TDT4171: Assignment 3

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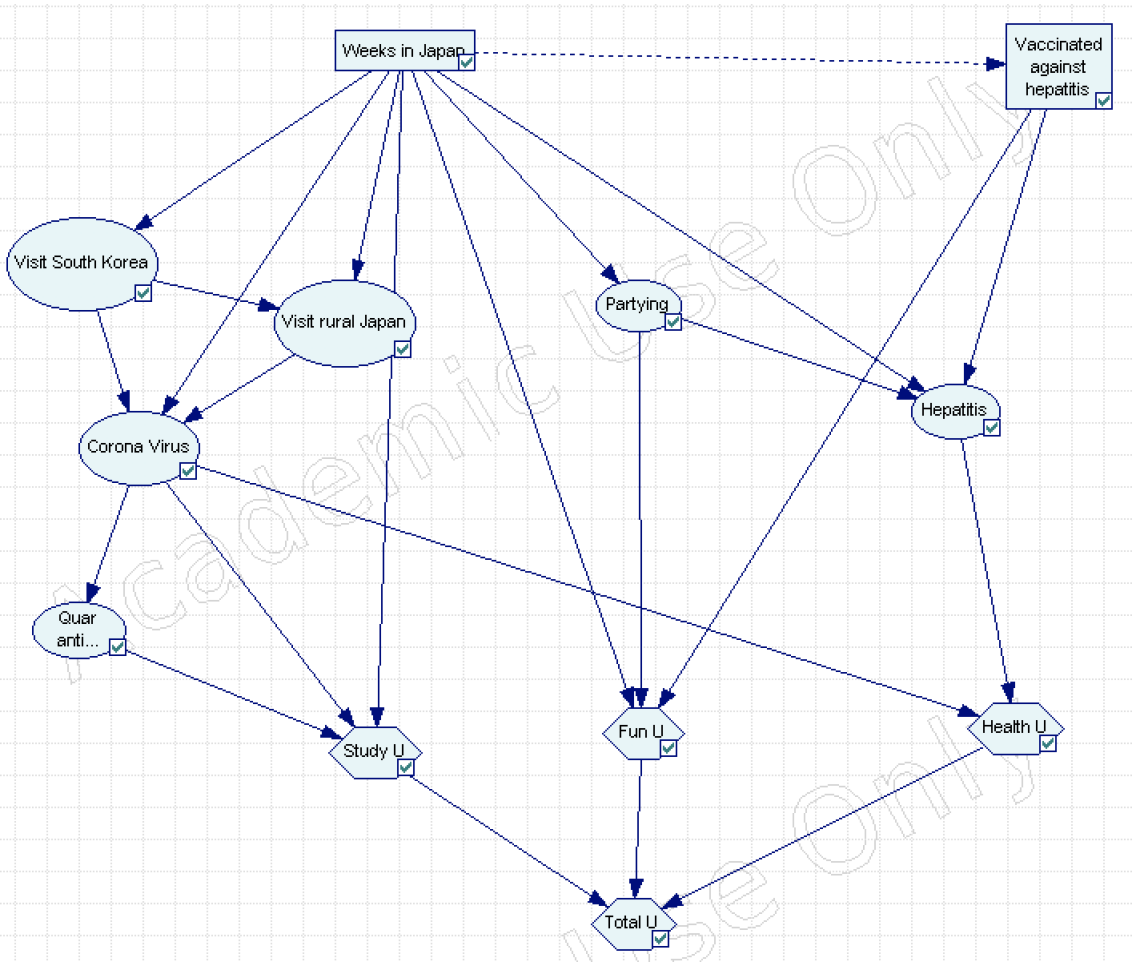
Create a decision support system for a decision problem of your own choice.

The Network

The network which i set out to create was a decision support system based on the dual decision of how long to go on excursion to Japan, and whether to get the recommended vaccine for hepatitis. This decision support system is based on a set of utility function nodes on different categories of utility, and a total utility which weights the different categories of utility for importance. These are arranged into the decision layer, the chance layer and the utility layer.
The network itself is available in the deliverable for review and for a more intuitive view of the effects.

