1. Consider a disease that is found in 0.5% of the population, with a test for this disease that gives a correct diagnosis 90% of the time. Suppose a person is randomly chosen from the population and given a first test. If the first test is positive, then the person is given a second test.

(a) Compute the probability that the first test is positive given that the person is infected with the disease.

(b) Compute the probability that both tests are positive given that the person is infected with the disease.

(c) Compute the probability that the person is infected given that the first test is positive.

(d) Compute the probability that the person is infected given that both tests are positive.

2. You know that a certain letter is equally likely to be in anyone of three different folders. Let $\alpha_i$ be the probability that you will find your letter upon making a quick examination of folder $i$ if the letter is, in fact, in folder $i, i = 1, 2, 3$. (We may have $\alpha_1 \leq 1$.) Suppose you look in folder 1 and do not nd the letter. What is the probability that the letter is in folder 1?

3. In a certain species of rats, black dominates over brown. Suppose that a black rat with two black parents has a brown sibling.

(a) What is the probability that this rat is a pure black rat (as opposed to being a hybrid with one black and one brown gene)?

(b) Suppose that when the black rat is mated with a brown rat, all 5 of their offspring are black. Now, what is the probability that the rat is a pure black rat?

4. A tour bus can only hold a maximum of 100 people, and assume that the tour bus company sells 110 tickets because each passenger has a 10% probability (independently of other passengers) of not showing up for the flight. What is the probability that there are enough seats for all passengers that show up for the trip? (Hint: It is not necessary to mathematically simplify the answer).
5. For each of the following scenarios, would you (i) accept the null hypothesis, (ii) reject the null hypothesis, or (iii) gather additional data and information before making a decision? Explain your reasoning. Note: The numbers in the scenarios below are fictional.

(a) The null hypothesis is that hospitals using paper records have equal costs compared to hospitals using electronic records, the difference in average costs per patient is $213 more for hospitals using paper records, and $p = 0.057$.

(b) The null hypothesis is that diners sitting at black tables spend as much as diners sitting at dark brown tables, the difference between the average spend amount is 10 cents, and $p = 0.039$.

(c) The null hypothesis is that there is no botulism bacteria in honey, 15% of store bought honey is found to contain botulism bacteria, and $p = 0.023$.

(d) The null hypothesis is that the speed of light in a vacuum on earth is the same as the speed of light in a vacuum in space, the measured difference is 25,000 meters per second, and $p = 0.009$. 