Yeshiva University

AIM 5009 Bayesian Statistics
Communication Task 1.1

Instructions

This communication task gives you an opportunity to create a short document that illustrates your knowledge of Bayes's rule for events. You are given a short scenario and asked to create a short document that presents the solution to a mathematically competent but unsophisticated audience. That is, assume that they can follow your mathematical reasoning, but do not assume that they could solve the problem themselves.

Complete the task. Your document should be typed and should be submitted as a PDF file by the due date given in Canvas.

Task

You are presented with the following scenario:

> The director of a medical testing company approaches you. Her team is developing a new test for a relatively uncommon disease. It is believed that approximately 15% of the people who take the test have the disease. Her team has managed to develop a test that has a sensitivity of 95% and a specificity of 90%, but this is not good enough. She has calculated that this would mean that someone who tests positive has a probability of about 63% of actually having the disease. That's useful, but she wants her test to perform better.

Write a brief report (~2-3 pages at most) that answers the following questions:

1. Is her initial calculation of 63% correct?

2. How much higher would the *specificity* need to be so that a person testing positive would have at least an 80% probability of having the disease? (Assume that the prior probability and the sensitivity are held fixed.)

3. How much higher would the *sensitivity* need to be so that a person testing positive would have at least an 80% probability of having the disease? (Assume that the prior probability and the specificity are held fixed.)

4. If the doctors sending patients for the test were able to use signs and symptoms better to screen patients, so that the prior probability of having the disease were to increase, how much better would the doctors need to do to reach an 80% probability of having the disease given a positive result? (Assume both sensitivity and specificity remain fixed.)

Grading Rubric

For this assignment, the following rubric will be used:

Correctness of Answers	0 – 4
Clarity of Explanation	0 – 4
Clarity and Organization of Presentation	0 – 2