

$P_1$ : The probability that at least one die is 3.

$$P = \frac{5}{6} \text{ (3 gelmore dummies)} \quad n=5$$

$$q = \frac{1}{6} \text{ (3 gelmore dummies)} \quad x=5$$

$$\left(\frac{5}{6}\right) \cdot \left(\frac{5}{6}\right)^5 \cdot \left(\frac{1}{6}\right)^{(5-5)} = 1 \cdot \left(\frac{5}{6}\right)^5 \cdot 1 = \left(\frac{5}{6}\right)^5$$

$$\left(\frac{5}{6}\right)^5 = 0,40189$$

$$1 - 0,40189 = \boxed{0,59812}$$

(1 - Unwanted situation)

$$\binom{n}{x} \cdot p^x \cdot q^{(n-x)}$$

$n$  = (How many times the event happened)  
 $x$  = (Number of occurrences in  $n$  events)

$P_2$ : The probability that at least one die is 3 given one of the dies is even.



$A$  = At least one die is 3.

$B$  = Given one of the dies is even.

$A \cap B$  = At least one die is 3 AND at least one die is even.

$$1 - (A' \cup B') = (A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$A'$  = There will never be "3".

$$P = \frac{5}{6} \text{ (3 gelmore dummies)} \quad n=5$$

$$q = \frac{1}{6} \text{ (3 gelmore dummies)} \quad x=5$$

$$\left(\frac{5}{6}\right) \cdot \left(\frac{5}{6}\right)^5 \cdot \left(\frac{1}{6}\right)^{(5-5)} = \left(\frac{5}{6}\right)^5 = 0,40189759201$$

$B'$  = All of odd.

$$P = \frac{1}{2} \text{ (Odd probability)} \quad n=5$$

$$q = \frac{1}{2} \text{ (Even probability)} \quad x=5$$

$$\left(\frac{5}{6}\right) \cdot \left(\frac{1}{2}\right)^5 \cdot \left(\frac{1}{2}\right)^{(5-5)} = \left(\frac{1}{2}\right)^5 = 0,03125$$

$$(A' \cup B') = 0,40189759201 + 0,03125 = 0,43314759201$$

$$1 - (A' \cup B') = (A \cap B) = 0,56685240799$$

$$P(B) = 1 - \left(\frac{1}{2}\right)^5 = 0,96875$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0,56685240799}{0,96875} = \boxed{0,5851586353445}$$

$P_3$ : The probability that at least one die is 3 given only one of the dice is even.

$$P = \frac{2}{3} \binom{3}{1} n=4$$

$$q = \frac{1}{3} \binom{3}{1} x=4$$

Out of 5 dice, only one is even, the rest is odd  
 $n=4$  because we eliminate one die directly.

$$\binom{4}{1} \cdot \left(\frac{2}{3}\right)^1 \cdot \left(\frac{1}{3}\right)^{4-1} = \frac{16}{81}$$

$$1 - \frac{16}{81} = \frac{65}{81} = \boxed{0.8024691}$$