1. The constraints are:
   (a) $P(d) <= 0.991058$
   (b) $P(t|\bar{d}) <= 0.002332$
   (c) $P(\bar{t}|d) <= 0.005966$

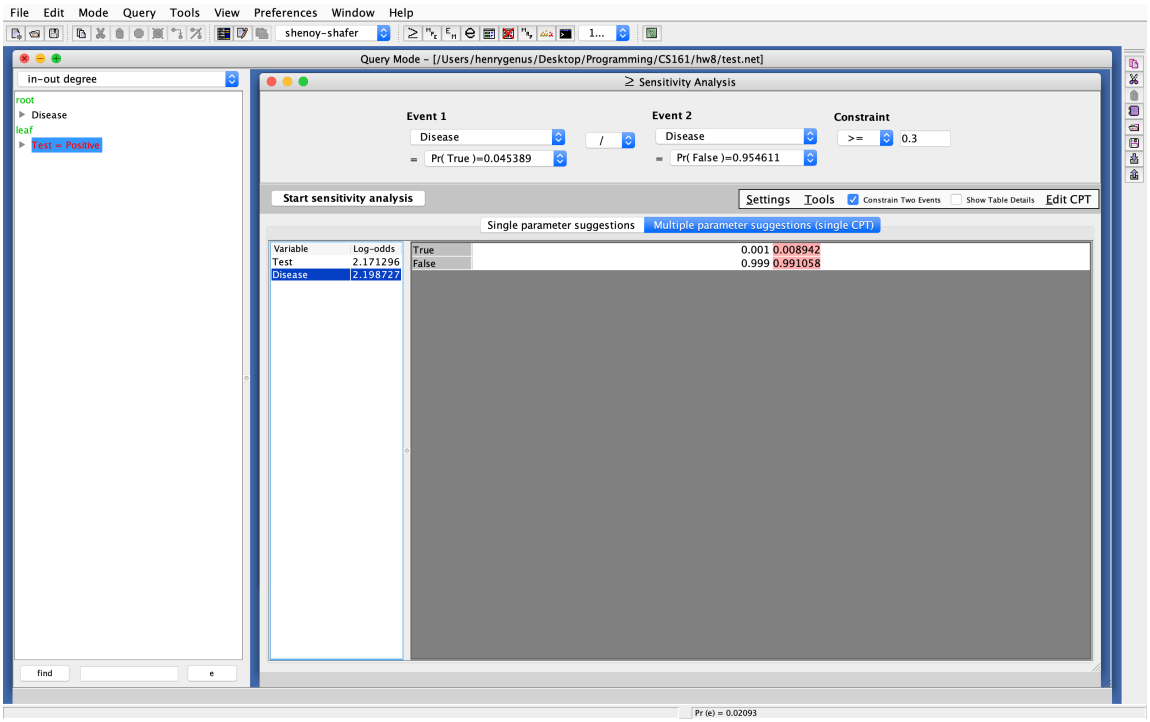


Figure 1: Disease Constraint

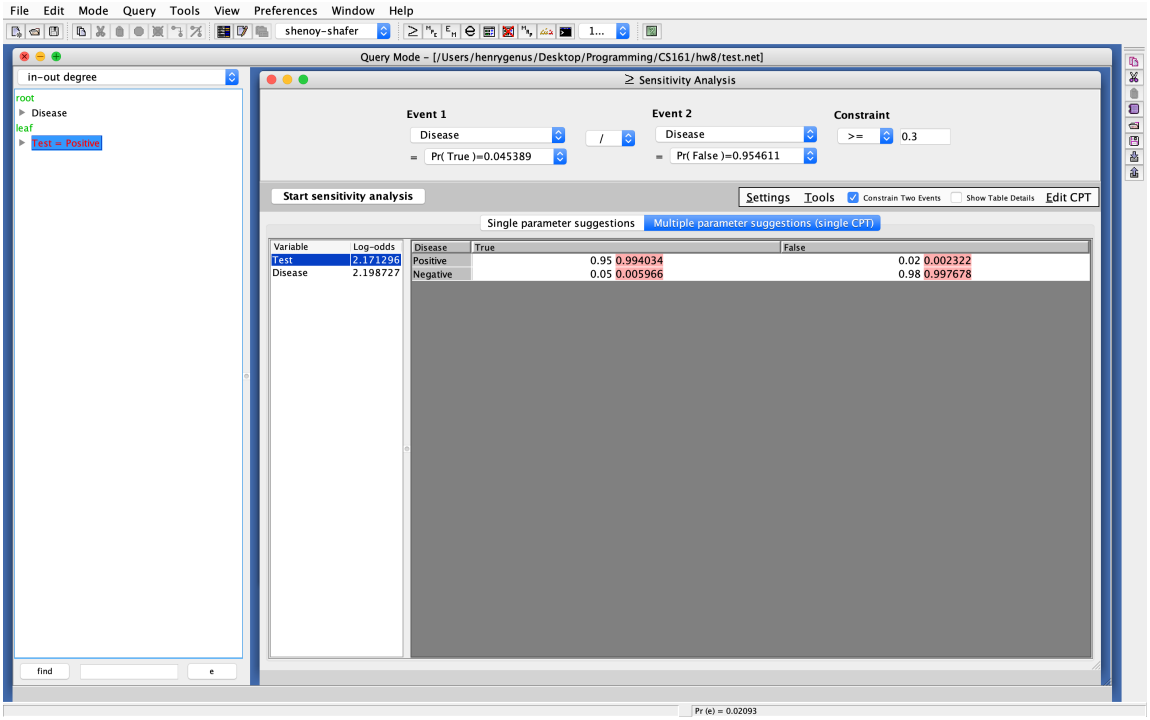


Figure 2: Test Constraints

2. Our variables are: {
   LightSensor = whether light is currently sensed
   SoundSensor = whether SamBot hears his dog barking,
   Battery = whether SamBot's battery is OK,
   Dog Barking = whether his dog is barking,
   Dog Bowel Trouble = whether his dog is having bowel trouble,
   Dog Outside = whether his dog is outside,
   Expecting Guests = whether his family is expecting guests,
   Family Home = whether his family is home,
   Hearable Barking = whether he can hear barking,
   Light Sensor Health = whether his light sensor is working,
   Outdoor Light = whether the outdoor light is on,
