

BIOMEDSCI 552: Problem Set 2

Note: For all questions, show your work! Partial credit can be given if you get a wrong answer and then carry it forward and use it correctly later, but only if I understand how you got there.

1. There is a patient whose symptoms correspond to a particular disease, but this is only one of several explanations, and a relatively rare one at that. Among people with similar life histories, various other diagnostic tests and biomarkers, etc. the prevalence of the condition is 1.33%.

There is a test that has a 2% false negative rate, and a 5% false positive rate.

If the patient is positive, what is the probability they have the condition?

2. What kind of factors should you consider when thinking about whether or not the patient should take the test?
3. Use the following line of code in R: `sample.int(73, size=5, replace=FALSE)`

This draws five samples from a sequence from 1 to 73, without replacement. Use both methods we discussed for the German Tank Problem to estimate the largest number in the sequence (which we happen to know is 73).

Try varying the size of the sample – do you get a better estimate if your sample size gets bigger? Is there a point of diminishing returns?

4. You are sitting in the lab waiting for a very long experiment to finish, and your lab mate hands you a six-sided die. They say that if you roll it twenty times, and get a 6 six or more times, they'll give you \$100. If you don't, you have to buy them lunch (which we assume will cost ~\$20).

Should you take this bet, and why?

5. Is buying a single lottery ticket rational? Why or why not?
Is buying two lottery tickets rational?