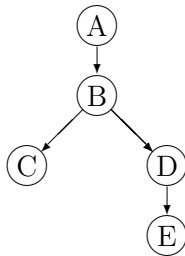


Exercise Sheet 7

Exercise 22 Probabilistic Propagation

Consider the following Bayesian network and the corresponding (conditional) probability distributions:



$P(A)$	a_1	a_2
	0.6	0.4

$P(B A)$	a_1	a_2
b_1	0.3	0.7
b_2	0.7	0.3

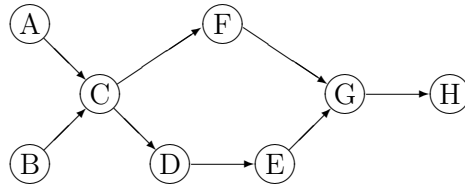
$P(C B)$	b_1	b_2
c_1	0.6	0.2
c_2	0.4	0.8

$P(D B)$	b_1	b_2
d_1	0.9	0.4
d_2	0.1	0.6

$P(E D)$	d_1	d_2
e_1	0.75	0.5
e_2	0.25	0.5

- a) Determine the a-priori distribution for all four variables!
- b) It becomes evident that variable D assumes value d_2 . Propagate this evidence across the network with the tree-based propagation algorithm presented in the lecture, i.e., compute all four a-posteriori distributions!
- b) After some time we get additional evidence about A . Assume a_2 being the observed value of A and propagate the evidence across the network with the tree-based propagation algorithm presented in the lecture. Which a-posteriori distributions are influenced by the additional evidence?

Exercise 23 Construction of Clique Trees



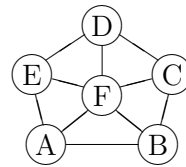
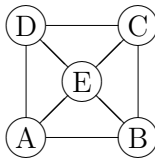
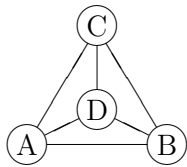
Construct stepwise for the depicted Bayesian network

- the moral graph,
- a triangulated moral graph,
- a perfect ordering using maximum cardinality search, and
- a cliquen tree/join tree!

At which steps of the construction do you have multiple options to proceed? Show that the resulting cliquen tree/join tree fulfills the running intersection property.

Exercise 24 Triangulation and Joint Tree Construction

Given the following three undirected graphs:



- Check which graphs are triangulated! Try to recognize this without applying the triangulation algorithm from the lecture.
- Triangulate the graphs that are not yet triangulated and determine for each of them a join tree!