

Discussion 4

Practice Problem

1. A group of researchers tested whether snakes tend to choose a warm resting site when both a warm site and a cool site are presented to them. Their hypotheses were H_0 : Snakes do not prefer the warmer site. H_A : Snakes prefer the warmer site. They carried out the experiment and with their data calculated a one-tailed P -value of $P = 0.03$. They rejected their null hypothesis and concluded that snakes prefer the warmer sites.
 - a. Is one-tailed test appropriate here? Explain.
 - b. What would their hypothesis statements have been had they use a two-tailed test instead?
 - c. What would their P -value have been had they used a two-tailed test instead?
2. In a test of Murphy's Law, pieces of toast were buttered on one side and then dropped. Out of 9821 total slices of toast dropped, 6101 landed butter-side down. Is it reasonable to believe that there is a 50:50 chance of the toast landing butter-side down or butter-side up? State hypotheses, find a test statistic, and compute the p -value. What is your conclusion?
3. A bag contains five pebbles. Three of these pebbles are black and two are white. For each of the following questions, the bag starts again in this state.
 - a. One pebble is randomly chosen from the bag. What is the probability that it is white?
 - b. One pebble is drawn from the bag and *not replaced*. The first pebble is black. What is the probability that a second randomly drawn people is white?
 - c. A pebble is drawn randomly from the bag and then returned to the bag, its color is recorded two more times (for a total of three draws). What is the probability that all three pebbles are black?
 - d. A pebble is drawn from the bag at random, its color is recorded, and then *it is not replaced in the bag*. A second pebble is drawn at random, and it is also not replaced. Finally, a third pebble is drawn from the bag. What is the probability that all three of these pebbles are black?
 - e. Why are the answers to parts (c) and (d) different?
4. An observational study investigates the connection between aspirin use and three vascular conditions – gastrointestinal bleeding, primary stroke, and cardiovascular disease – using a group of patients exhibiting these disjoint conditions with the following **prior probabilities**: $P(\text{GI bleeding}) = 0.2$, $P(\text{Stroke}) = 0.3$, and $P(\text{CVD}) = 0.5$, as well as with the following **conditional probabilities**: $P(\text{Aspirin}|\text{GI bleeding}) = 0.09$, $P(\text{Aspirin}|\text{Stroke}) = 0.04$, and $P(\text{Aspirin}|\text{CVD}) = 0.02$.
 - (a) Calculate the following **posterior probabilities**: $P(\text{GI bleeding}|\text{Aspirin})$, $P(\text{Stroke}|\text{Aspirin})$, and $P(\text{Aspirin}|\text{CVD})$.
 - (b) Interpret: Compare the prior probability of *each* category with its corresponding posterior probability. *What conclusion can you draw?* Be as specific as possible.