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Lehrstuhl Informatik VIII
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Assignment 3

Task 1 Plots and Basic Statistics

This task is about computing basic statistical values and the plotting of distributions. For Python, we recommend to use PyPlot (Documentation: http://matplotlib.org/api/pyplot_summary.html)[1].

a) Generate 3 graphs using networkx with each 50 nodes (0,1,..,49) and 100 edges.

- The generation rule for G1 shall be that: a) each node connects to a random other, b) 50 random edges.
- The generation rule for G2 shall be that: a) each node i connects to successor $i + 1$ and a quarter around the ring to $i + 12$.

Verify that G1 is connected. Use networkx to compute the shortest paths between all nodes. Ignore paths from a node to itself.

b) Compute mean, variance, standard deviation, and coefficient of variation for the average path length.[2]

c) Plot the path length distributions as bar plot (e.g. plt.bar(x,y)). Also cumulative.

d) Plot P-P and Q-Q plots for the distribution of G1 vs G2 (e.g. plt.plot(x,y)).

e) For G1 plot (e.g. plt.bar(x,y,'o')) each node with the x-axis as the number of edges of the node is adjacent to, and the y-axis being the average path length? Any visible correlation?

Task 2 Application of Little's Theorem

This task is about queuing systems. To refer more to networking, we call the jobs in a system packets.

a) Let us assume an $M/M/20 - \infty$ system. It's arrival rate is $\lambda = 0.4$ and the average time a packet stays in the system is E[T]=15s. What is the average number of packets E[X] in the system ?

b) Little's Theorem is valid independent of the distributions. Now assume a $D/M/20 - \infty$ system with the same arrival rate and processing rate. Will the average number of packets in the system be again the E[X] from a)? Give reasons for your claim.

[1] You can also generate scripts for Gnuplot or R if you like.
[2] To maximize learning,it is recommended to first use your own code to compute the values and optionally compare it with e.g. the results using libraries like Numpy or Scipy.