

CS 161 HW 8

1.

Sensitivity Analysis

Event 1: Disease, = Pr(Positive)=0.001

Event 2: Test, = Pr(Positive)=0.02093

Constraint: >= 0.3

Start sensitivity analysis | Settings | Tools | ☒ Constrain Two Events | ☐ Show Table Details | Edit C

Single parameter suggestions | Multiple parameter suggestions (single CPT)

Parameter	Current value	Suggested value
Pr(Disease = Positive)	0.001	>= 0.008322
Pr(Test = Positive Disease = Negative)	0.02	<= 0.002386

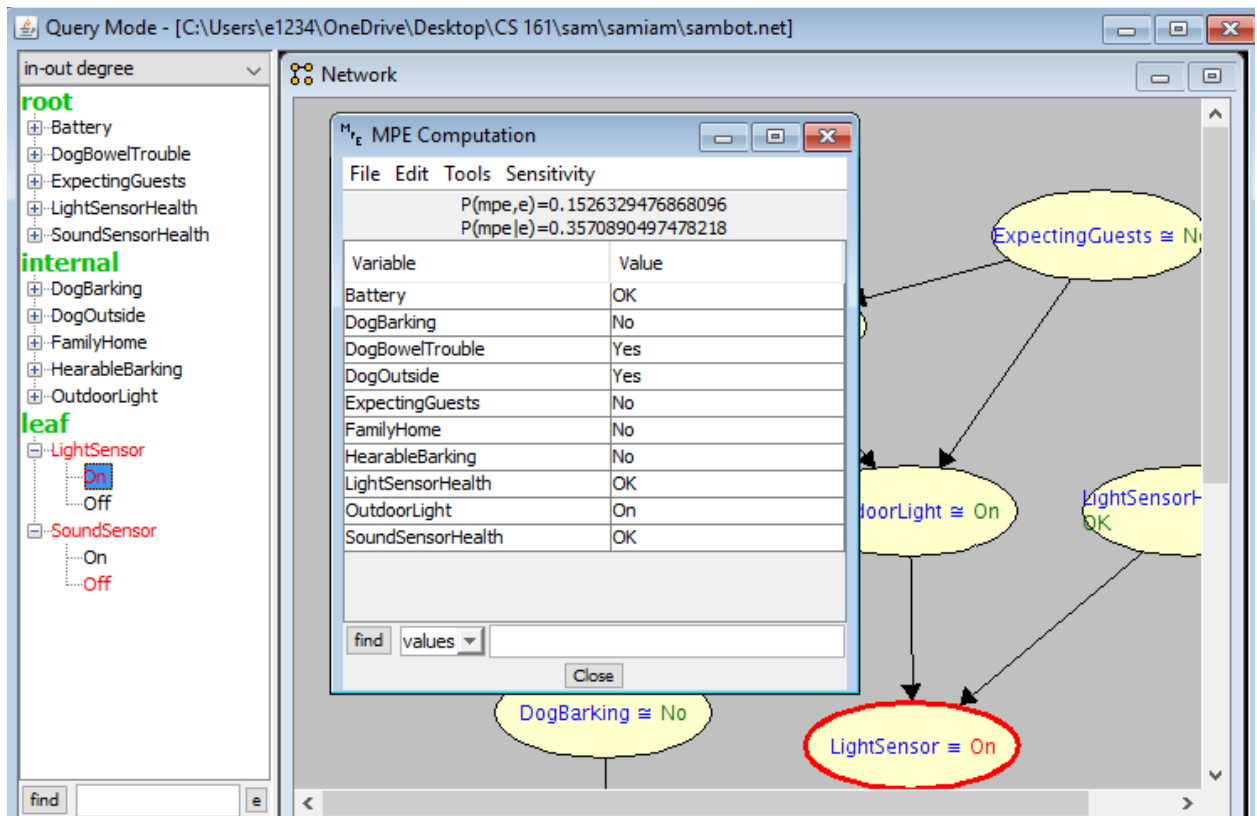
Note that D stands for Disease, and T stands for Test.

