

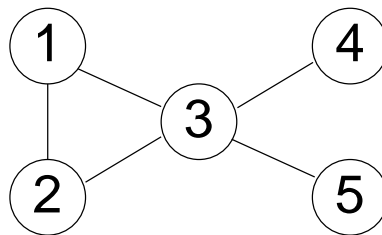
1. Exercise Sheet – Networks (with applications to neuroscience)

Due date: Fr. 10.06.2011 14:00

This exercise sheet is meant to provide help in order to recap the topics of this week's lectures. Solutions will be discussed during the Friday lecture.

Problem 1: Exemplary networks

Consider the following network:



Calculate:

1. the adjacency matrix.
2. the degree of each node.
3. the cluster coefficient for both definitions (via connections between neighbors and via triangles and triples).
4. the distance matrix and the average path length.

Repeat the calculation for a uni- and bi-directional ring of 6 elements.

Problem 2: Euler characteristic I

A graph is called *planar* if it can be drawn in \mathbb{R}^2 without crossing edges.

Proof the following theorem:

For any connected, planar graph G with n vertices, e edges, and f facets, the following equation holds:

$$n - e + f = 2.$$

Problem 3: Euler characteristic II

Why is the all-to-all connected graph of 5 vertices not planar?

Why is the bi-partite graph of 6 vertices not planar?