School of Computer Science and Software Engineering
Monash University, Clayton Campus
Computer Science
Semester I, 2004

Bayesian Models CSE458
Assignment 1

The purpose of this assignment is to write a program which reads in Decision Networks which have been built in Netica, and represents this network as a Decision Flow Diagram.

INSTRUCTIONS

- You may use any programming language for your implementation, as long as you provide the source code and a Makefile to build an executable version which will run on Linux.
- You **must** describe how to run your programs in a README file and document your code. Marks will be given to documentation.
- Your programs **must** work on the following input files:
  1. A Decision Network corresponding to the Urn problem given in lectures, (a copy is available via the courseware page).
  2. A Decision Network corresponding to the Oil Drilling Problem in the paper by Shachter (1986), which was handed out in lectures. Please include any numbers you need.
- For submission, please put your files (source, Makefile) in a directory called **CSE458-Ass1-loginId** then tar and gzip this directory and email it to me by the due date.

Shachter's Algorithm [20 marks]

Write a program which implements Shachter's algorithm. Your program must be able to read in an Influence Diagram (which was built in Netica) and outputs the nodes in the reverse order to which they were eliminated.

Decision Flow Diagram [40 + 10 = 50 marks]

1. Write a program which reads in a Influence Diagram (which was built in Netica) and represents the Influence Diagram as Decision Flow Diagram. You may represent the Decision Flow Diagram, in terms of a tree structure and/or a set of menus.

   The user must be able to determine:

   (a) For each decision node (in the Decision Flow Diagram), what were the various options, and what are their corresponding EMV values.

   (b) For each chance node (in the Decision Flow Diagram), what were the various outcomes, their corresponding EMV values, and their corresponding conditional probabilities.

2. Simplify the representation of the Decision Flow Diagram so that:

   (a) You eliminate any outcomes in a chance node which has a conditional probability of zero.

   (b) You eliminate any decision node whose options all have the same EMV value.

Multiple Utility Nodes [20 marks]

Extend your program to handle more than one utility node. You may of course assume that the utilities are additive. Also, as now some costs/benefits through out the Decision Flow Diagram, include the costs/benefits on the corresponding nodes in the Decision Flow Diagram.

Strategy [10 marks]

Although the evaluation of all possible pure strategies becomes unmanageable even for simple networks, it is still useful for managers to consider strategies. Extend your program so that a user can define a strategy, and your program finds EMV and the probability distribution of possible values (dependent on the outcomes of experiments and the true state of the world) corresponding to the strategy. For example for the strategy σ_{96} given in lecture 2, the EMV is 31.15 and the probability distribution would be:

Value	-33.5	-29	-18.5	26.5	31	86.5
Probability	0.02	0.02	0.10666	0.21333	0.48	0.16