Assignments $\mathcal{N}^{\underline{o}}$ 1

released: 29.10.2014   **due:** 03.11.2014

Task 1: Uniform Random Graph Model   2 points

Assume we have drawn a random graph from the uniform random graph model on the set of all *directed*, loopless graphs with n vertices. What is the probability that this graph has exactly m edges?

Task 2: Structural Balance   4 points

Let Δ the set of undirected triangle graphs, in which each edge is either labeled positive or labeled negative — that is, instead of being present or not, each of the three edges is either positive or negative. Define a random graph model on Δ, such that all of the following conditions hold at the same time:

(1) All balanced graphs are more probable than unbalanced ones.

(2) All edges are pairwise independent.

(3) Every edge depends on the two others.

Task 3: $\mathcal{G}(n,p)$ characterization   4 points

Proof the following three properties of the $\mathcal{G}(n,p)$ model:

(1) The edge probability of every dyad is equal to p.

(2) The model is fully independent.

(3) There is just one model satisfying properties (1) and (2).

Task 4: Preparing data for further analysis   **5 points**

(a) Import (as R matrices) the adjacency matrices `klas12b-net-1`, `klas12b-net-2`, `klas12b-net-3`, `klas12b-net-4` in R.

    (a.1) With respect to every matrix: delete the 21st row and the 21st column corresponding to a pupil who did not always fill the questionnaire.

    (a.2) Replace the missing links in each wave (coded by 9) by values of the previous wave (e.g. missing links in second wave by values of the first wave).

    (a.3) Export the four matrices in .csv (comma separated) files. Name the files `net-1.csv`, `net-1.csv`, `net-1.csv` and `net-1.csv`.

(b) Import the file `klas12b-demographics.dat`.

    (b.1) Delete the 21st row.

    (b.2) Add a (first) column with an id for each pupil (i.e. numbers from 1 to 25).

    (b.3) Name the columns `id`, `gender`, `age`, `ethnicity`, `religion`.

    (b.4) Export the result in a .csv (comma separated) file named `demographics.csv`.

(c) Import the file `klas12b-delinquency.dat`.

    (c.1) Delete the 21st row.

    (c.2) Add a (first) column with an id for each pupil (i.e. numbers from 1 to 25).

    (c.3) Replace missing values (coded by 0) by value of previous wave (succeeding wave if no previous value is available).

    (c.4) Name the columns `id`, `wave.1`, `wave.2`, `wave.3`, `wave.4`.

    (c.5) Export the result in a .csv (comma separated) file named `delinquency.csv`.

Please, send the solutions and your R-Script to `viviana.amati@uni-konstanz.de` and `juergen.lerner@uni-konstanz.de` by Monday 03.11.2014