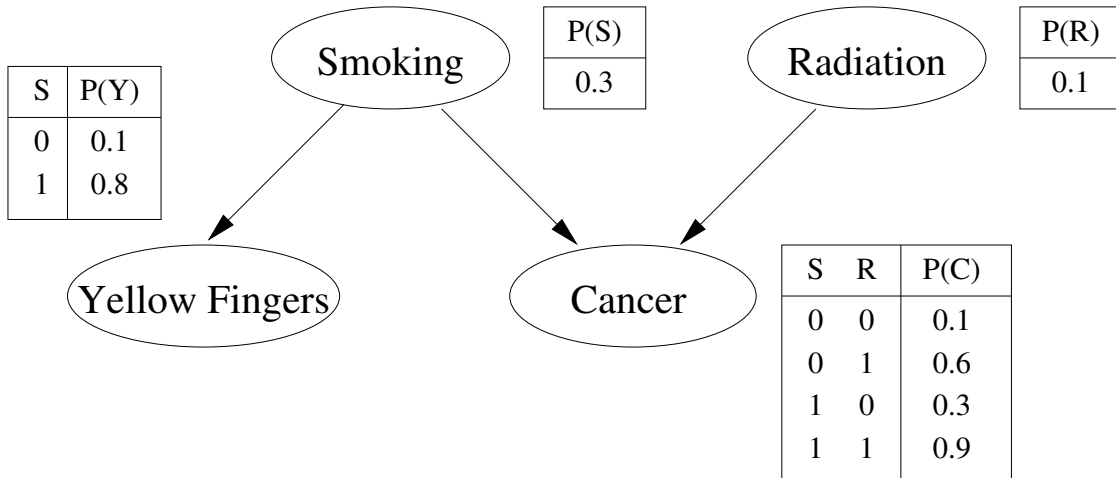


# CSE 590ST: Statistical Methods in Computer Science

## Homework 1

Due in class on April 19, 2004

1. Planets around distant stars can sometimes be detected by the tiny wobble they cause in the star's trajectory. Suppose that 1% of all stars have planets orbiting them, 80% of stars with planets show a wobble in their trajectory, and 5% of stars without planets show a wobble due to other causes. If a star shows a wobble in its trajectory, what is the probability that it has planets orbiting it?
2. Consider the following Bayesian network, where all variables are Boolean, and the associated conditional probability tables:



- (a) What is the Markov blanket of Cancer?
- (b) Is Radiation independent of Yellow Fingers?
- (c) Is Radiation independent of Yellow Fingers given Cancer?
- (d) What is the probability of Cancer given Radiation and Yellow Fingers? And given Radiation and not Yellow Fingers?
- (e) Does this mean that cleaning smokers' fingers so they're no longer yellow reduces their risk of cancer?
- (f) Suppose you're using likelihood weighting to compute the probability distribution of Yellow Fingers and Radiation given Smoking and not Cancer. What weight would you give to the sample (Smoking = True, Radiation = False, Yellow Fingers = True, Cancer = False)?

3. Suppose that  $A$ ,  $B$  and  $C$  are effects of a phenomenon  $D$ , independent among themselves given  $D$ , and that  $E$ ,  $F$  and  $G$  are causes of  $D$ , independent among themselves. Draw the graph of a Bayesian network representing these relationships.
4. Prove that a node in a Bayesian network is independent of all others given its Markov blanket.