   Sound Sensor Health = whether his sound sensor is working
   }

   (a) MLE | LightSensor $\wedge$ $\neg$SoundSensor = {
      Battery = OK,
      Dog Barking = No,
      Dog Bowel Trouble =Yes,
      Dog Outside = Yes,
      Expecting Guests = No,
      Family Home = No,
      Hearable Barking = No,
      Light Sensor Health = OK,
      Outdoor Light = On,
      Sound Sensor Health = OK
      }
      Setting LightSensor and $\neg$*SoundSensor* and using the MPE tool on the network gave us the following:

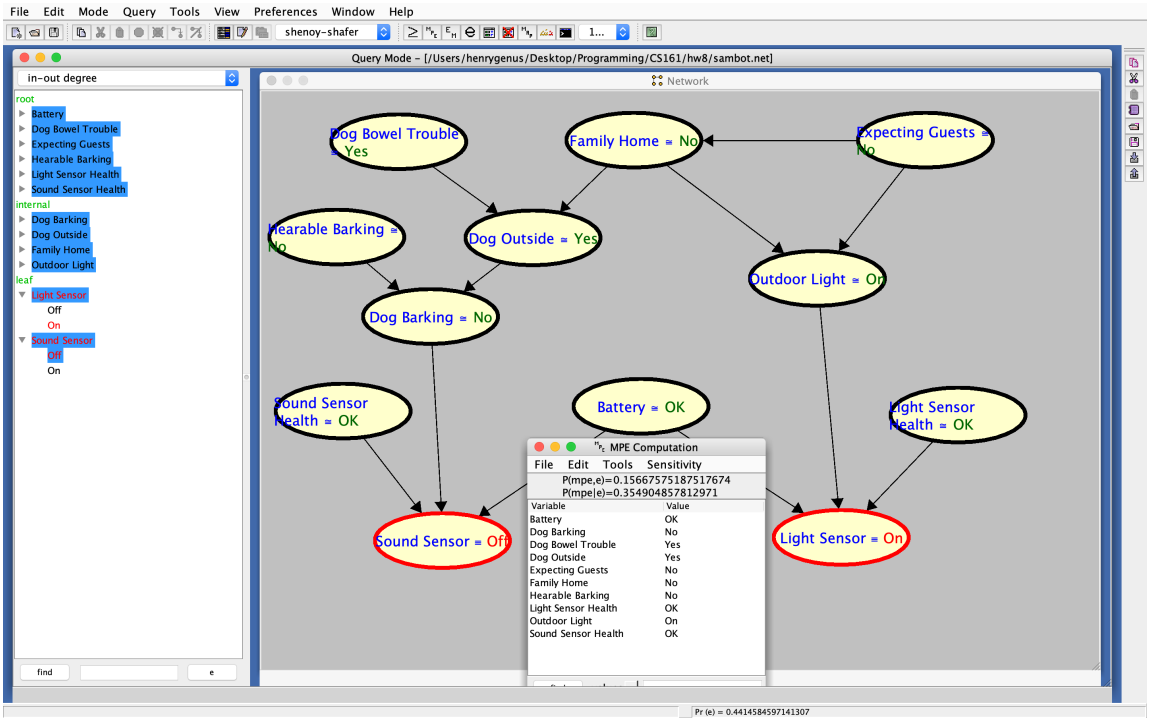


Figure 3: MLE | LightSensor $\wedge$ $\neg$BarkSensor

(b) MLE LightSensor, SoundSensor | FamilyHome ∧ ¬ExpectingGuests = {
LightSensor = Off,
SoundSensor = Off,
}
Setting FamilyHome and ¬ExpectingGuests and using the MPE tool on the network gave us the following:

