

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.

Down’s Syndrome

The following problem is based on a problem in R. Falk, *Understanding Probability and Statistics: A Book of Problems*, A K Peters, Ltd, 1993.

It is known that the risk of a newborn baby having Down’s Syndrome is strongly linked to the mother’s age. The following is a table of probabilities of giving birth to a child having Down’s Syndrome, which comes from OB/GYN Secrets by Helen L. Frederickson, M.D. and Louise Wilkins-Haug, M.D. Ph.D.

Age	32	33	34	35	36	37	38	39	40	41	42	43
Prob	$\frac{1}{725}$	$\frac{1}{592}$	$\frac{1}{465}$	$\frac{1}{365}$	$\frac{1}{287}$	$\frac{1}{255}$	$\frac{1}{177}$	$\frac{1}{139}$	$\frac{1}{109}$	$\frac{1}{85}$	$\frac{1}{67}$	$\frac{1}{53}$

Chorionic Villus Sampling (CVS) is known to be 98% accurate. We will assume that in 98% of the cases it will correctly identify an affected embryo as affected, and in 98% of the cases it will correctly diagnose a normal embryo as normal.

Amniocentesis is known to be a more accurate test than CVS. The test mistakenly diagnoses Down’s Syndrome in only 0.5% of the normal embryos, and incorrectly identifies affected embryos as normal in 0.5% of cases.

1. Build a Bayesian network and use it to calculate a table of probabilities which show for a women of each of the ages given above the probability of them having a embryo with Down’s Syndrome given that CVS test diagnosed Down’s Syndrome.
2. Assume now that the results of the Amniocentesis test and the CVS test are independent of age of the women given the true nature of the embryo. Build a Bayesian network and use it to calculate a table of probabilities which show for a women of each of the ages given above the probability of them having a embryo with Down’s Syndrome given that both tests diagnosed Down’s Syndrome.

Oil Drilling Problem

Consider the oil drilling problems stated in Exercise Sheet 2.

1. Construct a Bayesian Network which models the joint probability of the true state, the true structure (as observed by seismic soundings), and the structure observed by the experimental device.
2. Now, construct a Decision Network which uses the the following utility function:

$$u(x) = e^{x/200,000,000} - 1.$$

3. Use the Decision Network to determine what should the wildcatter do?