

1.

Query Mode - [C:\Users\karth\Documents\CS 161\Homework 8\test.net]

Sensitivity Analysis

Event 1
Disease
= Pr(Yes)=0.001

Event 2
Test
= Pr(Positive)=0.02093

Constraint
>= 0.3

Start sensitivity analysis ☒ Constrain Two Events ☐ Show Table Details **Edit** **Adopt Change**

Single parameter suggestions Multiple parameter suggestions (single CPT)

Parameter	Current value	Suggested value
Pr(Test = Positive Disease = No)	0.02	<= 0.002386
Pr(Disease = Yes)	0.001	>= 0.008322

The sensitivity analysis does not show anything for a false negative ($\text{Pr}(\text{Test} = \text{Negative} \mid \text{Disease} = \text{Yes})$). This is because changing the false negative probability alone would not be able to satisfy the given constraint.

2. a.

The most likely instantiation given that Sambot has sensed the lights to be on and sensed no bark -

MPE Computation	
$P(mpe, e) = 0.20798757487265024$ $P(mpe e) = 0.47950488490896365$	
Variable	Value
Battery	OK
DogBarking	No
DogBowelTrouble	Yes
DogOutside	Yes
ExpectingGuests	No
FamilyHome	No
HearableBarking	No
LightSensorHealth	OK
OutdoorLight	On
SoundSensorHealth	OK
Copy Copy (+evidence) Close	

Using the variable selection tool, I selected LightSensor to be On and SoundSensor to be Off. I then ran the MPE computation tool to obtain the above table.

b. The most likely instantiation of the sensors given that the family is home and no guests are expected -

$P(MAP, e) = 0.08043990284204483$ $P(MAP e) = 0.4430196647851582$	
Variable	Value
LightSensor	Off
SoundSensor	Off

Using the variable selection tool, I set FamilyHome to Yes and ExpectingGuests to No. I then ran the MAP tool on the LightSensor and SoundSensor variables, giving the above result.

c. One possible smallest set for Z could be {Battery, FamilyHome}. Battery is a divergent valve and blocks one path between LightSensor and SoundSensor if known, and FamilyHome is a sequential/divergent valve that blocks the other path if it is known. This therefore blocks all paths, leaving LightSensor and SoundSensor d-separated, thus independent given Z.

d. It is a multiply connected network since there is more than one path between some nodes in the network.