1. (10) Question 4.4 in Pearl’s book.

2. (10) (revised question 4.5 in Pearl’s book) Find a join-tree representation for the network in Figure 4.37 and "solve" the problem in exercise 4.4 schematically (demonstrating the type of messages that would be passed). Optional: solve the problem fully by hand or using one of the software available.

3. (10) (4.7 in Pearl’s book) Solve exercise 4.4 by belief propagation ignoring the loops: Generate the dual join-graph where each function is a single node and apply the message passing (lambda passing and pi's) as if the network is singly connected until you reach a stable state. Assess the merit of this technique as a possible approximation method. (You can also use REES for this question: belief propagation (IJP) is one of the methods available. You will only need to provide the network and set the parameters appropriately. Ask Radu for more information.)

4. (10) Consider the polytree in Figure 1. Explain how elim-mpe can find the most probable explanation (mpe) given the evidence, f=0. Demonstrate your computation. You can do calculation by hand or use REES, wiki-software, Hugin or JavaBayes to solve the computational parts of this question.
5. (15) Consider the Bayesian network dag in Figure 2.

(a) Assume you have evidence over $F$. Describe how the loop-cutset scheme can find the belief for every variable. What is its time and space complexity.

(b) Assume you compute the beliefs using join-tree clustering. What would be the time and space complexity. Explain.

(c) Suggest an efficient scheme for solving the network without recording more than unary functions. Discuss your proposals.
6. (10) Let \((G, P)\) be a Bayesian network and let \(C\) be a subset of variables that is a loop-cutset. Prove that \(P(C = c)\) can be computed in linear time and space.

7. (10) (extra credit) Which method has better time complexity, the loop-cutset method or join-tree clustering? Prove your claims.

8. (10) Consider the network in Figure 3. What will be the complexity of loop-cutset conditioning on the network. How would it compare with elim-bel? with join-tree clustering?

![Figure 3: A chain directed graph](image)

9. (5) (Extra credit) Provide feedback on chapter 2 in the class notes: structure, typos, clarity. Does it help in your studies?