

1. Explain the notion of a conjugate prior. Give and explain an example.
2. Give a definition of a Bayesian Network. What is the structure, what are the parameters in this model? What does this model represent and why is it useful? Give and explain an example.
3. Explain the notion of D-separation.
4. Explain the notion of marginal likelihood, how can it be approximated and why does it penalize model complexity.
5. Explain the difference between the complete likelihood and the observed likelihood. Give an example of a model and give the formula for the two types of likelihood in this model.
6. Explain what happens in the E step and in the M step of EM algorithm.
7. Explain what is KL divergence, how it is computed and how interpreted.
8. Define a Hidden Markov model.
9. What is computed by the algorithms: Viterbi, forward, backward and Baum-Welch algorithm?
10. Explain the maximum parsimony principle in reconstruction of phylogenetic trees.
11. Explain the Sankoff algorithm.
12. Explain the notion of a rate matrix in a rate substitution model.
13. Explain the Metropolis-Hastings algorithm.
14. Explain the MCMC algorithm for phylogenetic trees.
15. Explain variational inference with factorized distributions.
16. How is exact inference performed for cyclic and how for acyclic graphs? What are the basic laws, which are used as basis for the algorithms?
17. Explain the junction tree algorithm. What does it compute? What do the cluster potentials correspond to?
18. Explain model selection (learning the structure of the model) for Bayesian tree models.
19. Describe and explain the objective function of elastic net. What are the parameters of this model? Which part of the objective function is intended to obtain a good fit of the model to training data, and which to obtain model regularization?
20. Explain the objective function of fused lasso. What are the parameters of this model? Which part of the objective function is intended to obtain a good fit of the model to training data, and which to obtain model regularization? In which situations is this model best applicable?