

COM SCI 161A HW 8 Solution

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Problem 1. $P(D|T) \geq 0.3$

Solution 1. To satisfy the constraint $P(D|T) \geq 0.3$, following conditions are suggested:

- i) $P(D = \text{no}) \leq 0.991678$ i.e. $P(D = \text{yes}) \geq 0.008322$, the prior probability of having a disease should be atleast 0.008322
- ii) $P(T = \text{negative}|D = \text{no}) \geq 0.997614$ i.e. $P(T = \text{positive}|D = \text{no}) \leq 0.002386$, the false positive rate should be atleast 0.2386%
- iii) There is no condition given for the false negative rate, which means changing false negative rate doesn't satisfy our constraint.

Samlam: Sensitivity Analysis, Modeling, Inference and More

File Edit Mode Query Tools View Preferences Window Help

shenoy-shafer

Query Mode - [untitled4.net]

in-out degree

root

D

leaf

T

Sensitivity Analysis

Event 1: D, Pr(yes)=0.001

Event 2: T, Pr(positive)=0.02093

Constraint: ≥ 0.3

Start sensitivity analysis

Settings Tools Constraints Show Table Details Edit CPT

Single parameter suggestions

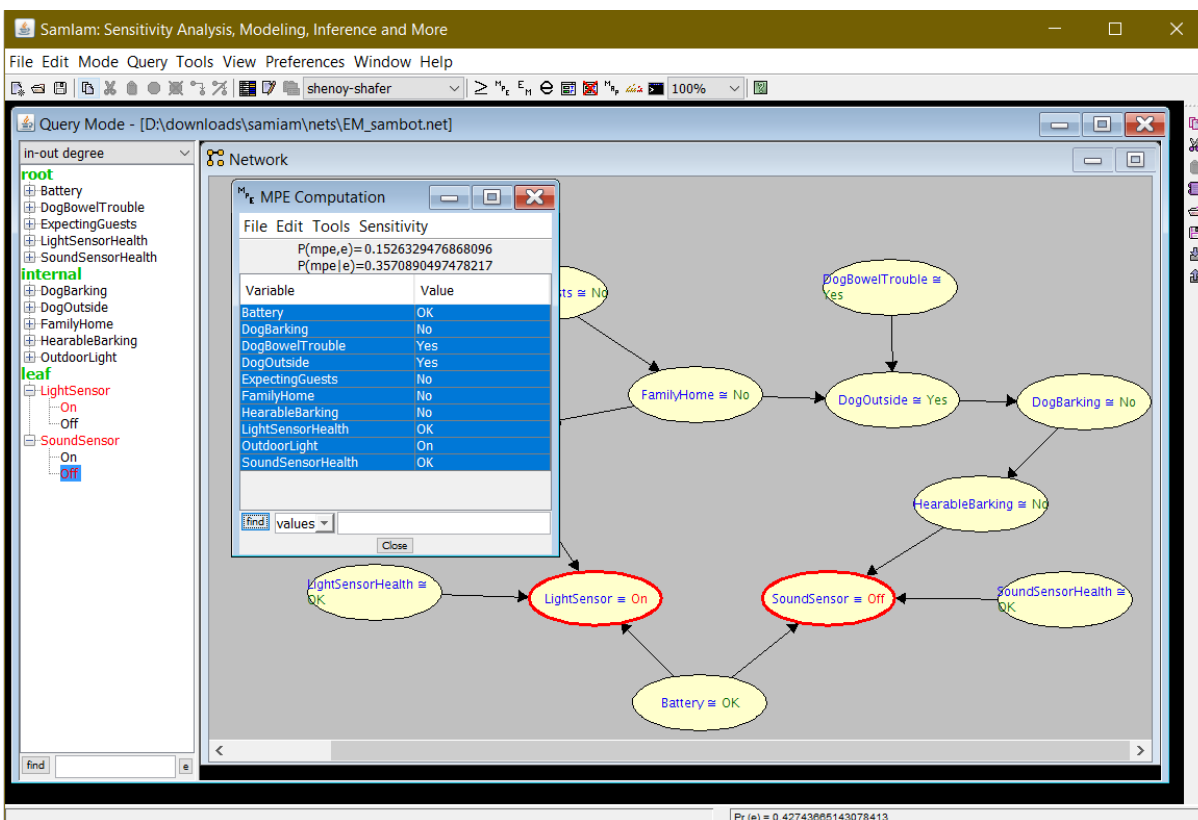
Parameter	Current value	Suggested value
Pr(T = negative D = no)	0.98	≥ 0.997614
Pr(D = no)	0.999	≤ 0.991678

