COMP30024 Tutorial Problems

Questions based on exercises from Russell and Norvig (3rd edition) have the original question numbers shown in brackets. Many of these questions are designed to provoke discussion in tutorials, rather than having a simple, closed-form answer.

Tutorial 8. Uncertainty

8.1 (RN13.8) Given the full joint distribution shown in the lecture notes for $\mathbf{P}(Cavity, Toothache, Catch)$, calculate the following:

   a. $P(toothache)$
   b. $\mathbf{P}(Cavity)$
   c. $\mathbf{P}(Toothache|cavity)$
   d. $\mathbf{P}(Cavity|toothache \vee catch)$

8.2 (RN13.15) After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for the serious disease Leckieitis, and 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 if you don't have the disease). The good news is that this is a rare disease, striking only one in 10,000 people.

   a. Why is it good news that the disease is rare?
   b. What are the chances that you actually have the disease?

8.3 (RN14.21, adapted from Pearl 1988) You are a witness to a night-time hit-and-run accident involving a taxi in Athens. All taxis in Athens are blue or green. You swear under oath that the taxi was blue. Extensive testing shows that under the dim lighting conditions, discrimination between blue and green is 75% reliable.

   a. Is it possible to calculate the most likely colour for the taxi? (Hint: distinguish carefully between the proposition that the taxi is blue and the proposition that it appears blue)
   b. What if you are given the extra information that 9 out of 10 Athenian taxis are green?