1. An event is a subset of a sample space. Given two events $A$ and $B$ derive the formula for calculating the probability of the event $A$ given that the event $B$ occurs.

2. Events $A$ and $B$ are independent if $P(A \cap B) = P(A)P(B)$. Prove that if $A$ and $B$ are independent events, the occurrence of $B$ does not change the probability of $A$. Show $P(A|B) = P(A)$

3. Suppose 4% of individuals that are tested for the flu actually have the flu. Furthermore, suppose that the test responds positively to 97% of individuals with the flu and responds positive to 3% who do not have the flu. What is the probability that
   (a) if you are tested and the result is positive what is the probability that you actually have the flu?
   (b) if you are tested and the result is negative what is the probability that you actually have the flu?

4. In Bayes Rule there are three parameters: how rare the disease is, how accurate the test is, and how inaccurate for false positives. Explore how accurate the test needs to be as a function of how rare the disease is. Present your results in an informative way.

5. You are given two graphs, $G_1$ and $G_2$. Graph $G_1$ is such that, each node has a distinct degree. In other words, no two nodes in $G_1$ have the same degree. Write out an algorithm to test whether or not $G_1$ and $G_2$ are isomorphic.

**Thought Problem:**

No need to hand in.

A family of hash functions

$$H = \{h|\{0,1,\ldots,p-1\} \rightarrow \{0,1,\ldots,p-1\}\}$$

is $k$-universal if for all $X = \{x_1,x_2,\ldots,x_k\}$ and $Y = \{y_1,y_2,\ldots,y_k\}$ the sets $X$ and $Y$ are independent.

Think of an example of a 1-universal but not 2-universal family; also think of a 3-universal family.