Lab Week 9

October 22, 2019

1 Problem 1

Supposed we want to test how random a coin flipping simulator is. In order to test this, we run the simulator 50 times and record the number of heads.

1. Write out the null and alternative hypotheses corresponding to this research question.

2. In one sample of 50, suppose we obtained 30 heads. Peform the five steps of the hypothesis test at level 0.05 corresponding to the hypotheses in 1. State the conclusion clearly about the how random this simulator is.

3. Perform this test in R using `prop.test()` function.

4. Using the R output, provide a 95% CI for p. Combine with the hypothesis test, what do you observe?

5. Suppose instead we believed the simulator flipped more heads than tails. Redo the hypothesis test starting at 1, what has changed?

2   Problem 2

A 2006 study considered whether dogs could be trained to detect lung or breast cancer by the smell of a subjects breath. Five ordinary household dogs were trained to distinguish, by scent alone, exhaled breath samples of 55 lung cancer patients and 31 breast cancer patients from those of 83 control patients. Once trained, researchers tested the dogs abilities to detect cancer on a new set of samples not previously encountered by the dogs. They had each dog try to identify the one cancer sample (where a sample is exhaled breath) from a set of five samples; one of which was from a cancer patient, four of which were from controls. Let p denote the probability a dog correctly detects the cancer sample from the five samples.

1. Write out the null and alternative hypotheses corresponding to whether the dog's prediction is better than random guessing in the researcher's test.

2. In one sample of 83, (where a set is the five patients, one of whom had cancer), the dogs correctly identified the cancer sample 81 times. Perform the five steps of the hypothesis test corresponding to the hypotheses you stated in the previous part. Use alpha=0.05. State your conclusion clearly about the dogs ability to detect cancer.

3. Perform this test in R using `prop.test()` function.

4. Using the R output, provide a 95% CI for p. Combine with conclusion of the hypothesis test, what do you observe?

5. Suppose instead the dogs correctly identified the cancer sample 20 times. Redo 3 and 4.