The Model



The Decisions

Length of Excursion

The first decision to make is the decision of how long one should go on excursion. The choice of excursion length is a parent of the likelihood of Visit South Korea, visiting rural japan, contracting the Corona virus, contracting hepatitis and influences the amount of partying done.

Vaccination Against Hepatitis

The second decision to make is whether to get vaccinated. This decision is to be made secondary to the excursion duration, meaning we only make this decision after we have made the decision on "Weeks in Japan". This choice is a parent of the likelihood of contracting Hepatitis, as well as directly influences the Fun Utility function.

The Chances

In the chance layer there are 6 chance nodes. These have one or more inputs which can determine the used probability distribution. For each of the nodes, the probability distribution is determined by my own world view and influence by class mates. e.g. for those who are travelling 3 weeks my best estimate is that half are going to South Korea.

When we select the duration which gives the highest utility we can see the simpler probabilities shown in figure 1. From the arrows one can see the strength of influence from a parent to a child. By looking at the vaccination decision we can see that to achieve the maximum utility which was advertised in 3 weeks, we must vaccinate.

Visit South Korea

The Visit South Korea probability distribution is illustrated in figure 2. Here i have used the knowledge that if one is only going a week on excursion this whole week is spent on the company presentations, and one does not have time to visit South Korea. Hence, the probability of True is 0. The other probabilities are taken from a rough estimate on how many of my friends are going.

Visit Rural Japan

The chance node of visiting rural japan is influenced by the amount of time on excursion as well as if one visits South Korea or not. This is because a trip to South Korea uses time on excursion leaving a lower probability for visiting rural japan. This is illustrated in Figure 3

