Artificial Intelligence — *CS5300, Spring 2009*

HW6: Probability

1 Probability and Hamburgers

Doctors have found that people with Kreuzfeld-Jacob disease (KJ) are almost invariably ate lost of hamburgers, thus $p(\text{HamburgerEater}|\text{KJ}) = 0.9$. KJ is a rare disease: about 1 in $100,000$ people get it. Eating hamburgers is widespread: $p(\text{HamburgerEater}) = 0.5$. What is the probability that a regular hamburger eater will have KJ disease? Show your work.

2 Modeling Independence

Consider the following set up. A student is taking a class. The student might Study or not. The student might Know-the-material or not. The student might Pass or not. For each of the following independence/conditional independence claims, state whether or not you think it is true and provide a one-sentence justification.

1. $S \perp\!\!\!\perp K$
2. $S \perp\!\!\!\perp P$
3. $K \perp\!\!\!\perp P$
4. $P \perp\!\!\!\perp S \mid K$
5. $P \perp\!\!\!\perp K \mid S$
6. $S \perp\!\!\!\perp K \mid P$

3 Independence in Joint Probability Tables

Suppose we have a three variable model with variables A, B and C. We assume $p(A, B, C) = p(A)p(B \mid A)p(C \mid B)$.

1. What (conditional) independence assumptions are made by the assumption of how this distribution factorizes?
2. Write out the full joint distribution based on the conditional probability tables shown below:

$p(A)$:

A	p
T	3/4
F	1/4

$p(B \mid A = T)$:

B	p
T	1/2
F	1/2

$p(B \mid A = F)$:

B	p
T	2/3
F	1/3

$p(C \mid B = T)$:

C	p
T	1/5
F	4/5

$p(C \mid B = F)$:

C	p
T	3/4
F	1/4