Lab 1: Introduction to `igraph`

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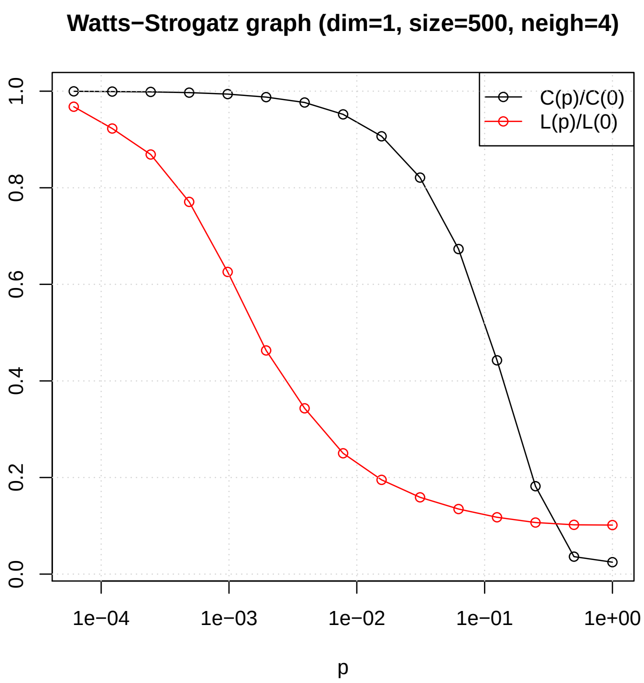
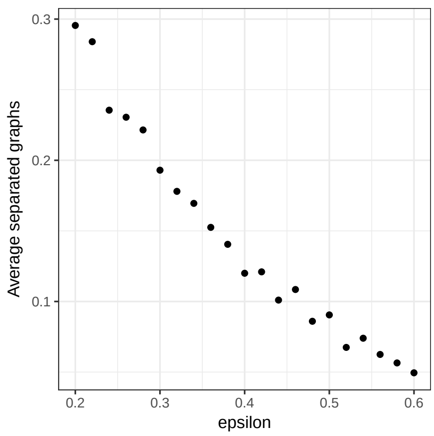
1 Watts–Strotgatz model

The clustering coefficient $C(p)$ and average shortest path $L(p)$ are computed for a Watts–Strotgatz graph with dimension 1, size 500, 4 neighbours and probability p. Each probability is computed as $p = 2^{-i}$ with $i \in \{0, 14\}$ (as a logarithmic scale is used). The mean values of 500 random graphs is performed to reduce the variance. Also, both are scaled between 0 and 1 to be compared using a graph with $p = 0$ as $C(p)/C(0)$ and $L(p)/L(0)$.

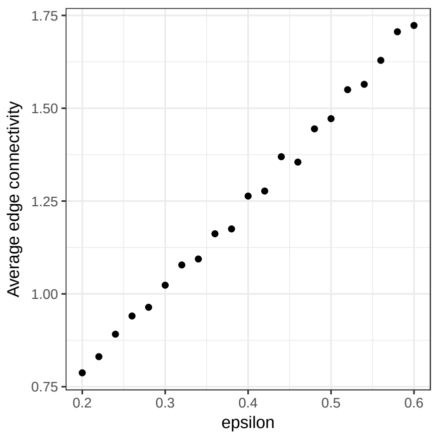


2 Erdös–Rényi model

The probability p of connecting two vertex is set to $p = (1+\epsilon)\ln(n)/n$ to keep the graph connected with high probability. In order to find a good ϵ value, a set of random graphs are generated, with values of $\epsilon \in [0.4, 0.6]$. The edge connectivity e is measured in a set of $r = 2000$ runs. The relative number of graphs with $e = 0$ is plot against ϵ in the figure 1a and the mean of e is plotted in 1b.



(a) The relative number of disconnected graphs against ϵ



(b) The mean of edge connectivity for graphs with different ϵ

The chosen value of $\epsilon = 0.5$ keeps the number of disconnected graphs close to 10%, while the mean edge connectivity is close to 1.5. Finally, the average shortest path is ploted against the number of nodes n of a Erdös–Rényi graph. The mean values of 10 random graphs are computed to reduce the variance. The number of nodes is set up to 5000, to maintain a reasonable computing time.