

COS30019 - Introduction to Artificial Intelligence
Tutorial Problems Week 10

Task 1: Show from first principles that $P(a|b \wedge a) = 1$.

Task 2: After your yearly checkup, the doctor has bad news and good news. The bad news is that you tested positive for serious disease and that the test is 99% accurate (i.e., the probability of testing positive when you do have the disease is 0.99, as is the probability of testing negative when you don't have the disease). The good news is that this is a rare disease, striking only 1 in 10,000 people of your age. Why is it good news that the disease is rare? What are the chances that you actually have the disease?

Task 3: (Exercise 13.15 from AIMA textbook) Suppose 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. 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.)

What about now, given that 9 out of 10 Athenian taxis are green?

Task 4: (The Monty Paradox and the TV game shows: How to Win?)

Apparently, this paradox or probability problem was inspired by the Monty Hall's TV game show *Let's Make A Deal*. The host, Monty Hall, offers the player the opportunity to win what is behind one of three doors. Typically there was a really nice prize (i.e. a car) behind one of the doors and not-so-nice prizes (i.e. a rabbit) behind the other two. After selecting a door, Monty would then proceed to open one of the doors you didn't select. It is important to note here that Monty would NOT open the door that concealed the car. Thus, the host always ELIMINATES one of the losing cases. At this point, he would then ask you if you wanted to switch your selection to another door.