/14.
Let's take the last battery from remaining 13 batteries and denote the event by C. The probability of that battery not being defective will be 8/13.
The probability of none of the three being defective is calculated as the product

$$P_1 = P(3\, nondefective) = P(A, B, C) = \frac{10}{15} \cdot \frac{9}{14} \cdot \frac{8}{13} = \frac{720}{2730} \approx 0.264$$

**B)** The number of combinations of choosing 3 batteries from 15 is $C_{15}^3$
$C_5^1$ is the number of combinations of choosing 1 defective battery from 5 defective ones.
$C_{10}^2$ is the number of combinations of choosing 2 good batteries from 10 good ones.
So $C_5^1 C_{10}^2$ is the total amount of combinations to choose exactly one defective and two good batteries. The probability of exactly one battery being defective will be

$$P_2 = P(2\, nondefective, 1\, defective) = \frac{C_5^1 C_{10}^2}{C_{15}^3} = \frac{\frac{5!}{1!\,4!}\frac{10!}{2!\,8!}}{\frac{15!}{3!\,12!}} = \frac{\frac{5 \cdot 10 \cdot 9}{2}}{\frac{15 \cdot 14 \cdot 13}{3 \cdot 2}}$$

$$= \frac{3 \cdot 5 \cdot 9 \cdot 10}{13 \cdot 14 \cdot 15} = \frac{45}{91}$$

**C)** The arguments are similar to ones in the previous part B) and the probability of choosing 2 from 5 defective batteries and 1 from 10 good batteries will be

$$P_3 = P(1\, nondefective, 2\, defective) = \frac{C_5^2 C_{10}^1}{C_{15}^3} = \frac{\frac{5!}{2!\,3!}\frac{10!}{1!\,9!}}{\frac{15!}{3!\,12!}} = \frac{\frac{5\cdot 4}{2}\cdot 10}{\frac{15\cdot 14\cdot 13}{3\cdot 2}}$$

$$= \frac{10\cdot\ 3\ \cdot 4\ \cdot 5}{13\ \cdot 14\cdot\ 15} = \frac{20}{91}$$

**D)**

$P_4 = P(\text{at least 1 is nondefective}) = P(1\, nondefective,\ 2\, defective) +$
$+P(2\, nondefective, 1\, defective) + P(3\, nondefective) = P_3 + P_2 + P_1 =$
$= \frac{20}{91} + \frac{45}{91} + \frac{720}{2730} \approx 0.978.$

**Answer:**

**A)** $0.264$ ;

**B)** $\frac{45}{91}$ ;

**C)** $\frac{20}{91}$ ;

**D)** $0.978.$