1. Write a computer program to construct a random graph edge by edge until n edges have been inserted. Output the number of components of each size at several time steps to illustrate the emergence of a giant component.
2. Prove that the probability of generating a given undirected graph is the same for the following two algorithms. Algorithm 1: create the probability matrix and then randomly round each entry to 0 or 1 respecting symmetry. Algorithm 2: Randomly generate the degree of each vertex, create a vector of edge endpoints, randomly permute elements of the vector and pair end points.
3. Consider $N_{p}$. We say that a property has a threshold $\mathrm{t}(\mathrm{n})$ if for $p=f_{1}(n)$ where $\lim _{n \rightarrow \infty} \frac{f_{1}(n)}{t(n)}=0 \quad N_{p}$ almost surely does not have the property and for $p=f_{2}(n)$ where $\lim _{n \rightarrow \infty} \frac{f_{2}(n)}{t(n)}=\infty N_{p}$ almost surely has the property. Does the property " $N_{p}$ contains the integer 1 " have a threshold? If so what is it?
4. In $N_{p}$ what is the threshold for a) perfect square, b) perfect cube, c) even number, d) three numbers such that $\mathrm{x}+\mathrm{y}=\mathrm{z}$.
