Background

The idea comes from exponential family

$$\mathbb{P}_\theta(\mathbf{Z}=\mathbf{z}) = \exp\{\theta^T \mathbf{g}(\mathbf{z}) - \psi(\theta)\}$$

Model

$G=(V,E)$, Y_{ij} describes the existence of edge between i and j

$$\mathbb{P}_{\boldsymbol{\theta}}(\mathbf{Y}=\mathbf{y}) = \left(\frac{1}{\kappa}\right)\exp\left\{\sum_H \theta_H g_H(\mathbf{y})\right\}$$

- each H is a *configuration*, which is defined to be a set of possible edges among a subset of the vertices in G;
- $g_H(\mathbf{y}) = \prod_{y_{ij}\in H} y_{ij}$, and is therefore either one if the configuration H occurs in $\mathbf{y}$, or zero, otherwise;
- a non-zero value for θ_H means that the Y_{ij} are dependent for all pairs of vertices $\{i,j\}$ in H, conditional upon the rest of the graph

R package

`ergm`

Reference

- Statistical Analysis of Network Data with R