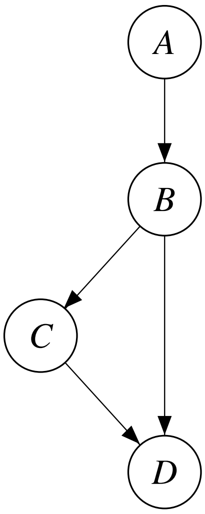
2009 Paper 8 Question 1

Artificial Intelligence II

Consider the following Bayesian Network:



The associated probability distributions for the binary random variables A, B, C and D are $\Pr(a) = 0.7$, $\Pr(\neg a) = 0.3$ and:

A	$\Pr(b\|A)$	B	$\Pr(c\|B)$	B	C	$\Pr(d\|B,C)$
$\top$	0.1	$\top$	0.2	$\top$	$\top$	0.6
$\bot$	0.15	$\bot$	0.95	$\top$	$\bot$	0.5
				$\bot$	$\top$	0.4
				$\bot$	$\bot$	0.3

(a) Write down an expression for the full joint distribution of the random variables A, B, C and D. Compute the probability that A and B are $\top$ while C and D are $\bot$. [2 marks]

(b) Use the *variable elimination algorithm* to compute the probability distribution of B conditional on the evidence that $D = \bot$. [16 marks]

(c) Explain why the variable elimination might not be an effective algorithm to use in practice and suggest an alternative that addresses the shortcoming you have given. [2 marks]