1. Degree and Strength

$$\text{Degree} \implies \sum_{j=1}^{N} a_{ij}$$

$$\text{Strength} \implies \sum_{j=1}^{N} w_{ij}$$

Opsahl's Tuning Parameter

$$C_D^{W\alpha}(i) = \deg_i \times \left(\frac{\text{str}_i}{\deg_i}\right)^{\alpha}$$

1.2. Node Indegree and Outdegree from Adjacency Matrix

$$\text{Indegree from Adjacency Matrix} = \sum_{i=1}^{n} A_{ij}$$

$$\text{Outdegree from Adjacency Matrix} = \sum_{j=1}^{n} A_{ij}$$

2. Shortest Path

$$d(i,j) = \min(x_{ih} + \cdots + x_{hj})$$

where $d(i,j)$ is the distance between nodes i and j. The nodes that come inbetween those are h.

2.1. Djikstra's Algorithm

$$d^W(i,j) = \min\left(\frac{1}{w_{ih}} + \cdots + \frac{1}{w_{jh}}\right)$$

Opsahl's Tuning Parameter

$$d^{W\alpha}(i,j) = \min\left(\frac{1}{(w_{ih})^{\alpha}} + \cdots + \frac{1}{(w_{jh})^{\alpha}}\right)$$

3. Betweenness and Closeness

$$\text{Betweenness} \implies C_B(i) = \sum_{j}^{N} \sum_{k}^{N} \frac{g_{jk}(i)}{g_{jk}}^{-1}$$

$$\text{Closeness} \implies C_C(i) = \left[\sum_{j}^{N} d(i,j)\right]$$

Opsahl's Tuning Parameter

$$C_B^{W\alpha}(i) = \sum_j^N \sum_k^N \frac{g_{jk}^{W\alpha}(i)}{g_{jk}^{W\alpha}}$$

$$C_C^{W\alpha}(i) = [\sum_j^N d^{W\alpha}(i,j)]^{-1}$$

4. Transitivity

$$\text{Global Clustering Co-efficient} \implies G_c = \frac{3 \times \Delta}{\text{triplets}} = \frac{\text{closed triplets}}{\text{triplets}} = \frac{\tau\Delta}{\tau}$$

where τ is the number of 2-paths, and $\tau\Delta$ is the number of these 2-paths that are closed by triangle.

$$\text{Local Clustering Co-efficient} \implies C(i) = \frac{\text{No of actual links}}{\text{No of possible links}} = \frac{\tau_i\Delta}{\tau}$$

5. Two-Mode Networks

$$\text{Density} \implies N_D = \frac{\text{No of available links}}{N_p \times N_s}$$