CS 161

HW6

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1.

(a). The problem can be modeled as a Bayesian network in the following manner:

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(b). The probability we need to calculate is actually .

According to Bayes’ Rule, we have

In this expression,

Therefore, if the test comes back positive, the probability that oil is present is

2.

(a).

According to the condition independence indicated in the Bayesian network, we can simplify this expression as

(b). Let’s define all factors as the following:

Therefore,

(c).

(d).

According to given CPTs, we know that

Hence,

(e). From the Bayesian network, we observe that are conditional, so

From the Bayesian network, we also observe that are conditional, so

To calculate , we need to make use of CPT of

which means .

(f). The Markovian assumptions encoded in the Bayesian network structure is that a node is conditionally independent of all other nodes in the network, given its parents, children, and children’s parents.

(g). The Markov blanket for variable contains: .

(h). The resulting factor of multiplying the factors corresponding to and is

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(i).

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