



[Course](#) > [Topic 1...](#) > [10.2 Ch...](#) > Chebys...

Chebyshev's Inequality Video

[Start of transcript. Skip to the end.](#)



- Hello and welcome back.
In the last lecture we talked about Markov's inequality, and as we said then, it's the basis of many other inequalities and today we're going to talk about one of these, which is Chebyshev's inequality.
Chebyshev was actually



10.2_Chebyshev

POLL

Which of the following is correct about Chebyshev's inequality?

RESULTS

☐ None of the above

67%

- ☒ It only applies to non-negative distribution 20%
- ☐ It only applies to continuous distribution 11%
- ☐ It only applies to discrete distribution 1%

Submit

Results gathered from 134 respondents.

FEEDBACK

Chebyshev's inequality applies to all of those distributions.

1

0 points possible (ungraded)

Apply Chebyshev's Inequality to lower bound $P(0 < X < 4)$ when $E(X) = 2$ and $E(X^2) = 5$.

6

✗ Answer: 0.75

6

Explanation

Note that $P(0 < X < 4) = P(|X - 2| < 2) = 1 - P(|X - 2| \geq 2)$

Also, $V(X) = E(X^2) - E^2(X) = 5 - 2^2 = 1$

By Chebyshev's Inequality, $P(|X - 2| \geq 2) = P(|X - E(X)| \geq 2) \leq \frac{V(X)}{2^2} = \frac{1}{4}$

Hence, $P(0 < X < 4) = 1 - P(|X - 2| \geq 2) \geq 1 - \frac{1}{4} = \frac{3}{4}$

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

2

0 points possible (ungraded)

The average number of spelling errors on a page is 5 and the standard deviation is 2. What is the probability of more than 20 mistakes on a page?

- ☐ no greater than 1%

☒ no greater than 2% ✓

☐ no greater than 5%

☐ no greater than 10%

Explanation

Using Chebyshev's inequality, we have

$$P(X > 20) < P(X \geq 20) = P(X - 5 \geq 15) = P(|X - 5| \geq 15) \leq \left(\frac{2}{15}\right)^2 \leq \frac{1}{50} = 2\%$$

P.S. Since we cannot get negative number of mistakes, $P(X - 5 \leq -15) = 0$ Hence,
 $P(|X - 5| \geq 15) = P(X - 5 \geq 15) + P(X - 5 \leq -15) = P(X - 5 \geq 15)$

Submit

You have used 1 of 2 attempts

i Answers are displayed within the problem

3

4.0/6.0 points (graded)

Let $X \sim \text{Exponential}(1)$. For $P(X \geq 4)$, evaluate:

- Markov's inequality,

0.25 ✓

0.25

- Chebyshev's inequality,

0.111111111 ✓

0.111111111

- the exact value.

2.718281828 ✗

2.718281828

Submit

You have used 4 of 4 attempts

4

0 points possible (ungraded)

A gardener has new tomato plants sprouting up in her garden. Their expected height is 8", with standard deviation of 1". Which of the following lower bounds the probability that a plant will be between 6" and 10" tall?

☐ 10% ✓☐ 25% ✓☐ 50% ✓☒ 75% ✓

✗

Explanation

By Chebyshev's Inequality, $P(|X - 8| \geq 2) \leq \frac{V(X)}{4} = \frac{1}{4}$ Hence
 $P(6 \leq X \leq 10) = 1 - P(|X - 8| \geq 2) \geq 1 - \frac{1}{4} = \frac{3}{4} = 75\%$
Since the probability is at least 75%, it is also at least 50%, etc.

Submit

You have used 2 of 2 attempts

i Answers are displayed within the problem

5

0.0/2.0 points (graded)

If $E(X) = 15$, $P(X \leq 11) = 0.2$ and $P(X \geq 19) = 0.3$, which of the following is impossible?

☐ $V(X) \leq 7$ ✓☒ $V(X) \leq 8$ ✗

☐ $V(X) > 8$

☐ $V(X) > 7$

Explanation

According to Chebyshev's inequality, $P(|X - 15| \geq 4) \leq \frac{V(X)}{16}$. As $P(|X - 15| \geq 4) = P(X \leq 11) + P(X \geq 19) = 0.5$, we have $V(X) \geq 8$.

Submit

You have used 2 of 2 attempts

i Answers are displayed within the problem

Discussion













Hide Discussion

Topic: Topic 10 / Chebyshev's

Add a Post

Show all posts ▼

by recent activity ▼

 Problem 4 Questions and comments regarding problem 4.  Staff	3
 <u>Problem 2</u> <u>Questions and comments regarding problem 2.</u>  Staff	5
 <u>Problem 5</u> <u>Questions and comments regarding problem 5.</u>  Staff	2 new_ 6
 <u>General Comments</u> <u>Questions and comments regarding this section.</u>  Staff	3
 <u>Problem 1</u> <u>Questions and comments regarding problem 1.</u>  Staff	1
 <u>Problem 3</u> <u>Questions and comments regarding problem 3.</u>  Staff	1

