Complex Networks

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Exercise 1 - Global Network characteristics (4 points)

Introduce the three general measures to characterise networks:

- (a) Node degree and degree distribution. (1 point)
- (b) Clustering coefficient. (1 point)
- (c) Average path length. (1 point)
- (d) Discuss their typically observed characters in real networks. (1 point)

Exercise 2 - Local Network characteristics (6 points)

Consider the following undirected, unweighted network structure



- (a) Derive the link overlap value of the link connecting nodes 3 and 4. (2 points)
- (b) Derive local clustering coefficient of node 3. (2 points)
- (c) Calculate the 1st, 2nd, and 3rd core of the graph. (2 points)

Exercise 3 - Network model (5 points)

- (a) Introduce the Barabási-Albert model and the conditions for the emergence of the scale-free degree property. (3 points)
- (b) Discuss briefly the characters of the Barabási-Albert network in terms of degreedistribution, clustering, and shortest path length (2 points)

Exercise 4 - Applications (5 points)

- (a) Define modularity and its features. (2 points)
- (b) What is a dendrogram and introduce the general idea of hierarchical clustering? (1 point)
- (c) Introduce a modularity based community detection method. (2 points)