

# ***Grade 12 GS***

## ***Probability ex 10***

**K.H**

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**Exercise 10:**

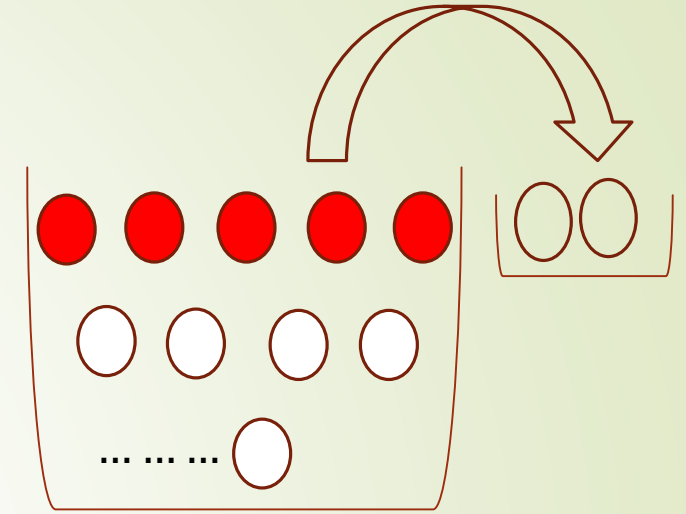
An urn U contains: urn U contains 5 red balls and  $n$  white balls, ( $n > 1$ ).

We draw simultaneously and at random two balls from the urn.

1) Calculate the probability of each of the following events:

**E:** « the two drawn balls are red »

**F:** « the two drawn balls have the same color ».



$$\begin{aligned}
 \bullet \quad P(E) &= P(2r) = \frac{C_5^2}{C_{n+5}^2} = \frac{10}{\frac{(n+5)(n+4)}{2}} = \frac{20}{(n+5)(n+4)} \\
 \bullet \quad C_n^2 &= \frac{(n)!}{2! \times (n-2)!} = \frac{(n)!}{2! \times (n-2)!} = \frac{(n) \times (n-1) \times \cancel{(n-2)!}}{2 \times \cancel{(n-2)!}} = \frac{n(n-1)}{2} \\
 \bullet \quad C_{n+5}^2 &= \frac{(n+5)!}{2! \times (n+5-2)!} = \frac{(n+5)!}{2! \times (n+3)!} = \frac{(n+5) \times (n+4) \times \cancel{(n+3)!}}{2 \times \cancel{(n+3)!}} = \frac{(n+5)(n+4)}{2} \\
 \bullet \quad P(F) &= P(2r \text{ or } 2w) = \frac{C_5^2 + C_n^2}{C_{n+5}^2} = \frac{10 + \frac{n(n-1)}{2}}{\frac{(n+5)(n+4)}{2}} = \frac{20 + n^2 - n}{(n+5)(n+4)}
 \end{aligned}$$

2) a) Knowing that the two drawn balls have same color,

prove that the probability  $p$  that both are red is  $\frac{20}{n^2-n-1}$

$$\bullet \quad P(E/F) = \frac{P(E \cap F)}{P(F)} = \frac{P(E)}{P(F)} = \frac{\frac{20}{(n+5)(n+4)}}{\frac{20+n^2-n}{(n+5)(n+4)}} = \frac{20}{n^2-n+20}$$

b) How many white balls should the urn contain so that  $p > \frac{10}{13}$ ?

$$\bullet \quad p > \frac{10}{13} \implies \frac{20}{n^2-n+20} > \frac{10}{13} \implies \frac{2}{n^2-n+20} > \frac{1}{13}$$

$n^2 - n + 20$  has no roots then it is always positive

$$\implies n^2 - n + 20 < 26$$

$$\implies n^2 - n - 6 < 0$$

$$\implies 1 < n < 3$$

$$\implies n = 2$$