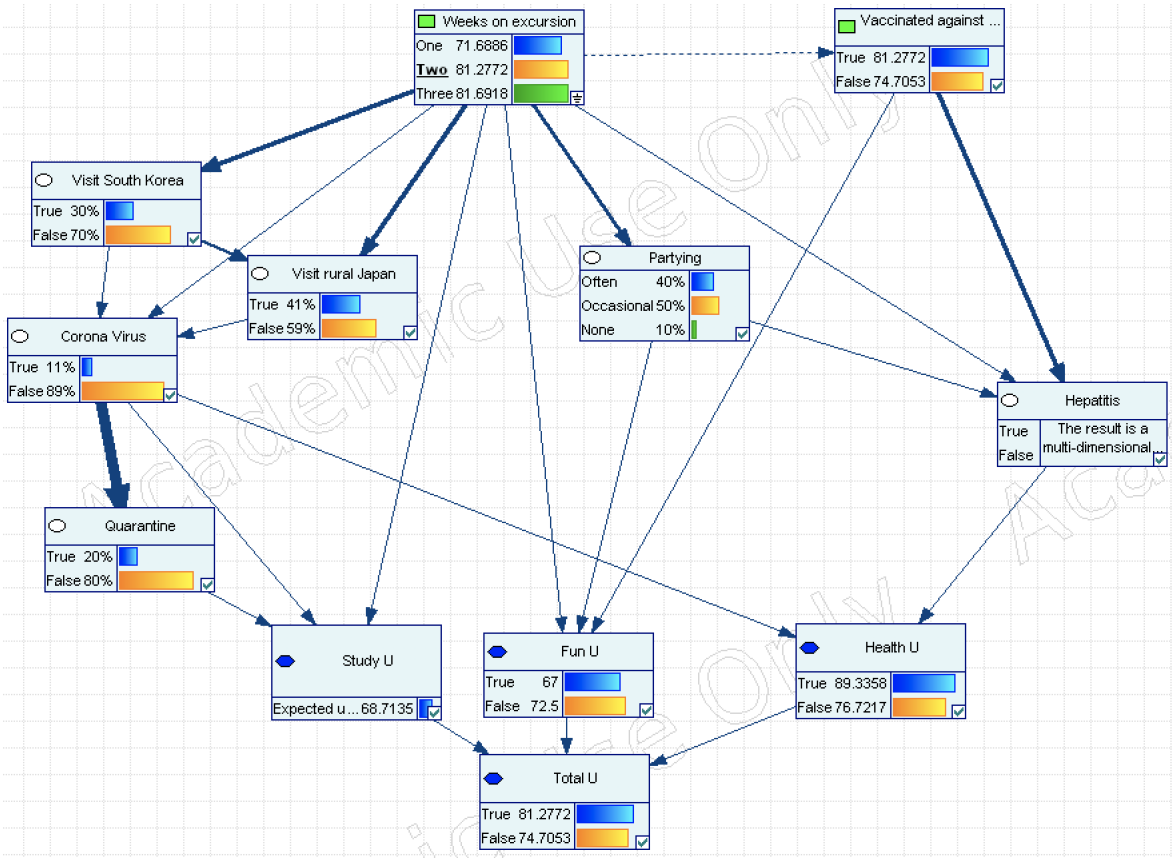


Figure 1: Model once two weeks are selected

Weeks on excursion	One	Two	Three
True	0	0.3	0.5
False	1	0.7	0.5

Figure 2: Total utility of each possible length.

Weeks on exc...	One		Two		Three	
Visit South Korea	True	False	True	False	True	False
True	0	0.2	0.2	0.5	0.5	0.7
False	1	0.8	0.8	0.5	0.5	0.3

Figure 3: Total utility of each possible length.

Contracting Corona Virus

Seeing as South Korea currently has a large outbreak of the Corona virus, visiting there will increase the chances of contracting the disease. However, visiting rural japan will lower it, as the disease is mostly contained to the larger urban areas. Visit South Korea has the direct effect on this node, as well as having the indirect effect of reducing the probability of spending time in rural japan, therefore increasing the probability of contracting the disease.

I realise this is starting to get impractically long without adding any real insight, which is why, for both my and the TA's sake, i will not go into the rest of the Chance nodes as they are similar to the ones i have already explained.

The Utilities

The three utility functions are used to separate the utility into categories of study-related utility, fun-related utility and health-related utility. This is to simplify the utility distribution, as having only a single total utility distribution would require utility measure of 2^6 cases. From the three types of utility to the total utility function I made an estimate of importance of each utility type. This became Study Utility: 0.12, Fun Utility: 0.25, Health Utility: 0.63.

Decision support

As we see in the figure 4, the decision support network suggests that with the described weighting and probabilities, 3 weeks is the highest valued length of excursion.
From the figure 5, the decision support network recommends to get vaccinated, when one is to travel for three weeks. Similar to the recommendation for length of travel, this is also dependent on the given probabilities and weighting of the utilities in the total utility function.

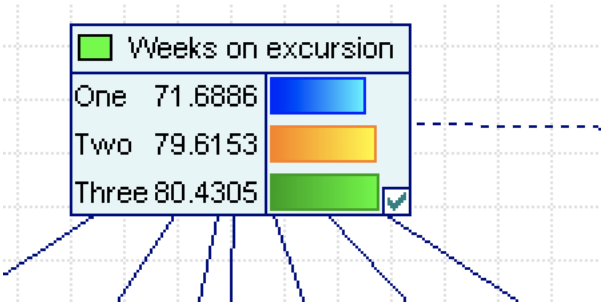


Figure 4: Total utility of each possible length.

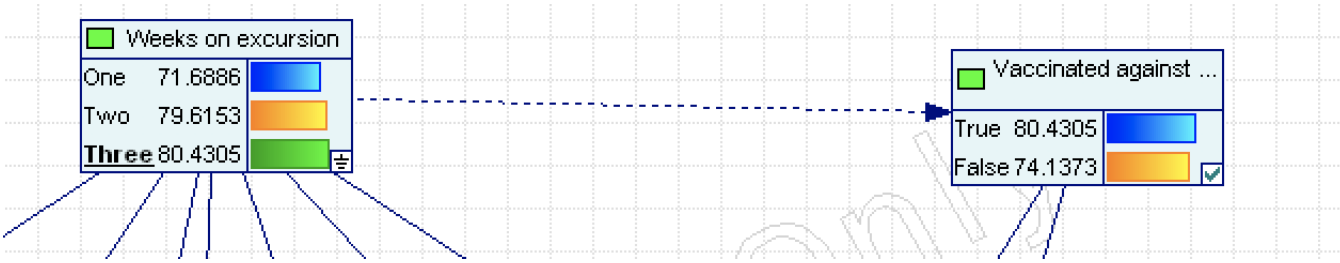


Figure 5: Total utility of vaccine given the utilitarian duration.