DS 102 Discussion 1
Wednesday, January 26, 2022

1. **Consequences of Binary Decisions**

   In the first lecture, we discussed binary decision making. The results of binary decisions can be summarized by the 2×2 table below:

	Decision 0	Decision 1
Reality 0	TN	FP
Reality 1	FN	TP

   Figure 1: $\mathbf{2 \times 2}$ **Table for Binary Decisions**

   Indicate whether each of the following statements are *True* or *False*.

   1. FPR $= 1 -$ TPR, where FPR and TPR and the False Positive Rate and True Positive Rate respectively.

   2. The False Discovery Proportion (FDP) can be thought of as a conditional probability that the reality is null ($R = 0$), given that a discovery was made ($D = 1$).

   3. Define the False Omission Proportion (FOP) as $\frac{\text{FN}}{\text{FN+TN}}$. This is a column-wise rate.
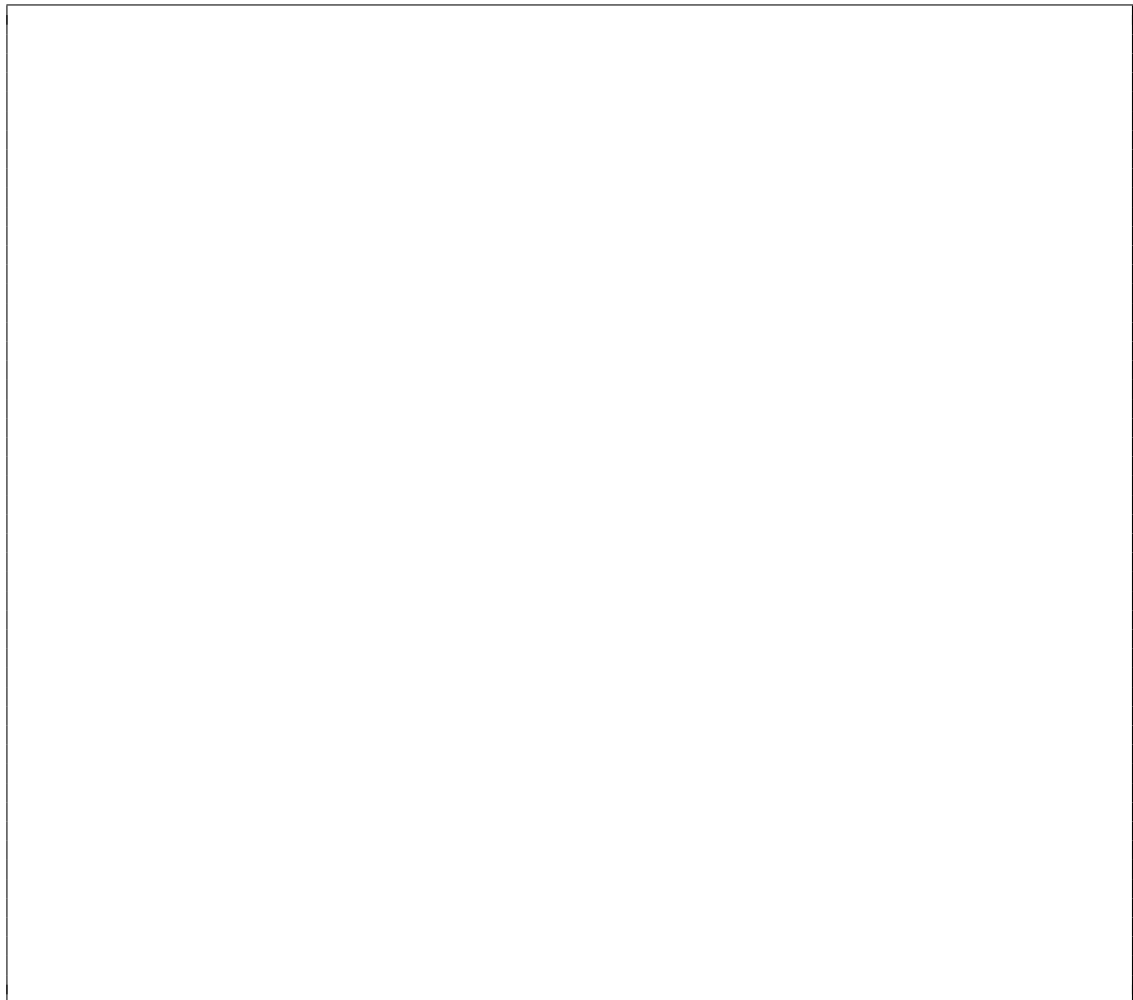
2. **COVID-19 Testing**

When the Abbott BINAXNow 15-Minute Antigen COVID test was released in August 2020, the company reported that the test had a sensitivity of 97.1% and a specificity of 98.5%.

Note: many studies conducted since then have shown a specificity closer to 100% but a lower sensitivity, especially with the Omicron variant. But for this question, we'll stick to the original numbers above.

