TDT4171 - Assignment 3

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1 Introduction

In this assignment we will make a decision support system to aid "linjeforeningen online"s excursion committee in deciding if and where to travel. The example used us a fictional example. The decision model is made in GeNIe 2.0.

2 Decision problems

Which country should "linjeforeningen online" go on excursion to?

This decision is not trivial and depends on various variables.

Decision alternatives:

- Latvia
- Iraq
- North Korea
- South Korea
- USA

3 Variables

Certain

- travel time: [short, medium, long]
- travel cost: [cheap, affordable, expensive]
- is the country known for its information technology? [yes, no]
- will enough student sign up for the excursion?: [yes, no]

Uncertain

- Wind: [calm, breeze, storm]
- Humidity: [dry, wet]
- Temperature: [cold, temperate, hot]
- Communication difficulty? [yes, no]
- Is it safe to travel?: [yes, no]
- Accommodation quality: [good, decent, bad]

4 Assigning probabilities and utilities

The probabilities were "guesstimated" based on wikipedia information about weather and "common" knowledge about the countries geographical location etc. And strictly speaking made up in some cases.

Utility values were assigned using integers in the rage 0-5 based on desirability, best explained by a couple of examples: For the humidity variable: dry=1, wet=0. Wind: calm=2, breeze=1, storm=0. etc. The full assignments are shown in the tables below.

The "Utility" function is calculated from the "Travel", "Weather", "Trip" and "Excursion" utility functions with the expression:

$$Utility = (2 * Travel + 9 * Trip + 3 * Weather) * Excursion$$

The weights where chosen by the authors discretion. One interesting aspect of the expression is that its multiplied by the "Excursion" utility that takes the value of 1 if there are enough students signed up, and 0 if not.

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
calm	0.3	0.6	0.4	0.5	0.5
breeze	0.5	0.3	0.4	0.2	0.2
storm	0.2	0.1	0.2	0.3	0.3

Figure 1: Wind variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
dry	0.4	0.8	0.3	0.5	0.5
wet	0.6	0.2	0.7	0.5	0.5

Figure 2: Humidity variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
cold	0.4	0.1	0.5	0.4	0.3
temperate	0.4	0.4	0.4	0.4	0.4
hot	0.2	0.5	0.1	0.2	0.3

Figure 3: Temperature variable

Wind	calm					
Humidity	dry			wet		
Temperature	cold	temperate	hot	cold	temperate	hot
Value	3	5	4	2	4	3

Figure 4: Weather utility function

breeze						storm					
dry			wet			dry			wet		
cold	temperate	hot	cold	temperate	hot	cold	temperate	hot	cold	temperate	hot
2	4	3	1	3	2	1	3	2	0	2	1

Figure 5: Continuation of Weather utility function

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
yes	0.6	0.8	0.9	0.5	0.1
no	0.4	0.2	0.1	0.5	0.9

Figure 6: Communication difficulties variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
yes	○	○	○	◉	◉
no	◉	◉	◉	○	○

Figure 7: Information technology variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
safe	0.7	0.1	0.3	0.9	0.7
unsafe	0.3	0.9	0.7	0.1	0.3

Figure 8: Safety variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
bad	0.4	0.5	0.7	0.2	0.2
decent	0.4	0.3	0.2	0.5	0.4
good	0.2	0.2	0.1	0.3	0.4

Figure 9: Accommodation quality variable

Communicatio...	yes											
Safety	safe						unsafe					
Information_te...	yes			no			yes			no		
Accomodation...	bad	decent	good	bad	decent	good	bad	decent	good	bad	decent	good
Value	3	4	5	2	3	4	2	3	4	1	2	3

Figure 10: Trip utility function

no												
safe							unsafe					
yes			no				yes			no		
bad	decent	good	bad	decent	good		bad	decent	good	bad	decent	good
2	3	4	1	2	3		1	2	3	0	1	2

Figure 11: Continuation of Trip utility function

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
short	◉	○	○	○	○
medium	○	◉	○	○	○
long	○	○	◉	◉	◉

Figure 12: Travel time variable

Where to travel?	Latvia	Iraq	North_Korea	South_Korea	USA
cheap	◉	○	○	○	○
affordable	○	◉	○	○	◉
expensive	○	○	◉	◉	○

Figure 13: Travel cost variable

Travel_time	short			medium			long		
Travel_cost	cheap	affordable	expensive	cheap	affordable	expensive	cheap	affordable	expensive
Value	1	2	3	2	3	4	3	4	5

