AI1103–Assignment-3

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Download all python codes from

https://github.com/AravindCSEiith/Probability−and−Random−variables_AI1103_Asignment−3/blob/main/Assignment−3−−AI1103.py

and latex-tikz codes from

https://github.com/AravindCSEiith/Probability−and−Random−variables_AI1103_Asignment−3/blob/main/Assignment−3−−AI1103.tex

Question

Let X be a random variable such that $E(X) = E(X^2) = 1$. Then $E(X^{100})$ =?
(A)0
(B)1
(C)2^{100}
(D)$2^{100} + 1$

Solution

Let $x_1, x_2, x_3, ..., x_n$ be the random values that 'X' take.

$$Var(X) = E(X^2) - (E(X))^2 \tag{0.0.1}$$
$$= 1 - (1)^2 \tag{0.0.2}$$
$$= 0 \tag{0.0.3}$$

$$Var(X) = \frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n} \tag{0.0.4}$$
$$0 = \frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n} \tag{0.0.5}$$
$$0 = \sum_{i=1}^{n}(x_i - \bar{X})^2 \tag{0.0.6}$$
$$x_1 = x_2 = x_3 = ... = x_{n-1} = x_n = \bar{X} = E(X) = 1 \tag{0.0.7}$$

$$E(X^{100}) = \frac{\sum_{i=1}^{n}(x_i)^{100}}{n} \tag{0.0.8}$$
$$= \frac{\sum_{i=1}^{n}(1)^{100}}{n} \tag{0.0.9}$$
$$= \frac{\sum_{i=1}^{n}1}{n} \tag{0.0.10}$$
$$= \frac{n}{n} \tag{0.0.11}$$
$$= 1 \tag{0.0.12}$$

Answer : Option B

Therefore, $E(X^{100}) = 1$