TDT4171 Artificial Intelligence Methods

Exercise 3

Introduction

My model in this exercise determines which drink I will buy/consume based on a set of variables. In this task I decided to include only 6 different drinks to decide between. 6 possible outcomes demonstrate that the problem works without making the workload unnecessarily large. This model contains three different nodes; A decisions node, chance nodes and utility(value)-nodes. All utility-nodes are denoted with a capital 'U' at the start of their name.

Model

What drink to buy – This is the decision node that determines which drink I will buy based on the input from the chance, and utility nodes.

UDrink – Sets a starting preference on certain drinks. For example; usually I like beer better than jeager shots, therefore beer gets a greater score from the beginning.

Exercise due tomorrow – Influences the decision based on whether an exercise is due tomorrow, or not. Is true/false.

Uexercise – Gives a weight of -5 if 'Exercise due tomorrow' is 'yes', and 0 if it is 'no'.

Tasted good – Is only observed after a decision is made. Is true/false. Has the child 'Ask for new drink.'

Ask for new drink – Is only observed after a decision is made. Is true/false. Has the parent 'Tasted good'. This node is a bit unrealistic since I rarely ask for a new drink, but I was running out of ideas for new nodes.

Has Eaten – Sets probabilities for having eaten on the day in question and sets a probability for buying each drink based on that. Contains the states 'little', 'medium' and 'a lot'.

Ueaten – Gives a weight of -5 if 'Has eaten' is 'little', -1 if it is 'medium' and 0 if it is 'a lot'.

Location – Sets probabilities for being at a specific location and sets a probability for buying each drink based on that. Contains the states 'Lyche', 'Wildside', 'Home', 'WorkWork' and 'Cellar'.

Ulocation – Gives a weight of -2 if 'Location' is 'Lyche', -4 if 'Wildside', 0 if 'Home', -3 if 'WorkWork' and 0 if 'Cellar'.

Hangover – Hangover determines whether I have a hangover on the day in question and sets a probability for buying each drink based on that. Contains the states ‘no, ‘little’ and ‘very’. This node is conditionally dependent on ‘Out night before’, ‘Is tired’, ‘Money’ and ‘Have a job’.

Uhangover - Gives a weight of -5 if ‘Hangover is ‘very, -2 if ‘little’ and 0 if ‘no’.

Is tired – Determines whether I am tired on the day in question and sets a probability for buying each drink based on that. Is true/false. This node is conditionally dependent on ‘Out night before’, ‘Hangover’, ‘Money’ and ‘Have a job’.

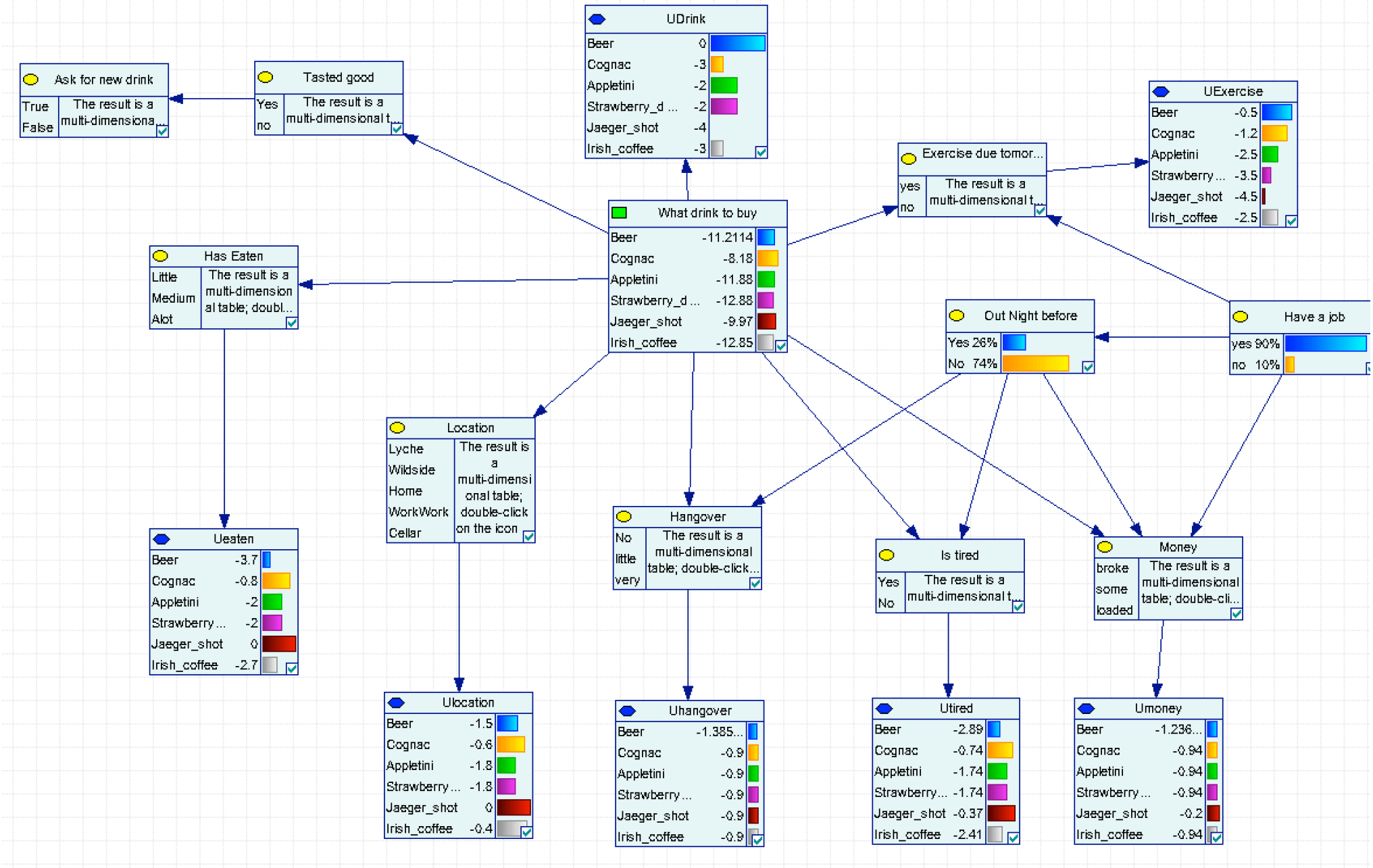
Utired - Gives a weight of -5 if ‘Is tired’ is ‘yes’ and 0 if it is ‘no’.

