Re: Simple binomial test question

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- *From*: Ken Butler <butler@xxxxxxxxxxxxxxx>
- *Date*: Thu, 26 Apr 2007 12:22:57 −0400

On Thu, 26 Apr 2007 15:47:51 GMT, "JPK"
<POISTA_AUTO_juhafiatkettunen@xxxxxxxxxxxxxxxxxx> wrote:

> Hi, very simple I know, but just want to check that I think correctly.

More or less, but making sure that you use the standard terminology will go a long way towards convincing others that you know what you're talking about:

> the problem:
> "A coin is tossed 10 times and 2 heads are obtained. Test Weather the coin is biased."
>
> So Definitely we are using binomial distribution, isnt it? so

Check your assumptions for a binomial distribution: fixed number of trials (yes, 10 coin tosses), independent trials (yes, one coin toss result doesn't influence others), same probability of success on each trial (yes, 0.5), all under the assumption that the coin is fair.

> null hypothesis: "We get 5 heads"
>
> alternative hypothesis: "head number<>5"

This is important: your hypotheses have to be statements about the *population*. If you have hypotheses about the sample, as here, you could decide immediately whether they're true or false based on the sample results you get, which would avoid the need for doing a test at all, and that doesn't make much sense. So your hypotheses need to be about the *coin* itself. Let's write p for the probability that a single toss of this coin comes up heads. Then:

null hypothesis: the coin is fair, p=0.5
alternative hypothesis: the coin is biased, p <> 0.5.

> So its gonna be 2−tailed test.

Indeed. At this point you should really choose a value for "alpha" (which is the probability of rejecting the null hypothesis when it is true, something you would like to avoid doing). 0.05 is a common choice [*].

> So if I calculate propabilities to get 0,1,2
> and add them I get the test value (which is about 0.054).

The usual terminology here is P−value. "Test value" doesn't really mean anything.

> But using 2−tailed
> 95% confidence level test, the first tail is located at 0.025 and the right tail is at 0.975.

Here you're making it more complicated than you need to. Forget about confidence intervals −− you're not getting an interval, you're doing a test.

> Becouse 0.054 is more than 0.025 , the null hypothesis
> remains, so we cannot say that the coin is biased.

I like this way: do the calculation you did before to get 0.054. Note that the test is two−tailed, so multiply this by 2 to get the P−value: 2 x 0.054 = 0.108.

Compare the P−value with the alpha you chose before, say 0.05. The P−value is bigger than alpha, so the null hypothesis is *retained* or *not rejected*. Your 10 coin toss results do not provide strong enough evidence to conclude that the coin is biased.

[*] You could choose whatever value you like for alpha. 0.05 is a common compromise between wanting to retain the null hypothesis when it is true, and wanting to reject the null hypothesis when it is false. If you choose a larger value for alpha, you will often be rejecting the null hypothesis when it is false, and if you choose a smaller value, you will rarely be able to reject the null hypothesis

at all, even when it is false.

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Ken Butler, Lecturer (Statistics)
University of Toronto at Scarborough
butler (at) utsc.utoronto.ca
http://www.utsc.utoronto.ca/~butler
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