# Machine Learning 2 — Homework 4

Maurice Frank
11650656
maurice.frank@posteo.de

September 26, 2019

## Problem 1.

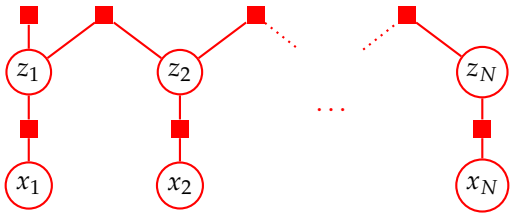
We have $\boldsymbol{X} = \{x_1, \dots, x_N\}$ and $\boldsymbol{Z} = \{z_1, \dots, z_N\}$.

**1.**

$$p(\boldsymbol{Z}, \boldsymbol{X}) = p(z_1) \cdot \left( \prod_{i=2}^{N} p(z_i | z_{i-1}) \right) \cdot \left( \prod_{i=1}^{N} p(x_i | z_i) \right)$$

**2.**

We present the factor graph for the Markov chain:




**3.**

$$p(\boldsymbol{X}) = f_1(z_1) \cdot \left( \prod_{i=2}^{N} f_i(z_i, z_{i-1}) \right) \cdot \left( \prod_{i=1}^{N} f_{N+1}(z_i, x_i) \right)$$

**4.**

$$p(z_n | \boldsymbol{X}) = \frac{\alpha(z_n)\beta(z_n)}{p(\boldsymbol{X})}$$

## Problem 2.

**1.**

$$\mu_\alpha(x_2) = \sum_{x_1} \psi_{1,2}(x_1, x_2)\mu_\alpha(x_i) \qquad = \sum_{x_{i-1}} \psi_{i-1,i}$$

**2.**

## Problem 3.

## Problem 4.