Money - Determines how much money I have on the day in question and sets a probability for buying each drink based on that. Contains the states ‘broke, ‘some and ‘loaded’. This node is conditionally dependent on ‘Out night before’, ‘Is tired’, ‘Hangover’ and ‘Have a job’.

Umoney - Gives a weight of -5 if ‘Money’ is ‘broke, -2 if ‘some’ and 0 if ‘loaded’.

Out night before – Determines if I was out the night before and sets a probability for buying each drink based on that. Is true/false. This node is parent to ‘Hangover’, ‘Is tired’ and ‘Money’. Is a child of ‘Have a job’.

Have a job – This node gives the probability for having a job at this current time. Is true/false. Has the children ’Exercise due tomorrow’, ‘Out night before’ and ‘Money’. In this model I always assume that this node affects whether or not I have money and if I was out the night the night before.


UDrink
Beer 0
Cognac -3
Appletini -2
Strawberry_d ... -2
Jaeger_shot -4
Irish_coffee -3
Ask for new drink
True
False
The result is a multi-dimensiona...
Tasted good
Yes
no
The result is a multi-dimensional t...
What drink to buy
Beer -11.2114
Cognac -8.18
Appletini -11.88
Strawberry_d ... -12.88
Jaeger_shot -9.97
Irish_coffee -12.85
Exercise due tomor...
yes
no
The result is a multi-dimensional t...
UExercise
Beer -0.5
Cognac -1.2
Appletini -2.5
Strawberry ... -3.5
Jaeger_shot -4.5
Irish_coffee -2.5
Has Eaten
Little
Medium
Alot
The result is a multi-dimension al table; doubl...
Out Night before
Yes 26%
No 74%
Have a job
yes 90%
no 10%
Location
Lyche
Wildside
Home
WorkWork
Cellar
The result is a multi-dimensi onal table; double-click on the icon
Hangover
No
little
very
The result is a multi-dimensional table; double-click...
Is tired
Yes
No
The result is a multi-dimensional t...
Money
broke
some
loaded
The result is a multi-dimensional table; double-cli...
Ueaten
Beer -3.7
Cognac -0.8
Appletini -2
Strawberry ... -2
Jaeger_shot 0
Irish_coffee -2.7
Ulocation
Beer -1.5
Cognac -0.6
Appletini -1.8
Strawberry ... -1.8
Jaeger_shot 0
Irish_coffee -0.4
Uhangover
Beer -1.385...
Cognac -0.9
Appletini -0.9
Strawberry ... -0.9
Jaeger_shot -0.9
Irish_coffee -0.9
Utired
Beer -2.89
Cognac -0.74
Appletini -1.74
Strawberry... -1.74
Jaeger_shot -0.37
Irish_coffee -2.41
Umoney
Beer -1.236...
Cognac -0.94
Appletini -0.94
Strawberry ... -0.94
Jaeger_shot -0.2
Irish_coffee -0.94

Assumptions

Conditional independence

There are some nodes that could be dependant on each other in the real world, such as: ‘Has eaten’ could be dependant on ‘Hangover’. I have chosen not to include this relation since it’s hard to come up with a correct ratio at which one affects the other. Some times a hangover leads to eating a lot the day after and sometimes it leads to not eating at all.