Throughout this question, we will use real data from the NY Times Interactive Coronavirus Tracker.
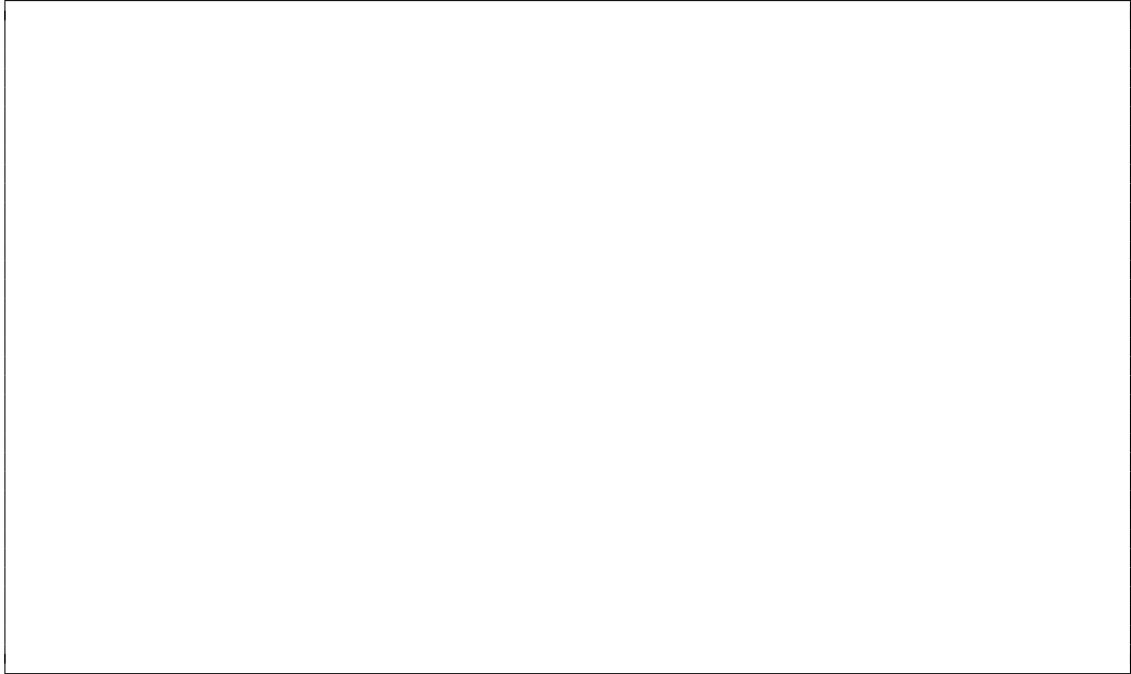
(a) *Calculating FDP I*

In Alameda County, the current rate of COVID cases as of today is reported to be $12,230$ per $100,000$ people. Assuming this is the true prevalence of the disease, what would the FDP for Abbott 15-Minute tests be? You may assume that the test is performed on an individual drawn uniformly at random from the entire population in Alameda County.
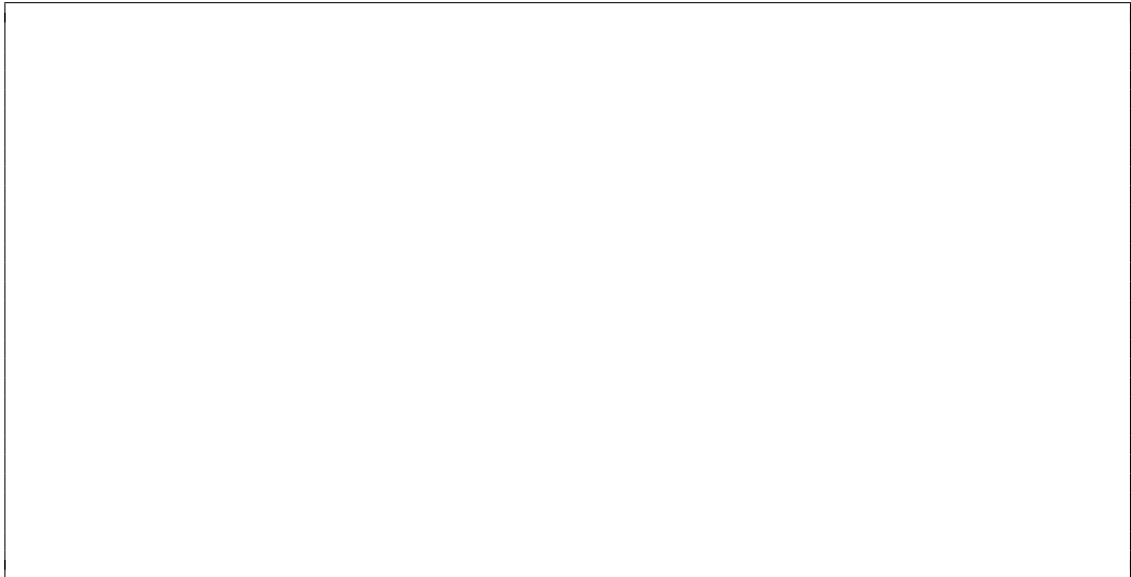
(b) *Calculating FDP II*

The rate of new COVID cases as of 2021/09/01 (near the start of the fall semester) was reported to be 260 per 100,000 people. Assuming this was the true prevalence of the disease at the time, what would the FDP for Abbott 15-Minute tests conducted then have been?

(c) *Connecting Prevalence and FDP*

Compare the FDPs calculated in 2(a) and 2(b). How does prevalence affect FDP? Why does this make intuitive sense?

3. **Comparing Column-Wise Rates**

   Can you think of situations where the False Omission Proportion (FOP) is more important than the False Discovery Proportion (FDP)? When is the FDP more important than the FOP?