

# Assignment 1

**AI1110:** Probability and Random Variables  
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**12.13.6.7: Question.** A die is thrown again and again until three sixes are obtained. Find the probability of obtaining the third six in the sixth throw of the die.

**Answer:**  $\frac{625}{23328}$ .

**Solution:**

Probability of obtaining a six in the throw of a die =  $\frac{1}{6}$

Let  $X$  be a random variable representing the number of sixes obtained in the first five throws of the die.

$$x \in \{0, 1, 2, 3, 4, 5\}$$

$$P(X = x) = {}^5C_x \times \left(\frac{1}{6}\right)^x \times \left(\frac{5}{6}\right)^{(5-x)}$$

where  $x$  is the possible value of  $X$ .

$x$	0	1	2	3	4	5
$P(X=x)$	$\left(\frac{5}{6}\right)^5$	${}^5C_1 \times \frac{1}{6} \times \left(\frac{5}{6}\right)^4$	${}^5C_2 \times \left(\frac{1}{6}\right)^2 \times \left(\frac{5}{6}\right)^3$	${}^5C_3 \times \left(\frac{1}{6}\right)^3 \times \left(\frac{5}{6}\right)^2$	${}^5C_4 \times \left(\frac{1}{6}\right)^4 \times \frac{5}{6}$	$\left(\frac{1}{6}\right)^5$

Let  $E_1$ : Event that two sixes are obtained in first five throws of the die

$E_2$ : Event that a six is obtained at the sixth throw of the die

Event that both  $E_1$  and  $E_2$  occur is favourable

$$P(E_1 E_2) = P(E_1) \times P(E_2)$$

[ $\because$  The events  $E_1$  and  $E_2$  are independent]

$$P(E_1 E_2) = P(X = x) \times \frac{1}{6}$$

$$P(E_1 E_2) = \frac{625}{23328}$$