The location may depend upon how much money I have, but as of now it is mostly never an issue when we decide where to go.

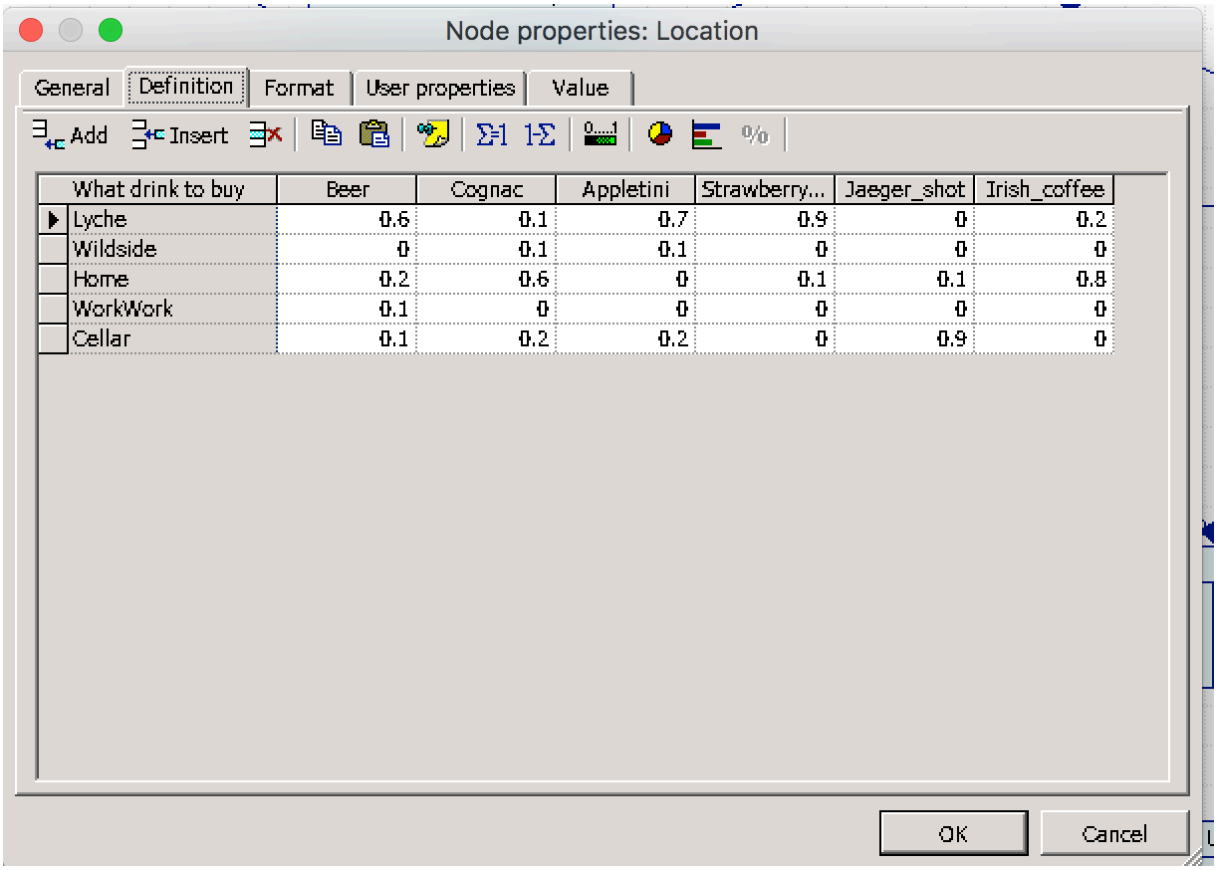
Structure

I have chosen to have singular utility nodes for the chance nodes. This is mostly just to avoid getting very large multidimensional matrices which would take a long time to edit. I also choose to add initial preferences to each drink with the ‘Udrink’ node. This was a simple way to say that I, for example, enjoy beer the most in most situation.

