CSc 74010 Fall 2011, Homework 5

1. From the joint distribution on page 31 of the notes, compute:

   (a) $P(cavity)$

   (b) $\mathbf{P}(Toothache)$.

   (c) $\mathbf{P}(Toothache|cavity)$.

   (d) $P(catch \vee cavity)$

   (e) $\mathbf{P}(Cavity|toothache \vee catch)$

   Recall what the difference is between P and $\mathbf{P}$ (see page 25 of the notes).

   (25 points)

2. For each of the following statements, either prove it is true, or give a counterexample.

   (a) If $P(a|b,c) = P(b|a,c)$, then $P(a|c) = P(b|c)$

   (b) If $P(a|b,c) = P(a)$, then $P(b|c) = P(b)$.

   (c) If $P(a|b) = P(a)$, then $P(a|b,c) = P(a|c)$

   (30 points)

3. Look at the meningitis example on page 43 of the notes. Carry out the calculation without using the value for $P(s)$.

   This is the same trick of considering the denominator to be a normalization constant α.

   Start by making up a suitable value for $P(s|\neg m)$ and use it to calculate unnormlaized values for $P(m|s)$ and $P(\neg m|s)$. Then normalize to make the values sum to 1.

   (15 points)

4. You take a test T to tell whether you have a disease D. The test comes back positive. You know that test is 95% accurate (the probability of testing positive when you do have the disease is 0.95, and the probability of testing negative when you don't have the disease is also 0.95). You also know that the disease is rare, only 1 person is 10,000 gets the disease.

   What is the probability that you have the disease?

   How would this change if the disease was more common, say affecting 1 person in 100?

   (30 points)