AI1103-Challenging Problem 1

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Latex codes :

https://github.com/CS20BTECH11004/AI1103/blob/main/Challenging%20Problem%201/Challenging%20Problem%201.tex

Question: Challenging Problem 1

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

$$\rho^2 = E[X^2] - E[X]^2 \tag{0.0.1}$$
$$= 1 - 1^2 \tag{0.0.2}$$
$$= 0 \tag{0.0.3}$$

$\therefore$ X is constant and equal to 1
Thus we can conclude that

$$E[X^{100}] = \sum X^{100} \Pr(X) \tag{0.0.4}$$
$$= 1 \tag{0.0.5}$$

Solution: Option B