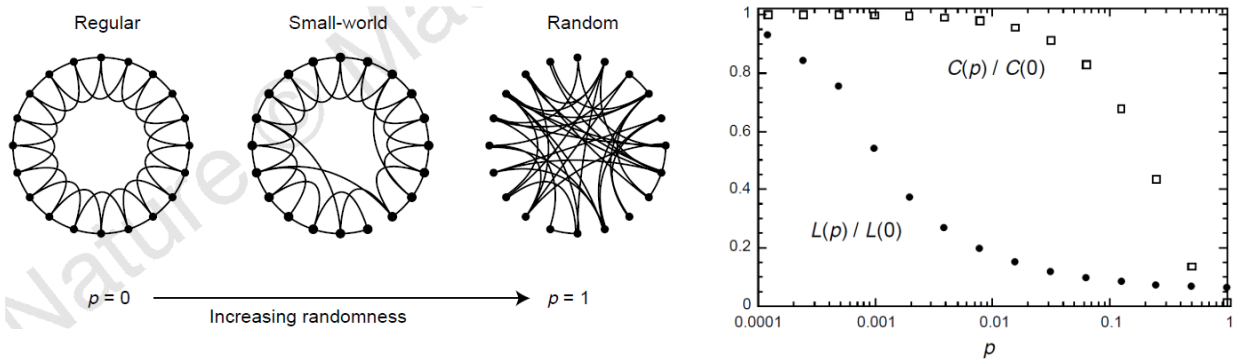
# Network Science

Assignment 2

- *All results must be submitted through a well-documented Jupyter Notebook describing the solution to the question in thorough detail.*
- ***You <u>must</u> provide the data, Jupyter Notebook as well as the PDF of the final Jupyter Notebook FOR EACH QUESTION SEPARATELY.***
- **<u>Delayed submissions will be flatly penalized with 5 points (out of total 20 scaled points).</u>**
- Please start working on the assignment right away as the tasks are computationally intensive.
- The single ZIPped file to be uploaded should be named with following convention: **Rollnumber_FullName.zip**

1. Implement Watts and Strogatz's small-world network model. **Compute and plot** the 'scaled clustering coefficient' and 'scaled characteristic path length' of Watts and Strogatz network models with increasing value of rewiring probability. Choose the values of $n$, $k$ suitably.

   Exact replication of the below-shown plot is expected. **[20]**




2. (a) **Write the code** to implement Barabasi-Albert (BA) algorithm for generation of scale free networks. Vary the size of the initial random network as well as number of nodes and edges added at every stage of evolution. **Assess the topology** of the final network (minimum 100 instances) **in terms of its (a) average clustering coefficient, (b) characteristic path length, and (c) degree distribution**. **[10]**

$$P_i(k) \propto \frac{k_i}{\sum_{j=1}^{n} k_j}$$

3. Modify the Barabasi-Albert algorithm to accentuate/strengthen the bias of rich getting richer phenomenon such that the probability of a newly added node getting connected to an existing node is now "proportional to the square of its degree". **Compute and compare topological features** a comparable size of networks created using BA algorithm. Create variants of higher order. **[10]**