Take a look at this (LINK) lecture video, up until 1:00 or so. The point is that for any finite n, including even $n = 1$ or $n = 2$, your statistic T_n comes with a non-asymptotic test if its distribution does not depend on the common underlying distribution of the original samples.

Asymptotic test example: $X_1, \ldots, X_n \sim_{iid} \text{Uniform}(0, a)$. Test the hypothesis $(H_0 : a = 1)$ against $(H_1 : a \neq 1)$.

Let $T_n = \sqrt{n}(\overline{X}_n - 5)$, and consider the level α two-sided test $T_n > q_{\alpha/2}(\mathcal{N}(0, 1))$.

However, T_5 is not Gaussian. Its distribution depends on a (in fact, its support depends on a) so it cannot be a *non*-asymptotic test.

However, $T_n \to_D \mathcal{N}(0, 1)$ under H_0. So this is an asymptotic test.

If somehow you came up with a statistic T_n whose distribution did not depend on the true value of a, then it would come with a **non-asymptotic test**.

KS/KL tests do not rely on Gaussian distributed statistics to begin with. They come with explicitly characterized distributions.

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[staff] Definition of an asymptotic test

question posted a day ago by **Nimnath** (Community TA)

What is the definition of an asymptotic test?

My understanding was that an asymptotic test is only valid when the sample size is adequate, and an exact test is valid for small samples sizes too. But the explanations given in the solutions suggest otherwise. See below.

In the solution to the penultimate question:

"Note however, for any fixed n, the distribution of T_n is not pivotal. Hence, a test designed in this form is inherently **non-asymptotic.**"

In the solution to the last question.

"Therefore, this test is **not asymptotic**, because we do not know the distribution of the test statistic."

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SaeyoungRho (Staff)
a day ago

Asymptotic means it approaches to something as n goes to infinity. If it is possible to have a large number of samples, we can use the asymptotic theory in statistics. However, when we do not have enough observations, we cannot rely on asymptotic features. Remember that CLT, LLN show how the statistic behaves asymptotically. In the last part, "Therefore, this test is not asymptotic, because we do not know the distribution of the test statistic." <- this means, we do not know the exact distribution when n is small. Now I see what triggered your confusion. I will update this solution, and I believe you have a good understanding of the asymptotic test.

Thank you for the clarification, Saeyoung. What asymptotic means is clear. The confusion I have is here: The χ^2 test in this scenario is valid only when n goes to infinity. But we say that the test is not asymptotic.

posted about 22 hours ago by **Nimnath** (Community TA)

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mrBB (Community TA)
about 19 hours ago

It seems clear to me the sentence you quote from the last exercise either contains a typo ("not" should be "only", just like in the sentence above) or shouldn't be there at all.

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