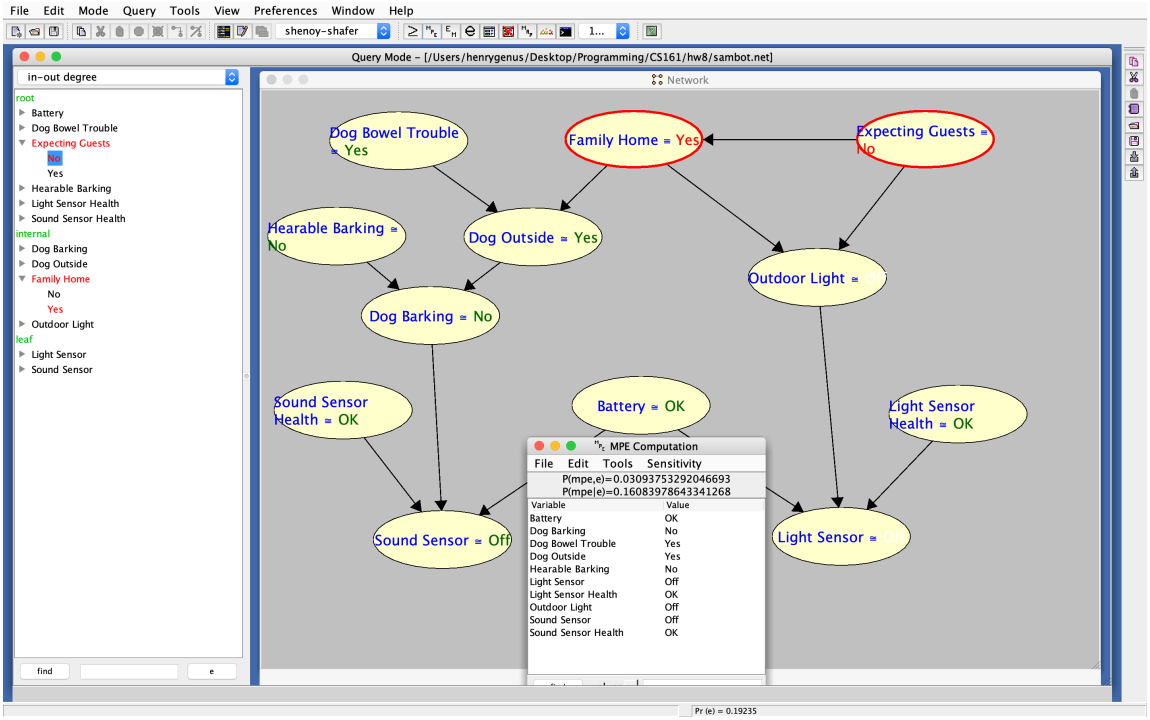


Figure 4: MLE | FamilyHome ∧ ¬ExpectingGuests

(c)

$$\text{MIN}(\mathbf{Z}) \text{ — } \text{ND}(\text{SoundSensor}, \mathbf{Z}, \text{LightSensor}) = \{\text{Battery}, \text{FamilyHome}\}$$

*Proof.* We can see this by considering that all paths from SoundSensor to LightSensor must flow through one of the two items in **Z**.

Battery is divergent, so it blocks all paths through it. therefore

$$\text{blocked}(\text{SoundSensor}, \text{Battery}, \text{LightSensor})=\text{True}$$

FamilyHome has two paths through it: {ExpectingGuests, FamilyHome, DogOutside} and {OutdoorLight, FamilyHome, DogOutside}. The former is sequential and the latter is divergent, so both are blocked by assigning FamilyHome. Therefore

$$\text{blocked}(\text{ExpectingGuests}, \text{FamilyHome}, \text{DogOutside})=\text{True}$$
$$\text{blocked}(\text{OutdoorLight}, \text{FamilyHome}, \text{DogOutside})=\text{True}$$

Thus we can see that

$$\text{d\_SEP}(\text{SoundSensor}, \text{FamilyHome Battery}, \text{LightSensor})=\text{True}$$

and therefore that

$$\text{IND}(\text{SoundSensor}, \text{FamilyHome Battery}, \text{LightSensor})=\text{True}.$$

□

(d) Our structure is multiply connected, as can be seen by the triangular connection of FamilyHome, ExpectingGuests, and OutdoorLight,