Read chapters 1 and 2 from Pearl’s book and answer the following questions.

1. After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for a serious disease, and that the test is 99% accurate (i.e., the probability of testing positive given that you have the disease is 0.99, as is the probability of testing negative given that you don’t have the disease). The good news is that this is a rare disease, striking only one in 10,000 people. Why is it good news that the disease is rare? What are the chances that you actually have the disease?

2. Use the joint-probability distribution in the table below to compute the following conditional probability for all values of $x$, $y$, and $z$.

$$
\begin{array}{ccc|c}
 x & y & z & p(x, y, z) \\
 \hline
 0 & 0 & 0 & 0.12 \\
 0 & 0 & 1 & 0.18 \\
 0 & 1 & 0 & 0.04 \\
 0 & 1 & 1 & 0.16 \\
 1 & 0 & 0 & 0.09 \\
 1 & 0 & 1 & 0.21 \\
 1 & 1 & 0 & 0.02 \\
 1 & 1 & 1 & 0.18 \\
\end{array}
$$

- $p(x|y, z)$
- $p(y|x, z)$
- $p(z|x, y)$

3. Questions 2.1, and 2.3a from Pearl’s book.

4. This problem investigates the way in which conditional independence relationships affect the amount of information needed for probabilistic calculations.

(a) Suppose we wish to calculate $P(H|E_1, E_2)$, and we have no conditional independence information. Which of the following sets of numbers are sufficient for the calculation?

i. $P(E_1, E_2), P(H), P(E_1|H), P(E_2|H)$.
ii. $P(E_1, E_2), P(H), P(E_1, E_2|H)$.
iii. $P(E_1|H), P(E_2|H), P(H)$. 