Process

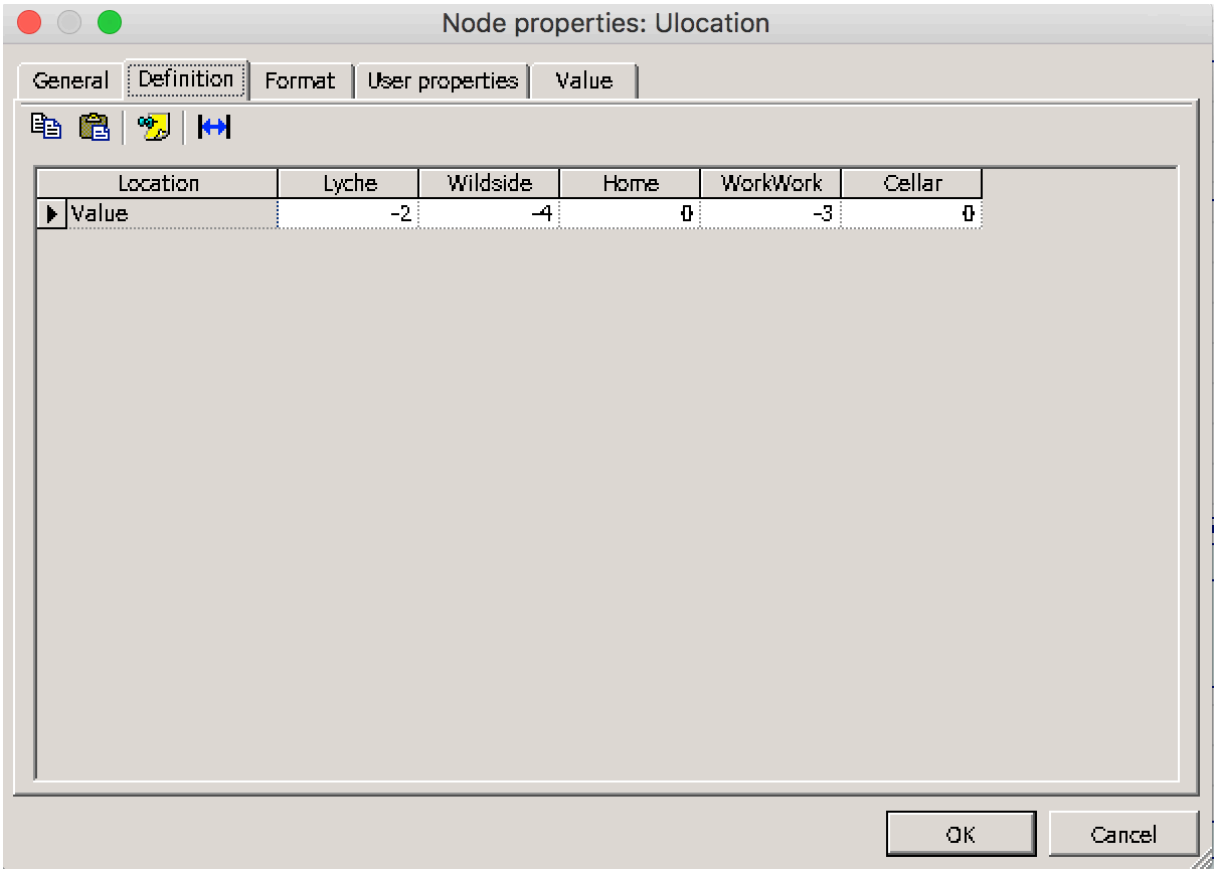
The process of creating this model followed chapter 16.7 in the book. At first I created the nodes which were relevant. Then I created the relations between them. I then assigned initial probabilities and utilities which I had to tweak a good deal before the results started to make sense. I then also had to change the amount small changes could make to the overall decision. Essentially I followed the book step by step.

Quantifications of uncertainties



The above image is from the ‘Location’ node. As you can see, the probabilities for each drink are based on the location. All the other chance nodes are modeled in a similar way. The probabilities are based of of my experience with buying drinks at the specific locations.

Quantifications of utilities



The above image is from the ‘Ulocation’ node. The values are based on the taste and cost of drinks at each location. As you can see I have chosen to add negative values starting at 0 and going downwards instead of starting at 0 and going upwards with positive values. This is consistent throughout the model. The choice of the model will be the same as long as the values are correct relative to each other. The values themselves are somewhat achieved through trial and error. I wanted values where one utility node would not dominate the others, and where realistic decisions were achieved. I can tweak the values a lot more, but I hope this will demonstrate