Pr(e) = 1.0

Problem 2. Sambot

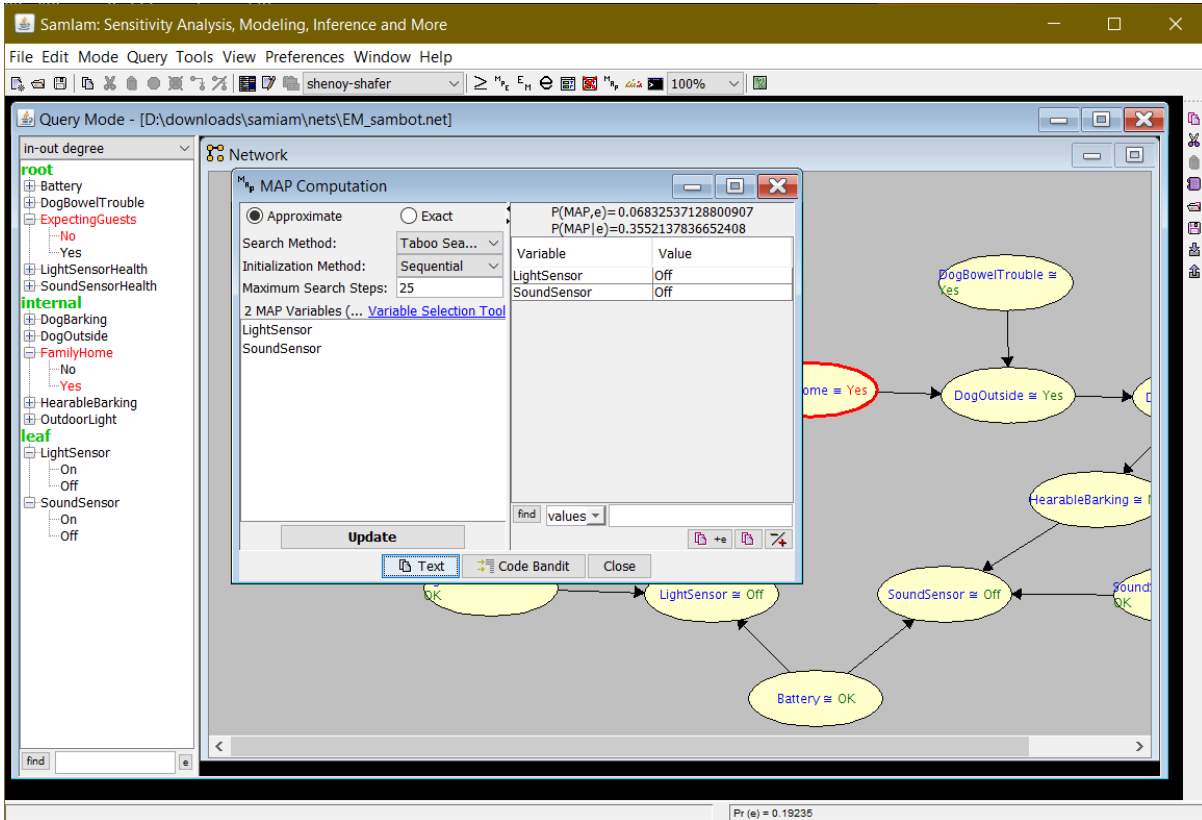
Solution 2a. After doing EM, we set the LightSensor to be "On" and SoundSensor to be "Off" and run MPE to get the most likely explanations for all variables, as follows:

Battery	OK
DogBarking	No
DogBowelTrouble	Yes
DogOutside	Yes
ExpectingGuests	No
FamilyHome	No
HearableBarking	No
LightSensorHealth	OK
OutdoorLight	On
SoundSensorHealth	OK



Solution 2b. Since we only need to find the most likely instantiations of the sensors, we first set FamilyHome to "Yes" and ExpectingGuests to "No" and run MAP to get following instantiations:

LightSensor	Off
SoundSensor	Off



Solution 2c. Since Battery directly connects the two sensors as a divergent node, it needs to be in Z to close the path. The other path can be close by knowing any of the following: OutdoorLight, FamilyHome, DogOutside, DogBarking or Hearable Barking. So the minimum node in Z has to be 2. One possible Z can be **{Battery, FamilyHome}**.

Solution 2d. The network constructed is **Multiply connected network** as there exists multiple path between nodes.