Assignment 1

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Download all python codes from

https://github.com/CS20BTECH11054/AI1103/blob/main/Assignment_2/codes/Assignment_2.py

and latex-tikz codes from

https://github.com/CS20BTECH11054/AI1103/blob/main/Assignment_2/Assignment_2.tex

1 Problem

(Prob, 5.30) Find the variance of the number obtained on a throw of an unbiased die

2 Solution

Let $X \in \{1, 2, 3, 4, 5, 6\}$, be the random variable representing outcome of the die.The probability mass function(pmf) can be expressed as

$$p_X(n) = P(X = n) = \begin{cases} \frac{1}{6} & 1 \leq n \leq 6 \\ 0 & otherwise \end{cases} \tag{2.0.1}$$

The variance (Var(X)) of this distribution can be found by definition,

$$Var(X) = E(X^2) - (E(X))^2 \tag{2.0.2}$$

where,

$$E(X) = \sum_{k=1}^{k=6} k p_X(k) \tag{2.0.3}$$

$$E(X) = \frac{1}{6} \sum_{k=1}^{k=6} k \tag{2.0.4}$$

$$E(X) = \frac{1}{6} \times \frac{6 \times 7}{2} \tag{2.0.5}$$

$$E(X) = \frac{7}{2} \tag{2.0.6}$$

$$E(X^2) = \sum_{k=1}^{k=6} k^2 p_X(k) \tag{2.0.7}$$

$$E(X^2) = \frac{1}{6} \sum_{k=1}^{k=6} k^2 \tag{2.0.8}$$

$$E(X^2) = \frac{1}{6} \times \frac{6 \times 7 \times 13}{6} \tag{2.0.9}$$

$$E(x^2) = \frac{91}{6} \tag{2.0.10}$$

Therefore, substituting values from Eq.(2.0.6) and Eq.(2.0.10), we get

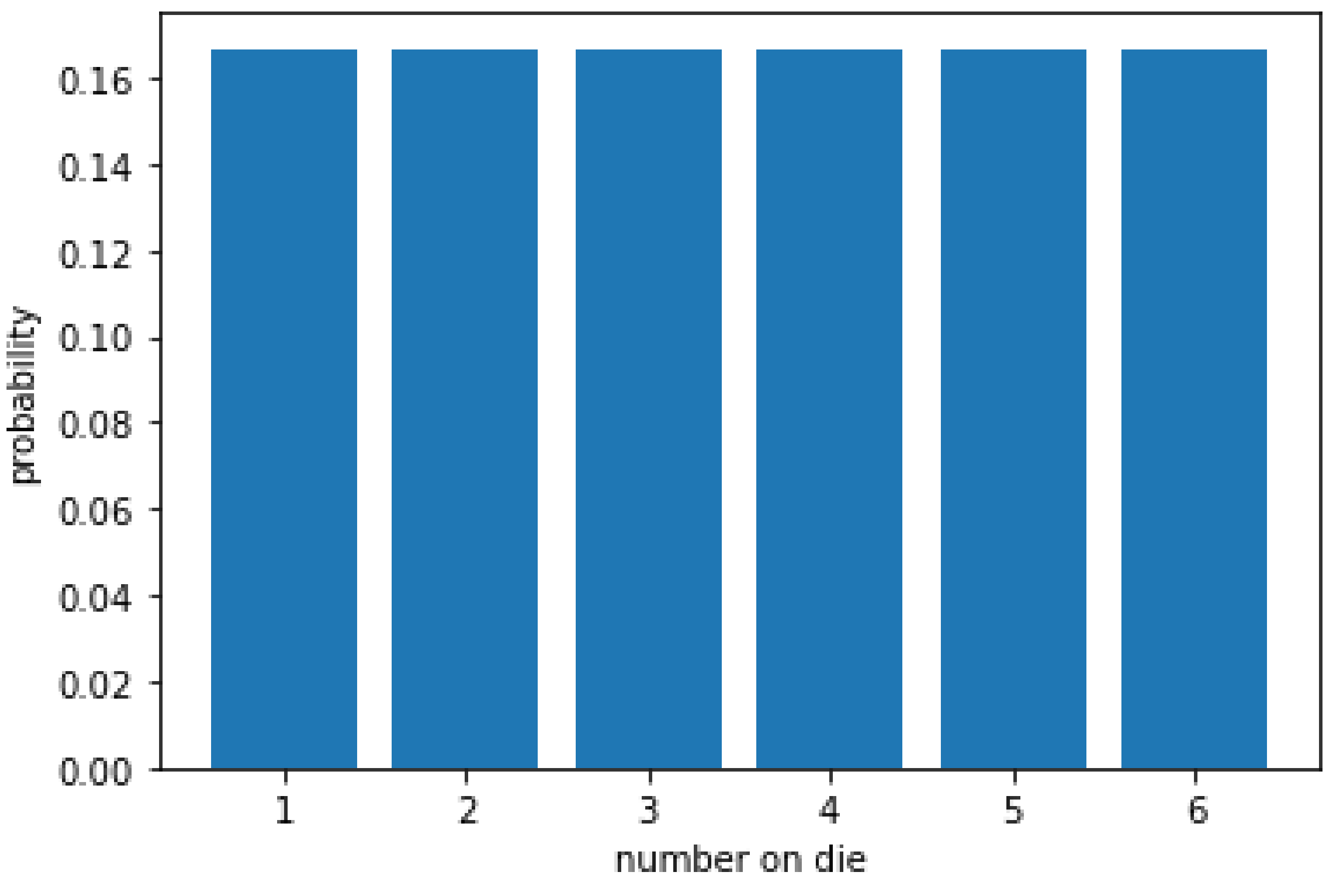
$$Var(X) = E(X^2) - (E(X))^2 \tag{2.0.11}$$

$$Var(X) = \frac{91}{6} - \frac{49}{4} \tag{2.0.12}$$

$$Var(X) = \frac{70}{12} \tag{2.0.13}$$

$$Var(X) = 2.9167 \tag{2.0.14}$$

Therefore, the variance of the number obtained on a throw of an unbiased die is **2.9167**.


0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
probability
1
2
3
4
5
6
number on die