

Bayesian Models CSE458
Exercise 3

NOTE:

- For this assignment you will be required to construct various networks in Netica.
- You are required to save the all the networks you construct, put them in a directory called **CSE458-Ex3-loginId** then tar and zip this directory and email it to me.
- Please hand in all the other answers.

An Oil Drilling Problem

Consider the Oil Drilling Problem given in the last Exercise Sheet. Construct a Bayesian Network showing the connection between the **True State**, the **Seismic outcomes**, and the **Structure indicated by the Experimental Device**. The tables required to construct the network are given here for convenience.

True State	Seismic outcome		
	No Structure	Open Structure	Closed Structure
Dry	0.30	0.15	0.05
Wet	0.09	0.12	0.09
Soaking	0.02	0.08	0.10

Table 1

Underlying Structure	Structure indicated by experiment		
	No Structure	Open Structure	Closed Structure
No Structure	0.90	0.10	0.00
Open Structure	0.20	0.70	0.10
Closed Structure	0.10	0.30	0.60

Table 2

Urn Problems

1. Consider the urn problem discussed in lectures, where we had **800** urns, of **Type 1**, with **4 Red Balls** and 6 Black Balls, and **200** urns, of **Type 2**, with **9 Red Balls** and **1 Black Ball**. Construct a Bayesian Network representing drawing a single ball from an unknown urn.

2. Now, suppose you get Charlie to draw a ball for you, and Charlie only correctly states it is a **Red Ball 80%** of the time, and correctly states it is a **Black Ball 70%** of the time.
 - (a) Construct a Bayesian Network representing Charlie drawing a single ball from an unknown urn.
 - (b) Suppose Charlie tells you he drew a **Black Ball**, what would then be your probability that he drew it from the urn of **Type 1**?
3. Now suppose you not sure how many urns there are of each type. However, you have the following belief that the percentage of urns of **Type 1**.

Percentage	10%	20%	30%	40%	50%	60%	70%	80%	90%
Belief	0.01	0.02	0.04	0.10	0.20	0.35	0.15	0.08	0.05

Table 3

- (a) Construct a Bayesian Network representing this situation.
 - (b) Suppose Charlie tells you he drew a **Black Ball**, what would then be your probability distribution of the percentage of urns of **Type 1**?
4. Now suppose Charlie is allowed to take **5** samples with replacement.
 - (a) Construct a Bayesian Network representing this situation.
 - (b) Suppose Charlie tells you he drew a **3 Black Balls** and **2 Red Balls**, what would then be your probability distribution of the percentage of urns of **Type 1**?