Assignment # 2: Random Graphs

October 6, 2020

Goals:

- Acquire ability to estimate complex-network properties;
- Learn to generate synthetic networks of given properties;
- Learn to assess basic characteristics of complex networks, such as their node-degree distributions.

Assignment:

1. Generate characteristic complex networks:
   (a) Regular graph,
   (b) Sparse Erdos-Renyi graph,
   (c) Watts-Strogatz graph,
   (d) Barabasi-Albert graph.

   For every type of graph, choose suitable parameters and generate 2 graphs:

   (a) with 25 nodes/vertices,
   (b) with 10 000 nodes/vertices;
2. Visualize every 25-node graph - choose the most suitable method;
3. Create a histogram of node/vertex degrees for every 25-node graph;
4. Discuss (in a written form) the results and their (in)consistency with theoretical distributions.

Advice:

1. Refer to your previous assignment for visualization;
2. To get a list of all degrees of nodes/vertices in a graph G, you can use

```
list_of_degrees = list(nx.degree(G).values())
```

3. To set a histogram axis to logarithmic scale, you can do

```
plt.xscale('log')   # for x-axis
plt.yscale('log')   # for y-axis
```

4. To generate random graph, you can utilize methods from `nx` library (refer to documentation)
   - `nx.random_regular_graph`,
   - `nx.erdos_renyi_graph`,
   - `nx.watts_strogatz_graph`,
   - `nx.barabasi_albert_graph`.