15. Exercise: Correlation coefficient

Exercises due Mar 25, 2020 05:29 IST *Completed*

Exercise: Correlation coefficient

1/1 point (graded)

It is known that for a standard normal random variable X, we have $\mathbf{E}[X^3] = 0$, $\mathbf{E}[X^4] = 3$, $\mathbf{E}[X^5] = 0$, $\mathbf{E}[X^6] = 15$. Find the correlation coefficient between X and X^3. Enter your answer as a number.

0.7746 ✔ **Answer:** 0.77460

Solution:

Since $\mathbf{E}[X] = \mathbf{E}[X^3] = 0$, we have $\mathsf{Cov}(X, X^3) = \mathbf{E}[X \cdot X^3] = \mathbf{E}[X^4] = 3$. Furthermore, since $\mathsf{Var}(X) = 1$ and $\mathsf{Var}(X^3) = \mathbf{E}[X^6] = 15$, we obtain

$$\rho(X, X^3) = \frac{3}{\sqrt{1} \cdot \sqrt{15}} = \sqrt{3/5}.$$

Interestingly, even though the random variables are strongly dependent (the value of one determines the value of the other), the value of the correlation coefficient is moderate.

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Answers are displayed within the problem

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