

Instructions

- You may do the assignment either in pairs or individually.
- All results are to be justified. Show your knowledge when giving your results.
- Present your assignments in a clean, and well-organized manner.
- Remember to hand-in the assignment both in paper and electronically. When uploading the assignment to Aula Global, please make sure it is a well-scanned PDF document. If you do the assignment in pairs, only one written assignment needs to be hand-in in paper with both names, but both of you must upload the same assignment in your own Aula Global.

Q 1. (2 points) Clustering Coefficient

- (1 point) In your own words, define the clustering coefficient. Give the formula and some examples.
- (1 point) Prove that for a Random Network, the clustering coefficient is constant. Determine the value of the constant.

Q 2. (2 points) We will consider that a Random Network is in the connected regime only when one node is expected to be isolated from the others. Prove that this takes place when:

$$p = \frac{\ln N}{N}$$

Hint: The Advanced Topic 3.8 in Barabási might be useful.

Q 3. (3 points) Consider a Random Network (Erdős - Rényi Network) with $N = 10^5$ nodes, connected to each other with probability $p = 2.5 \cdot 10^{-6}$.

- (0.5 points) What is the expected number of links (L)?
- (0.5 points) What is the average degree (k)? In which regime do we expect to find the network?
- (0.5 points) Find its degree distribution and determine the probability that a node has less than 3 edges attached.
- (1 point) Suppose that the number of nodes of our network stays fixed. What is the minimum number of links that we are expected to add to the network so that it goes to the connected regime?
- (0.5 points) Determine the smallest range of values of k for which we will expect to find 68% of the nodes in the network.

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Reviewing **Networks Crowds And Markets Solutions To Exercises** : Unlocking the Spellbinding Force of Linguistics

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