HW 8 - Chaoran Lin

1

	Constraint to satisfy $Pr(D\|T) \geq 0.3$
Prior probability of having the disease	$Pr(disease = yes) \geq 0.008942$
False positive	$Pr(test = positive\|disease = no) \leq 0.002219$
False negative	$Pr(test = negative\|disease = yes)$: no suggested value

2

(a)

Variable	Values
FamilyHome	Yes, No
OutdoorLight	On, Off
GuestExpected	Yes, No
DogInBackyard	Yes, No
DogHasBowelTrouble	Yes, No
DogBarking	Yes, No
HearableBarking	Yes, No
LightSensor	On, Off
SoundSensor	On, Off
LightSensorCondition	OK, Broken
SoundSensorCondition	OK, Broken
BatteryCondition	OK, Dead

(b)
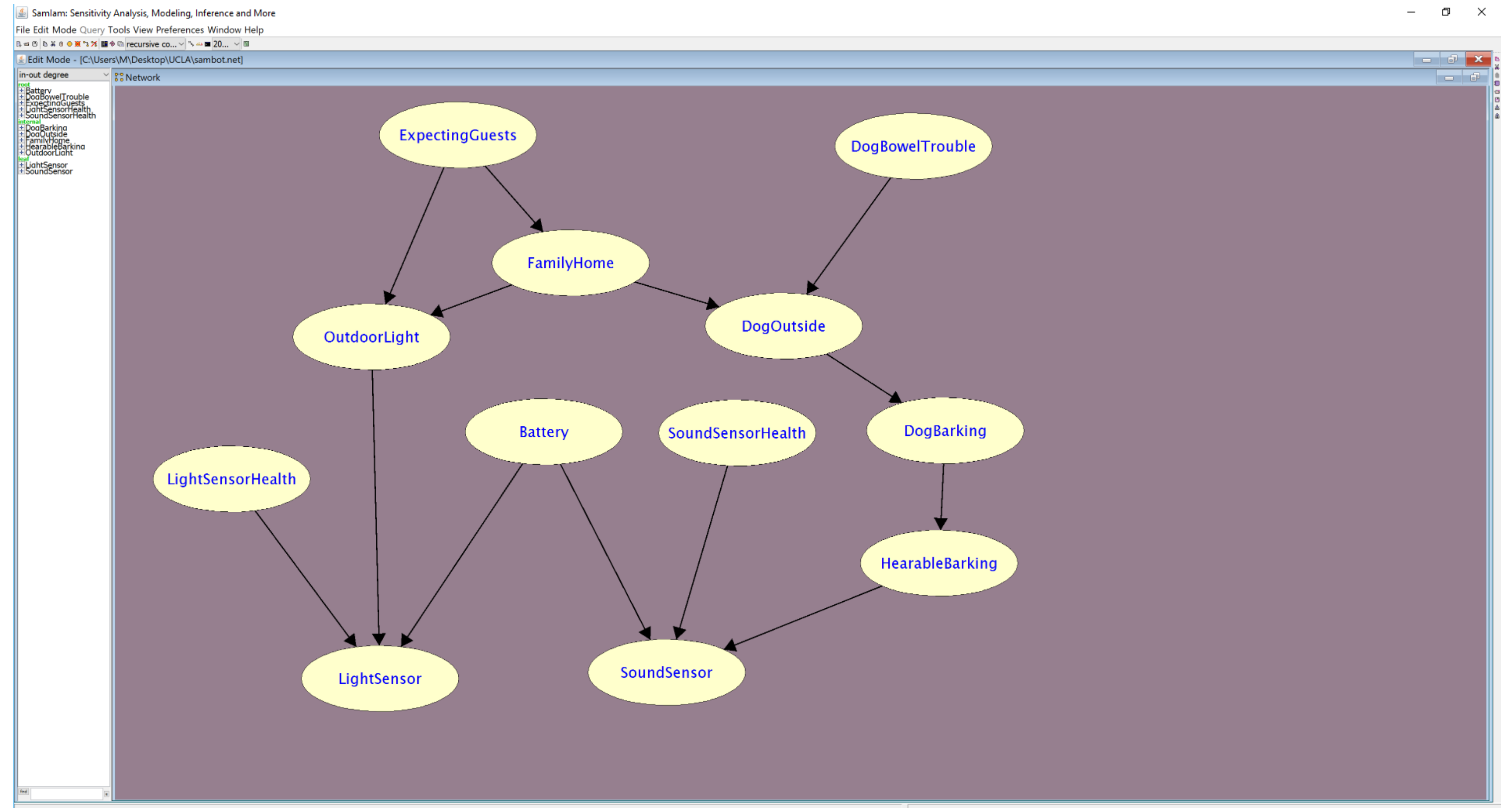
(c)

Network CPT available in sambot.net

Report

```
The most likely instantiation of all variables given that Sambot has sensed the lights to
    be on, but has sensed no bark. Explain how you obtained this answer (for partial credit
    in case you get the wrong answer).
```

I used SamIam's MPE tool to obtain the most probable explanation given that the LightSensor variable is true and the Hearablebarking variable is No:

Variable	Value
LightSensor	On

Variable	Value
HearableBarking	No
Battery	OK
DogBarking	No
DogBowelTrouble	Yes
DogOutside	Yes
ExpectingGuests	No
FamilyHome	No
LightSensorHealth	OK
OutdoorLight	On
SoundSensor	Off
SoundSensorHealth	OK

```
The most likely instantiation of the sensors given that the family is home and no guests
  are expected. Explain how you obtained this answer (for partial credit in case you get
  the wrong answer).
```

I used SamIam's MPE tool to obtain the most probable explanation given that the FamilyHome variable is Yes and the ExpectingGuests variable is No, and observed the LightSensor and SoundSensor variables:

Variable	Value
LightSensor	Off
SoundSensor	Off

```
The smallest set of variables Z in your network such that the two sensors are independent
  given Z. Justify your answer based on d-separation.
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The smallest Z is $\{Battery, OutdoorLight\}$.

- We see that there is a divergent valve from Battery to LightSensor and SoundSensor. We know that in this situation, since the top node in the valve is in Z, the path is blocked.
- We see that there is a sequential path Lightsensor->OutdoorLight->FamilyHome and LightSensor->OutdoorLight->ExpectingGuests. We know that in these two situations, since the middle node in the valve is in Z, the paths are blocked.

Thus $d-separated(LightSensor, \{Battery, OutdoorLight\}, SoundSensor)$ is true. In other words, LightSensor and SoundSensor are independent given Battery and OutdoorLight.

```
The type of network you constructed: tree, polytree (singly-connected network), or multiply-connected network.
```

I seemed to have constructed a multiply-connected network, as it is not a tree (there are nodes with more than one parent) and it is not a polytree (if all directed edges were replaced with undirected edges, the graph would not be acyclic).