Bayesian Networks - Exercise Sheet 4

Solutions need to be handed in until **Tuesday, November 22nd 2pm**

Exercise 1: Markov Networks, Potentials (10 Points)

Given are two potentials ψ_1 and ψ_2 that factorize a joint probability distribution $P(A, B, C, D)$.

A	B	$P(A, B)$
0	0	0.2
0	1	0.2
1	0	0.3
1	1	0.3

Table 1: Potential ψ_1

D	B	C	$P(B, C, D)$
0	0	0	0.225
0	0	1	0.05
0	1	0	0.075
0	1	1	0.15
1	0	0	0.075
1	0	1	0.15
1	1	0	0.025
1	1	1	0.25

Table 2: Potential ψ_2

a) Multiply both potentials and reconstruct P. Normalize P. What is the normalization constant?

b) Sketch the graph G that results from the factorization. List all independencies that are visible in the graph.

c) Proof that $I_P(A, C \mid B)$ holds.

d) Does the independence relation $I_P(B, D \mid C)$ hold? Explain.

e) Is G a representation of P? If yes is G a faithful representation of P? Explain.

Exercise 2: Cliques in Graphs, Triangulation (10 Points)

Have a look at the undirected graph in Figure 1.

a) List all cliques of G. Does G contain a chain of cliques? Explain.

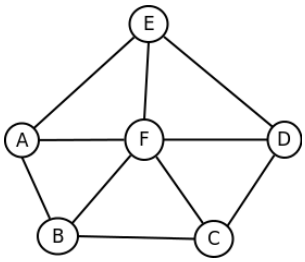

Figure 1: The undirected graph G.

b) Modify G (by adding edges) to a triangulated graph G^{mod}. List all cliques of G^{mod}. Does G^{mod} contain a chain of cliques? Explain.

c) Does G or G^{mod} contain a perfect ordering? Name the perfect ordering, if it exists. Explain.