In order to satisfy the constraint $\Pr(D|T) \geq 0.3$, the SamIAM program suggest the following:

- $\Pr(D = \text{Positive}) \geq 0.008322$
- $\Pr(T = \text{Positive} | D = \text{Negative}) \geq 0.002386$ [Probability of a false positive]

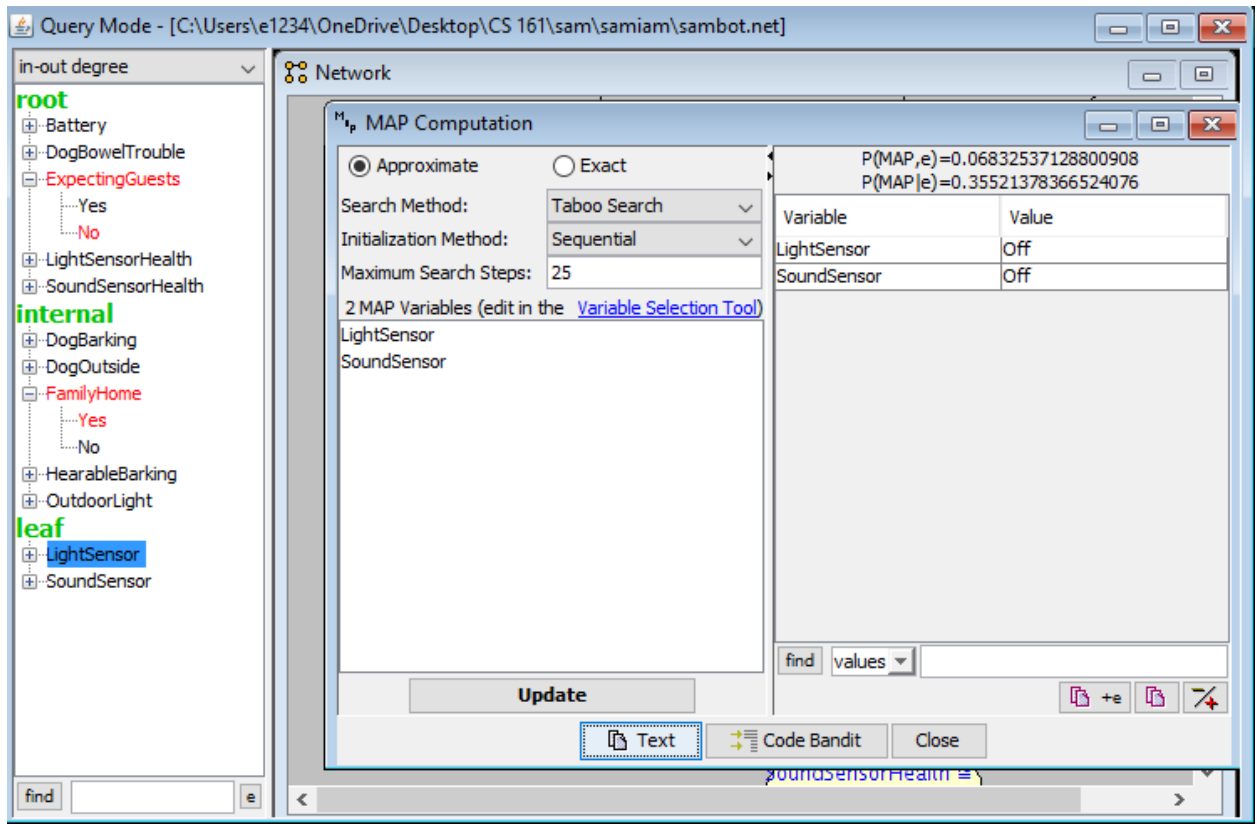
The sensitivity analysis actually does not suggest anything for the probability of a false negative test. This is most likely because changing the false negative probability would not have helped us to satisfy the given constraint.

2. a)



This is the most likely instantiation of all variables given that Sambot has sensed the lights to be on, but has sensed no bark. I generated this MPE Computation by turning the LightSensor On and by turning the SoundSensor Off within the variable options pictured in the left menu.

b)



This is the most likely instantiation of the sensors given that the family is home and no guests are expected. I generated this result by setting ExpectingGuests to No and FamilyHome to Yes. I then use the MAP Computation tool. I first set LightSensor and SoundSensor as MAP variables, then I clicked update to generate the result seen above.

c) The smallest set of variables Z such that the two sensors are independent given Z is $\{\text{Battery}, \text{FamilyHome}\}$. Battery is a divergent valve, and it blocks one of the paths between the two sensors. Similarly, FamilyHome is another divergent valve that blocks the remaining path between the sensors. Battery and FamilyHome are able to block all the paths between the sensors, making them d-separated when Z is known.

d) The network constructed in SamIAM is a multiply-connected network as some of the nodes have more than one path between them.