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R&W
Red and White
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L'abus d'alcool est dangereux. Consommez avec modération

Story line

You play the role of a statistical consultant for the fictional Merry-a-Lot chain of hotels, whose recent marketing experiment involves offering a free half-carafe of house wine to any group of patrons ordering dinner. The inventor of the experiment, advertising executive Shara Glass, believes that the free wine will encourage patrons to stay longer at the restaurant, creating a more inviting atmosphere for other potential patrons in addition to spending more money themselves.

Rather than studying the effect on the income from each recipient, which she considers too narrow in scope, or on the total income of the restaurant, which she considers too variable, she wants to study the impact of this “free-wine (and fee-dine)” strategy on the length of time spent by patrons in the restaurant.

(1) Apéritif:

Suppose that Shara Glass asks you to analyze the average times for patron visits reported by 42 Merry-a-Lot hotels participating in the marketing experiment (offering the free half-carafe of house wine with dinner). She would like to compare the mean for these hotel restaurants to the benchmark of 88 minutes, as determined from a previous study of locations not offering free wine. A visual summary of the data would also be nice. (Data_1)

http://www.mastermarketingdauphine.com/charge/ADD/ADD_test/Data_1.doc

(2) Starter:

A few weeks after reporting your findings to Shara, you receive a bouquet of flowers in appreciation. Attached is a small note:

I discovered that each restaurant only stocks one variety of house wine at a time. I wonder if it matters whether it's red or white. Perhaps you'd consider extending your consulting services by checking this out for me. I figured out the types of wine used at those same restaurants you analyzed before. (Data_2).

http://www.mastermarketingdauphine.com/charge/ADD/ADD_test/Data_2.doc

(3) Main course:

You find a cordial letter from Shara Glass in your mailbox a few days later:

I figured I'd present a one-sided version of that original analysis at our next executive meeting. I don't think anyone will question the assumption that the free wine would increase the average patron visit time if it differed at all. Since I can report a higher lower bound with a one-sided confidence interval, can you please produce one for me? And I figure the new p-value will be 0.0091 or 0.0092, but I can't tell which by just looking at my printout from last time. (Neal from Decision Support might care about that fourth decimal place.)

(4) Cheese:

Once again you receive a gift from Shara Glass, a basket of fruit. A polite little note is attached:

The folks at the meeting were interested in that red/white comparison from before, but not for the reasons I had guessed. They're encouraged by the overall increase in patron visit lengths, but they're hoping for a lack of a distinction between red and white wines. Apparently the restaurant managers prefer to choose their wine type based on changing trends and supplier

discounts. So folks are looking for a reason to downplay the importance of wine type when it comes to getting patrons to stay a little longer. I was about to reassure them by reminding them how insignificant that p-value was (around 0.5), but then I realized that it doesn't really prove anything about the similarity of red and white wines...it only demonstrates that we didn't have enough evidence to conclude a significant difference! Neal from Decision Support proposed a toast when I told him that, but I'm not sure why, since we weren't drinking anything at the time.

You chuckle at the last sentence, realizing that Neal was on the right track. So you write back to Shara proposing a “TOST” and ask her to decide what length of patron visit time she and her colleagues would consider a minimally meaningful difference in comparing red and white wines. She settles on a criterion of a 10-minute difference (in either direction). So, you should use -10 and 10 as equivalence bounds, defining the null and alternative hypotheses as follows:

$$H_0: \mu_{\text{diff}} < -20 \text{ or } \mu_{\text{diff}} > 20$$

$$H_1: -20 \leq \mu_{\text{diff}} \leq 20$$

where μ_{diff} is the mean visit length with red wine minus the mean visit length with white wine.

(5) Dessert:

A large package arrives at your door a month later. You discover that Shara has sent you the oakiest gift yet, a tree. There is, of course, a note attached:

I hope you know I'm not harboring any tannins about the insignificant results in both of the red/white analyses you did for me. I realize the sample size was probably too low to achieve enough power for those tests. I'd have to be insane to blame a statistician who wasn't even consulted during the design phase!

We've done a confirmatory study on the free-wine strategy. This time we asked 30 restaurants to offer the free half-carafe for a period of two months, then spend a month offering it only to patrons who happened to ask about it, then discontinue the practice for the following two months. Another 30 restaurants did the same thing but with the order reversed. They all reported the average patron visit lengths during each of the two-month periods. Hopefully this has reduced the variability from the previous study. And now we have a control group to improve the legitimacy of the results too. (Data_3).

http://www.mastermarketingdauphine.com/charge/ADD/ADD_test/Data_3.doc

Appendice

Tost : <http://hrcak.srce.hr/file/69411>
<http://www2.sas.com/proceedings/sugi29/154-29.pdf>

Equivalence test : http://www.graphpad.com/library/BiostatsSpecial/article_182.htm

Data manipulation :

Data_2 http://www.mastermarketingdauphine.com/charge/ADD/ADD_test/Wine_2_1.sas