Bayesian Probability *(find and work with a partner)*

Clinical Trials Example. Say the probability of a disease (D) in the general population is 1 in 100, i.e. $P(D) = \frac{1}{100}$. This is our *prior* probability of the disease (i.e., without any data).

Furthermore, say we have test for this disease with 90% accuracy. We will call the results of the test positive ("pos") and negative ("neg"). 90% accuracy means that $P(\text{pos}|D) = \frac{9}{10}$, and $P(\text{neg}|H) = \frac{9}{10}$, where H means healthy.

What we actually want to know is: what is the probability of having the disease, given a positive test?

1. Apply Bayes rule to $P(D|\text{pos})$. Recall that Bayes rule says:

$$P(A|B) = \frac{P(A)P(B|A)}{P(B)}.$$

2. We can often write the denominator as the sum of $P(a, B)$, for all options $a \in \text{vals}(A)$:

$$P(A|B) = \frac{P(A)P(B|A)}{\sum_{a \in \text{vals}(A)} P(a, B)}.$$

   Use this idea to expand the denominator in the clinical trials example and compute a numerical value for $P(D|\text{pos})$.