A box contains 5 white and 7 black balls. Two successive drawn of 3 balls are made.

1) with replacement
2) without replacement

The probability that the 1st draw would produce white balls and 2 nd draw would produce black balls are

## Solution

$C_{k}^{n}$ - the number of k-combinations from a given set of n elements.

$$
C_{k}^{n}=\frac{n!}{(n-k)!k!}=\frac{n(n-1)(n-2) \cdots(n-k+1)}{k!}
$$

where $n$ ! denotes the factorial of $n$.

## 1) When the balls are replaced before 2 nd draw

Total balls in the box $=5+7=12$.

3 balls can be drawn out of 12 balls in $C_{3}^{12}$ ways.
3 white balls can be drawn out of 5 white balls is $C_{3}^{5}$ ways.
The probability of drawing 3 white balls

$$
P(3 W)=\frac{C_{3}^{5}}{C_{3}^{12}}
$$

3 balls can be drawn out of 12 balls in $C_{3}^{12}$ ways.
3 black balls can be drawn out of 7 white balls is $C_{3}^{7}$ ways.
The probability of drawing 3 black balls

$$
P(3 B)=\frac{C_{3}^{7}}{C_{3}^{12}}
$$

Since both the events are dependent, the required probability is

$$
P(3 W \text { and } 3 B)=\frac{C_{3}^{5}}{C_{3}^{12}} \cdot \frac{C_{3}^{7}}{C_{3}^{12}}=\frac{10}{220} \cdot \frac{35}{220}=0.007
$$

## 2) When the balls are not replaced before 2nd draw

Total balls in the box $=5+7=12$.

3 balls can be drawn out of 12 balls in $C_{3}^{12}$ ways.
3 white balls can be drawn out of 5 white balls is $C_{3}^{5}$ ways.
The probability of drawing 3 white balls

$$
P(3 W)=\frac{C_{3}^{5}}{C_{3}^{12}}
$$

After the first draw, balls left are 9.
3 balls can be drawn out of 9 balls in $C_{3}^{9}$ ways.
3 black balls can be drawn out of 7 white balls is $C_{3}^{7}$ ways.
The probability of drawing 3 black balls

$$
P(3 B)=\frac{C_{3}^{7}}{C_{3}^{9}}
$$

Since both the events are dependent, the required probability is

$$
P(3 W \text { and } 3 B)=\frac{C_{3}^{5}}{C_{3}^{12}} \cdot \frac{C_{3}^{7}}{C_{3}^{9}}=\frac{10}{220} \cdot \frac{35}{84}=0.019
$$

