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COMPSCI 383 – Spring 2021

Homework 4 Calculations

Due ~~Monday, March 29th~~ Wednesday, March 31st at 11:59pm ET

You are encouraged to discuss the assignment in general with your classmates, and may optionally collaborate with one other student. If you choose to do so, you must indicate with whom you worked. Multiple teams (or non-partnered students) submitting the same code will be considered plagiarism.

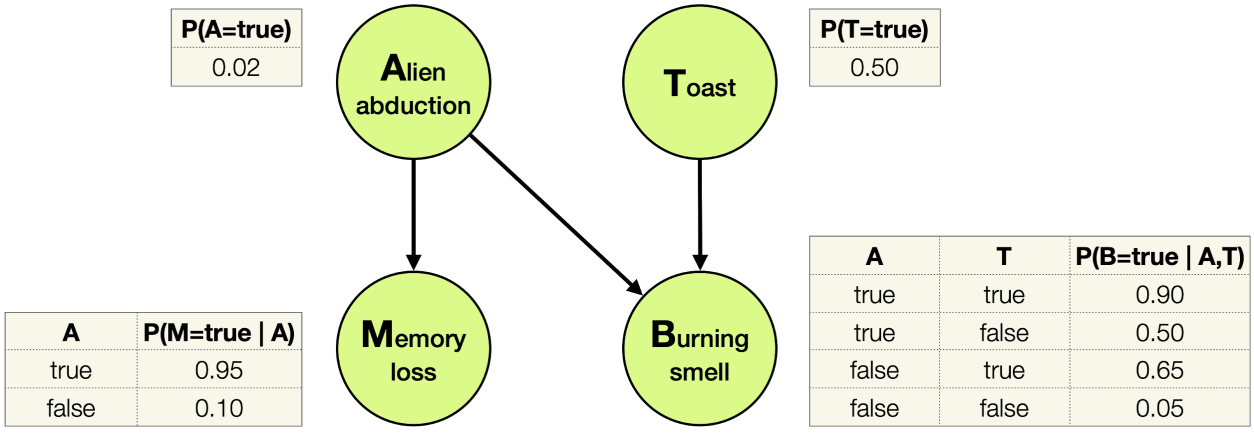
For the Homework 4 Primer, you were asked to answer "qualitative" questions about a Bayesian network that could be answered with some inspection and basic reasoning about probabilities. For this assignment, you will calculate some of those quantities precisely. As you're working, you should make sure your answers two the two parts of the assignment agree with each other.

What to Submit

You should submit a file named `homework4calc.pdf`, containing your answers to the questions. You can record your answers on this document (preferred) or create your own.

I Want to Believe, Again (36 points)

The Bayesian network shown below describes a typical evening at home for your friend Fox Mulder. On any given night, he may decide to make toast, he may get abducted by aliens, he may experience memory loss, and/or there may be a burning smell in his apartment.



P(A=true)
0.02

P(T=true)
0.50

A	P(M=true | A)
true	0.95
false	0.10

A	T	P(B=true | A,T)
true	true	0.90
true	false	0.50
false	true	0.65
false	false	0.05

Answer the following questions precisely by calculating the different probabilities. *You must show your work*. Note that you are free to use any of the probability definitions and laws covered in lecture, and are not required to emulate the Variable Elimination algorithm from Lecture 12.

a. On a typical night, what is the marginal probability that Fox will suffer memory loss, P(M=true)?

P(M = True) = 0.10

or

p(M = True) = 0.95

It can be either or because M is dependent on A so it is up to A to determine the probability of M.

b. Calculate the probability that Fox is abducted given that he has memory loss, P(A=true | M=true). Also calculate the probability that Fox is abducted given that he is not suffering memory loss.

using Bayes' Rule we can solve this problem

P(A|M) = P(M|A) P(A)/P(M)

P(A)P(M)/P(A) = 0.02(0)/0.02 = 0

P(A = T |M = T) = 0.95 (0.02)/0.95 = 0.02

P(A = T |M = F) = 0(0.02)/0.02 = 0

used the 0 because if M is false then M =0 and when I inputted P(M|A) I got 0

c. Calculate the probability of Fox being abducted by aliens *and* making toast.

P(A = True, T = True)

(0.02) (0.50) = 0.01

Using conditional probability, the probability of Fox being abducted by aliens and making toast is 0.01 since both A and T are independent of each other .

d. Calculate the probability of Fox being abducted by aliens *or* making toast.

P(A|T) = 0.02

or

P(T|A) = 0.5

Since both cases are independent of each other the probability does not effect on the probability evidence via the independence rule lec 10 slide 10.

e. Calculate the probability of Fox being abducted by aliens, given that he has memory loss and there is a burning smell in the apartment.

P(M|A) ^ P(B|A) = 0.95(0.5) = 0.475

I used the joint probability to calculate the probability of fox being abducted by aliens given that he has memory loss and it smells like burnt toast. Given the table above I used those two probabilities and combined them together(conditional independence) given that the mem loss and burnt toast are independent of each other connected by alien abduction.

f. Calculate the probability of Fox being abducted by aliens, given that he has memory loss, there is a burning smell in the apartment, and he makes toast.

P(M|A) ^ P(B|A) ^ P(T) = 0.95(0.5) = 0.475 * 0.5 = 0.2375

I used the Conditional Independence again but this time multiplied the probability of making toast.