Complex Network

Quiz 12

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Code

```
import networkx as nx
import collections
#import numpy as np
import matplotlib.pyplot as plt
from networkx.utils.random_sequence import powerlaw_sequence

er = nx.erdos_renyi_graph(10000, 0.001)
print("Erdos-Renyi graph")
print(nx.info(er))
print("Number of connected components:
    ",nx.number_connected_components(er)) # 2ln(n)/n -> 0 when n -> inf
print("Number of triangles: ", sum(nx.triangles(er).values())//3)
print("Transitivity: ",nx.transitivity(er))
maxi = max(list(er.degree()), key = lambda x: x[1])
print("Maximum degree: ", maxi[1])
mini = min(list(er.degree()), key = lambda x: x[1])
print("Minimum degree: ", mini[1])
# plt.subplot(221)
# plt.plot(nx.degree_histogram(er))
degree_sequence = sorted([d for n, d in er.degree()], reverse=True)  #
    degree sequence
# print "Degree sequence", degree_sequence
degreeCount = collections.Counter(degree_sequence)
deg, cnt = zip(*degreeCount.items())

fig, ax = plt.subplots()
plt.subplot(121)
plt.bar(deg, cnt, width=0.80, color='b')

plt.title("Erdos-Renyi Degree Histogram")
plt.ylabel("Count")
plt.xlabel("Degree")
ax.set_xticks([d + 0.4 for d in deg])
ax.set_xticklabels(deg)


print()
ba = nx.barabasi_albert_graph(10000, 5)
print("Barabasi-Albert graph")
print(nx.info(ba))
print("Number of connected components:
    ",nx.number_connected_components(ba)) # 2ln(n)/n -> 0 when n -> inf
print("Number of triangles: ", sum(nx.triangles(ba).values())//3)
print("Transitivity: ",nx.transitivity(ba))
maxi = max(list(ba.degree()), key = lambda x: x[1])
print("Maximum degree: ", maxi[1])
mini = min(list(ba.degree()), key = lambda x: x[1])
print("Minimum degree: ", mini[1])
# plt.subplot(222)
```

```
# plt.plot(nx.degree_histogram(ba))
degree_sequence = sorted([d for n, d in ba.degree()], reverse=True)  #
    degree sequence
# print "Degree sequence", degree_sequence
degreeCount = collections.Counter(degree_sequence)
deg, cnt = zip(*degreeCount.items())

plt.subplot(122)
plt.bar(deg, cnt, width=0.80, color='b')

plt.title("Barabasi-Albert Degree Histogram")
plt.ylabel("Count")
plt.xlabel("Degree")
ax.set_xticks([d + 0.4 for d in deg])
ax.set_xticklabels(deg)
```

Results

1. Plot (a) Erdos-Renyi graph and (b) Barabasi-Albert graph of 10,000 nodes and about 50,000 edges.
2. Show the following metrics of the above both graphs. - Number of nodes
- Number of edges
- Average degree
- Number of connected components
- Number of triangles
- Transitivity (clustering coefficient)
- Maximum degree
- Minimum degree

Erdos-Renyi graph
Name:
Type: Graph
Number of nodes: 10000
Number of edges: 49788
Average degree: 9.9576
Number of connected components: 1
Number of triangles: 159
Transitivity: 0.0009614570609648433
Maximum degree: 24
Minimum degree: 1

Barabasi-Albert graph
Name:
Type: Graph
Number of nodes: 10000
Number of edges: 49975
Average degree: 9.9950
Number of connected components: 1
Number of triangles: 2248
Transitivity: 0.004997884199378822
Maximum degree: 339
Minimum degree: 5