

Assignment Six: Reasoning Under Uncertainty

Solution Solution

Question One

Solution (a), (b) load the following url into the AIspace belief and decision network app:

<https://www.cs.ubc.ca/~poole/cs322/2020/as6/plumbing.xml>

(c) Give some examples of the interesting things you can do! Particularly some normal cases-show that it works for the normal cases, e.g., combinations of observing taps on and off and plugs in and not in, and show there is flow as expected. Also show some observations of unusual things happening (e.g., a scenario where you would expect the floor to be wet, and it isn't, or the other way around).

(d) There are many more arcs, in particular there are arcs between any pair of nodes X and Y in the new ordering if there were arcs in the original network or if they have common ancestors in the original (causal) belief network that are after both X and Y in the total ordering or where there are common descendants (in the original graph) of X and Y that are also parents in the new graph. E.g., *Water_flowing_into_sink* is dependent on *D2_flow* You just need to give some examples.

Question Two

Solution a) & b) load the following url into the AIspace belief and decision network app:

<https://www.cs.ubc.ca/~poole/cs322/2020/as6/cab.xml>

To answer (a) just condition on *Witness_1_report*.

$$P(\text{cab} = \text{blue} \mid b, b, g) = 0.41$$

$$P(\text{cab} = \text{blue} \mid b, b, b) = 0.92$$

c) One solution can be obtained from: https://www.cs.ubc.ca/~poole/cs322/2020/as6/cab_collusion.xml

If you play with this you will find an interesting fact: Although the believe network is not symmetric between witness 1 and witness 2, the probabilities make the models symmetric: the effect on the cab company or the other witnesses' probabilities when conditioning on witness 1 or witness 2 is the same.

d) one solution is: https://www.cs.ubc.ca/~poole/cs322/2020/as6/cab_accident.xml

The rate of accidents was not given and cannot be inferred from the description. I arbitrarily chose $P(\text{accident}) = 0.1$. Note that this only modified *Cab_Company* so I decided to make a variant of the colluding witness case; you could also go it as a variant of part (a).

Question Three

Solution It should not have taken more than a few hours. Most of this should have been in understanding the material and playing, not in doing busy work. I hope it was reasonable, and you learned something.