4. Variance of Estimators

Variance of Estimators

less than one half

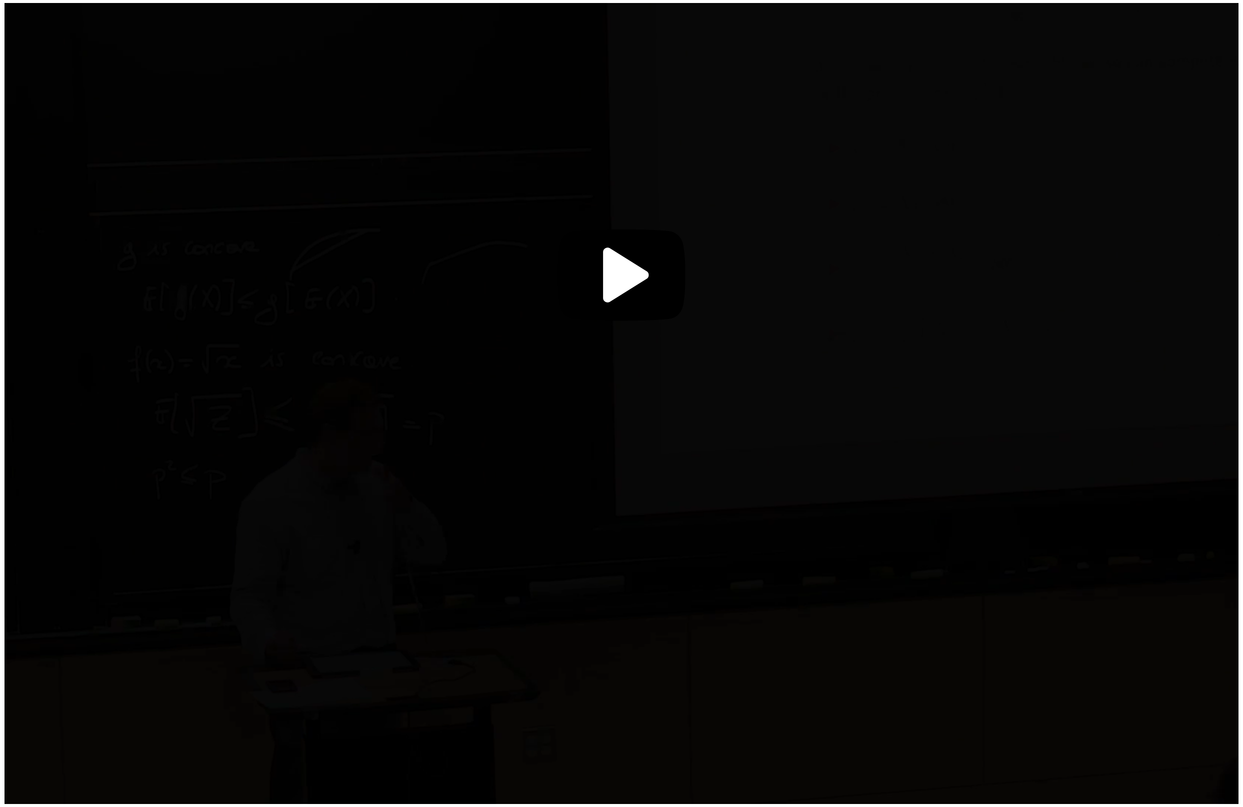
or larger than one half.

So it might be if p is larger than 1/2,

this one has less variance.

If p is smaller than 1/2, this one has less variance.

Keep this picture in mind. p 1 minus p



will be a function that we want to know a little bit.

Any questions about those bias and variance computations?

End of transcript. Skip to the start.

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Variance of the Sample Mean

1/1 point (graded)

Again, let $X_1, \ldots, X_n \stackrel{iid}{\sim} \mathcal{U}([a, a+1])$ where a is an unknown parameter. In terms of n, what is the variance of the estimator $\overline{X}_n$?

Var $\left[\overline{X}_n\right] =$ 1/(12*n) ✔ **Answer:** 1/(12*n)

$\frac{1}{12 \cdot n}$

Solution:

Since $X_1, \ldots, X_n$ are independent, the variance is additive. Hence,

$$\mathrm{Var}\left(\overline{X}_n\right) = \frac{1}{n^2} \sum_{i=1}^{n} \mathrm{Var}\left(X_i\right) = \frac{1}{n} \mathrm{Var}\left(X_1\right)$$

Note that we used the fact that the X_i's are identically distributed. Next,

$$\mathrm{Var}\left(X_1\right) = \mathbb{E}\left[X_1^2\right] - \left(\mathbb{E}\left[X_1\right]\right)^2 = \int_a^{a+1} x^2\, dx - \left(a + \frac{1}{2}\right)^2 = a^2 + a + 1/3 - a^2 - a - 1/4 = 1/12.$$

Hence,

$$\mathrm{Var}\left(\overline{X}_n\right) = \frac{1}{n}\mathrm{Var}\left(X_1\right) = \frac{1}{12n}.$$

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Answers are displayed within the problem

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Is computation in the end of the segment correct? What is smaller: p(1-p) vs. p^2(1-p^2)? 10

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