Stats. Inference Homework #2

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9.66 Exploring Type II Errors

Refer to the web app from Activity 2 at the end of this section, now assuming that we are using the two-sided test $H_0 : p = 0.33$ against $H_a : p \neq 0.33$.

a. Explain the effect of increasing the sample size on the probability of a Type II error when the true $p = 0.50$.

Solution a.

As sample size increases, the probability of a Type II error decreases. This is because as sample size increases, value of the null hypothesis p_0 falls increasingly more standard deviations from the mean.

b. Use the app to find the sample size needed to achieve a power of at least 90% when truly $p = 0.5$.

Solution b.

A sample size of 84 is suffcient to achieve a power of at least 90%.

c. For a fixed sample size, do you think the probability of a Type II error will increase or decrease when the true p is 0.40 instead of 0.50? Check your answer with the app.

Solution c.

I think that for a fixed sample size, the probability of a Type II error will increase when the true p is 0.40 instead of 0.50. This is because the center of the H_a distribution will be closer to the value p_0 of the null hypothesis.

Indeed, it is true!

d. Does the power increase or decrease when the significance level is 0.10 instead of 0.05? Check your answer with the app.

Solution d.

The power increases when the significance level is 0.10 instead of 0.05. This is because by increasing our significance level, we are decreasing the radius around p_0 under which we compute the area under the H_a distribution. This decreases the Type II error probability, increasing the Power.