Figure 14: Travel utility function

5 The model

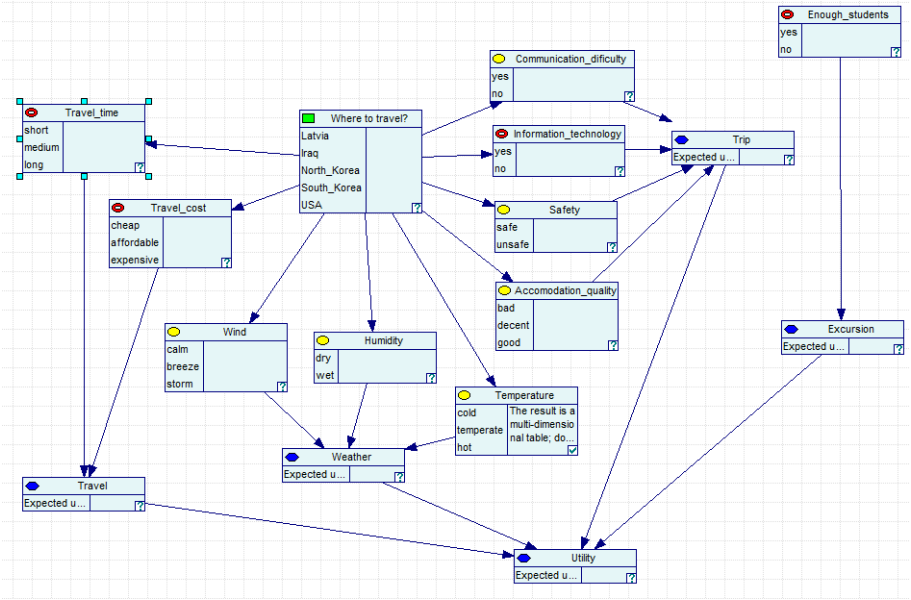

Figure 15: Influence graph for the decision problem

6 Verification

With enough students, South Korea is the best option, followed by USA in a close second. North Korea and Iraq are the worst options. These results seems to be what one would expect. With not enough students

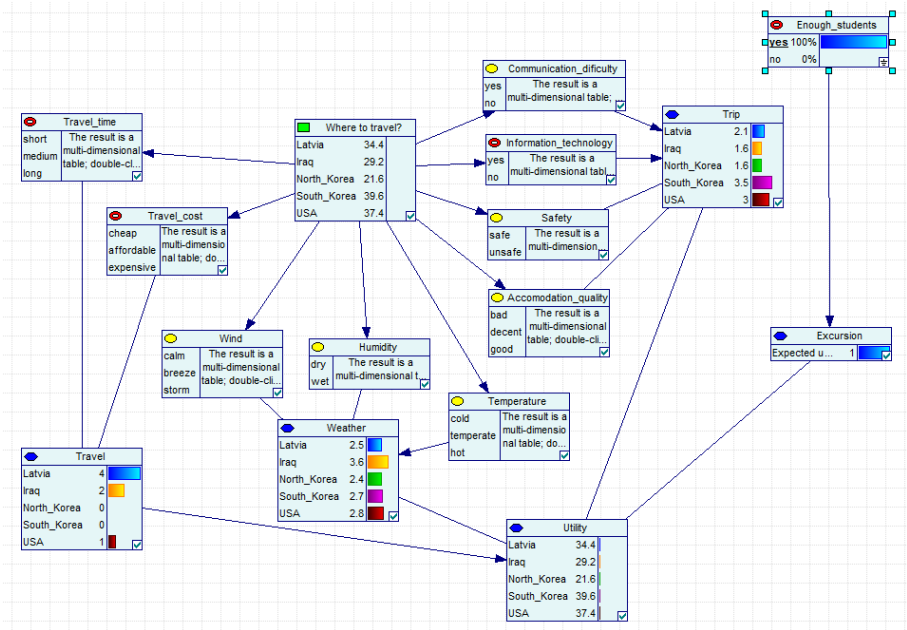

Figure 16: Enough students

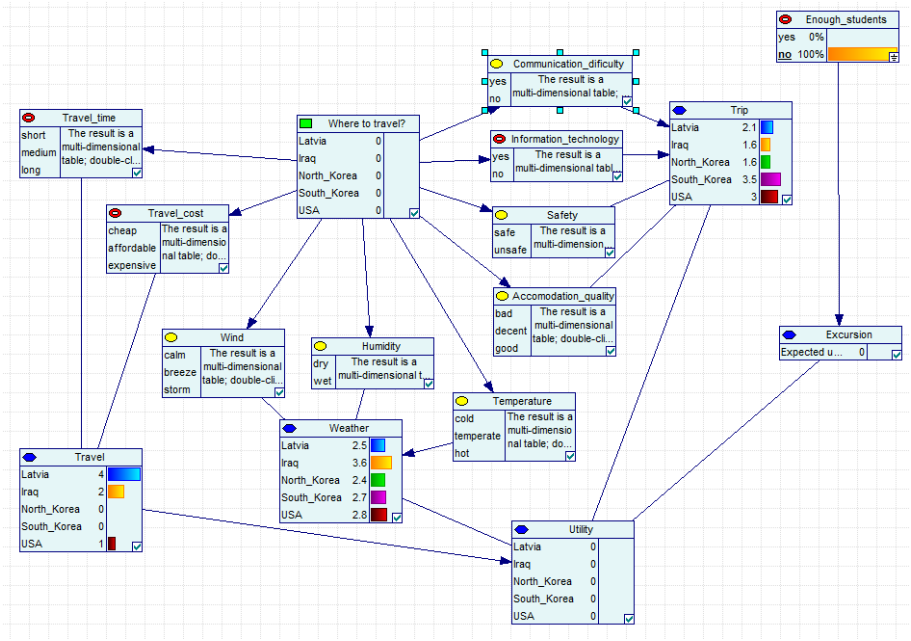

Figure 17: Not enough students