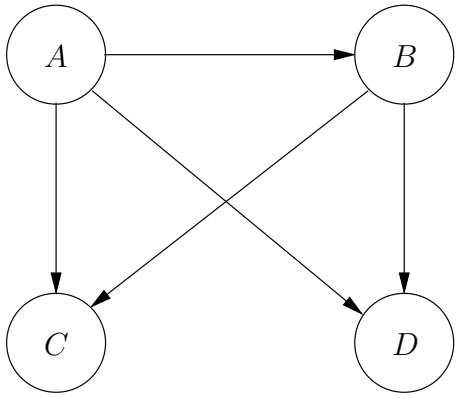
COMPUTER SCIENCE TRIPOS Part II – 2014 – Paper 7

2 Artificial Intelligence II (SBH)

Consider the following Bayesian network:



The associated probability distributions for the binary random variables A, B, C and D are $\Pr(a) = 0.2$, $\Pr(\neg a) = 0.8$ and:

A	$\Pr(b\|A)$
$\bot$	0.8
$\top$	0.7

A	B	$\Pr(c\|A,B)$	$\Pr(d\|A,B)$
$\bot$	$\bot$	0.4	0.9
$\bot$	$\top$	0.2	0.8
$\top$	$\bot$	0.3	0.1
$\top$	$\top$	0.1	0.2

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

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

(c) Comment on the computational complexity of the variable elimination algorithm. [2 marks]