T-79.230 **Kevät 2005**

Agenttipohjaisen tietojenkäsittelyn perusteet
Laskuharjoitus 2
Tehtävät

1. Consider following probability distribution for variables *toothache*, *cavity* and *catch*.

	toothache		$\neg$*toothache*	
	catch	$\neg$*catch*	*catch*	$\neg$*catch*
cavity	0.108	0.012	0.072	0.008
$\neg$*cavity*	0.016	0.064	0.144	0.576

   Calculate following probabilities based on the distribution:

   a $P(toothache)$
   b $P(toothache|cavity)$
   c $P(cavity)$
   d $P(cavity|toohache \vee catch)$

2. (13.8)

   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 10000 people. Why is it good news that the disease is rare? What are the chances that you actually have the disease?

3. Show that the degree of belief after applying the Bayesian updating process is independent of the order in which the pieces of evidence arrive. That is, show that $P(A|B,C) = P(A|C,B)$ using the Bayesian updating rule.

4. Show that $P(B \rightarrow A) = P(A|B)P(B) + P(\neg B)$ starting from axioms.

5. (13.16)

   Three prisoners, A, B, and C, are locked in their cells. It is common knowledge that one of them will be executed the next day and the others pardoned. Only the governor knows which one will be executed. Prisoner A asks the guard a favor: "Please ask the governor who will be executed, and then take the a message to one of my friends B and C to let him know that he will be pardoned in the morning." The guard agrees, and comes back later and tells A that he gave the pardon message to B.

   What are A's chances of being executed, given this information?