Answer on Question #44494 – Math – Statistics and Probability

A bag contains two red balls, three blue balls and five green balls. Three balls are drawn at random. Find the probability that:

a) three balls are of different colours;
b) two balls are of the same colour;
c) all the three are of the same colour.

Solution.

a)

$$P(\text{three balls are of different colours}) = \frac{M}{N},$$

M is the number of ways to select 1 red ball, 1 blue ball and 1 green ball,
N is the number of ways to select 3 balls from the set of 10 balls;

So:

$$M = \binom{2}{1}\binom{3}{1}\binom{5}{1} = 2 \cdot 3 \cdot 5 = 30;$$

$$N = \binom{10}{3} = \frac{10!}{3!\,7!} = \frac{8 \cdot 9 \cdot 10}{6} = 8 \cdot 3 \cdot 5 = 120;$$

$$P(\text{three balls are of different colours}) = \frac{30}{120} = 0.25.$$

b)

$$P(\text{two balls are of the same colour}) =$$

$$= P(\text{2 balls are red and 1 isn't red}) + P(\text{2 balls are blue and 1 isn't blue}) +$$

$$+P(\text{2 balls are green and 1 isn't green}) = \frac{P + Q + R}{N},$$

P is the number to select 2 red balls and 1 ball which is not red,
Q is the number to select 2 blue balls and 1 ball which is not blue,
R is the number to select 2 green balls and 1 ball which is not green,
N is the same as in (a);

So:

$$P = \binom{2}{2}\binom{8}{1} = 1 \cdot 8 = 8;$$

$$Q = \binom{3}{2}\binom{7}{1} = 3 \cdot 7 = 21;$$

$$R = \binom{5}{2}\binom{5}{1} = \frac{5!}{2!\,3!} \cdot 5 = 10 \cdot 5 = 50;$$

$$P(\text{two balls are of the same colour}) = \frac{8 + 21 + 50}{120} = \frac{79}{120}.$$

c)

Note that $P(\text{3 balls are red}) = 0$.

$$P(\text{all the three are of the same colour}) =$$

$$= P(\text{3 balls are red}) + P(\text{3 balls are blue}) + P(\text{3 balls are green}) = 0 + \frac{S + T}{N},$$

S *is the number of ways to select* 3 *blue balls*,
T *is the number of ways to select* 3 *green balls*,

$$N \text{ is the same as in } (a);$$

So:

$$S = \binom{3}{3} = 1;$$

$$T = \binom{5}{3} = \frac{5!}{3!\,2!} = 10;$$

$$P(\text{all the three are of the same colour}) = \frac{1+10}{120} = \frac{11}{120}.$$