AI1103 : Assignment 2

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PROBLEM(GATE 8)

Consider a dice with the property that the probability of a face with n dots showing up is proportional to n. The probability of the face with three dots showing up is....

SOLUTION(GATE 8)

Let X be random variable.
$X \in \{1,2,3,4,5,6\}$
Given that the probability of a face with n dots is proportional to n, Let $p_X(n)$ denote the probability of showing up n. As $p_X(n)$ is proportional to n, we have

$$p_X(n) = \begin{cases} kn & 1 \le n \le 6 \\ 0 & otherwise \end{cases} \tag{8.1}$$

Where k is some real constant.

n	1	2	3	4	5	6
$p_X(n)$	k	2k	3k	4k	5k	6k

We know that,

$$\sum_{n=1}^{6} p_X(n) = 1 \tag{8.2}$$

By substituting the values in 8.2, we have

$$k + 2k + 3k + 4k + 5k + 6k = 1 \tag{8.3}$$

$$\implies 21k = 1 \tag{8.4}$$

$$\implies k = \frac{1}{21} \tag{8.5}$$

Probability of the face with three dots showing up

$$\implies p_X(n = 3) = 3k \tag{8.6}$$

$$\implies p_X(n = 3) = \left(\frac{1}{21}\right) \tag{8.7}$$

$$\implies p_X(n = 3) = \frac{1}{7} \tag{8.8}$$

Therefore the probability of the face with three dots showing up is 0.143.
The below figure shows the probability distribution of the dice.