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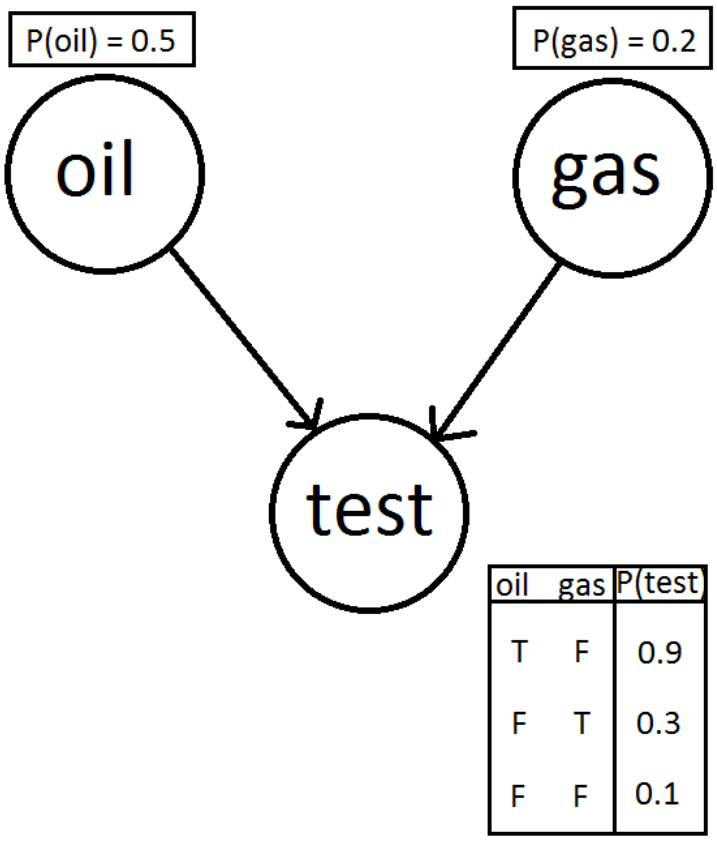
Homework 6

1.

a.



oil	gas	P(test
T	F	0.9
F	T	0.3
F	F	0.1

b. Using Bayes' theorem:

P(oil|test=T) = (P(test|oil=T) * P(oil)) / P(test)

P(oil|test = T) = (0.9 * 0.5) / (0.9(0.5)+0.3(0.2)+0.1(0.3)) = 0.8333

83.33% chance of oil given test is positive.

2.

a. Pr(A,B,C,D,E,F,G,H) =

Pr(A)*Pr(B)*Pr(C|A)* Pr(D|AB)*Pr(E|B)*Pr(F|CD)*Pr(G|F)*Pr(H|FE)

b. Pr(A,B,C,D,E,F,G,H) =

$f_1(A) * f_2(B) * f_3(AC) * f_4(ABD) * f_5(BE) * f_6(CDF) * f_7(FG) * f_8(EFH)$

c. Pr(EFGH) =$f_5(BE) * f_6(CDF) * f_7(FG) * f_8(EFH)$

d. Pr(a,¬b,c,d, ¬e,f, ¬g,h) =

Pr(A=1)*Pr(B=0)*Pr(C=1|A)* Pr(D=1|AB)*Pr(E=0|B)*Pr(F=1|CD)*Pr(G=0|F)*Pr(H=1|FE) =

0.2*0.3*Pr(C=1|A=1)*0.6*0.1*Pr(F=1|C=1 D=1)*Pr(G=0|F=1)*Pr(H=1|F=1 E=0)

e. Pr(¬a,b) = 0.8 * 0.7 = 0.56

just multiply independent probabilities for joint probability

Pr (¬e|a) = Pr (¬e) = 0.9*0.7+0.1*0.3 = 0.66

a doesn't affect probability of e since it isn't a parent, just compute Pr (¬e)

f. each variable is conditionally independent from its non-descendants given its parent and each variable is also conditionally independent of all other nodes in the network given its markov blanket.

g. D's blanket contains A,B,F, and C

h. $f_4(ABD) * f_5(BE) = f_9(ABDE)$

i. $\sum_D f_9(ABE) = f_9(ABDE) + f_9(AB\neg DE)$