6. Exercise: Chebyshev versus Markov

Exercises due May 1, 2020 05:29 IST *Completed*

Exercise: Chebyshev versus Markov

2/2 points (graded)

Let X be a random variable with zero mean and finite variance. The Markov inequality applied to $|X|$ yields

$$\mathbf{P}\big(|X| \geq a\big) \leq \frac{\mathbf{E}\big[|X|\big]}{a},$$

whereas the Chebyshev inequality yields

$$\mathbf{P}\big(|X| \geq a\big) \leq \frac{\mathbf{E}[X^2]}{a^2}.$$

a) Is it true that the Chebyshev inequality is stronger (i.e., the upper bound is smaller) than the Markov inequality, when a is very large?

Yes ✔ **Answer:** Yes

b) Is it true that the Chebyshev inequality is always stronger (i.e., the upper bound is smaller) than the Markov inequality?

No ✔ **Answer:** No

Solution:

a) Yes, because for very large a, the term $1/a^2$ will be much smaller than $1/a$.

b) No. For example, suppose that $a = 1$. It is certainly possible to have $\mathbf{E}[X^2] > \mathbf{E}[|X|]$, in which case the Markov inequality provides a stronger bound.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

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? "Very large" should be more clarified 5
I think "a is very large" should be replaced with "a is large enough but does not go to infinity" Because "a...

? In the answer to a), shouldn't we also need to say something about the expectations? 1 new 9

hint 1

Is it not true that Markov inequality applies only for non-negative RVs? 2

Probability > 1 2
I realize it violates the probability axioms e.t.c, but what is the interpretation (if any) of these inequalities ...