Metropolis_on_graphs_3

February 15, 2018

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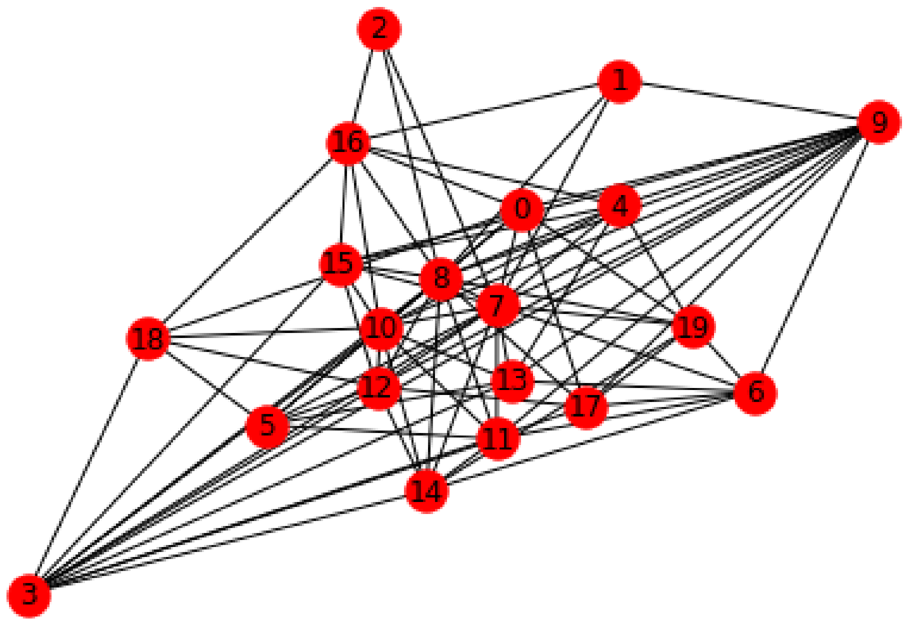
In [4]: import networkx as nx
        import numpy as np
        import random
        import pandas as pd
        import math
```

```
In [5]: G=nx.powerlaw_cluster_graph(20, 7, 0.3, seed=654) # https://networkx.github.io/documen
        G=nx.Graph(G) # to remove parallel edges
        G.remove_edges_from(G.selfloop_edges()) # to remove self loops
        nx.draw(G, with_labels=True)
```



```
In [6]: # How to use the object G: some examples
        for node in G.nodes():
            deg = G.degree(node)
            neighbors = G.neighbors(node)
            print str(node) + " has neighbours " + ",".join(str(n) for n in G.neighbors(node))
            print str(node) + " has degree " + str(G.degree(node))
```

```
0 has neighbours 7,8,9,10,16,17,18,19
0 has degree 8
1 has neighbours 8,9,16,7
1 has degree 4
2 has neighbours 8,16,7
2 has degree 3
3 has neighbours 7,8,9,10,11,12,13,14,15,17,18
3 has degree 11
4 has neighbours 7,8,9,10,13,15,16,19
4 has degree 8
5 has neighbours 7,8,10,11,12,13,18
5 has degree 7
6 has neighbours 7,9,11,13,14,17,19
6 has degree 7
7 has neighbours 0,1,2,3,4,5,6,8,9,10,11,12,13,14,15,19
7 has degree 16
8 has neighbours 0,1,2,3,4,5,7,9,10,11,12,14,15,16,17,19
8 has degree 16
9 has neighbours 0,1,3,4,6,7,8,10,11,12,13,15,17
9 has degree 13
10 has neighbours 0,3,4,5,7,8,9,11,12,13,14,15,16,18
10 has degree 14
11 has neighbours 3,5,6,7,8,9,10,14
11 has degree 8
12 has neighbours 3,5,7,8,9,10,14,15,17,18
12 has degree 10
13 has neighbours 3,4,5,6,7,9,10
13 has degree 7
14 has neighbours 3,6,7,8,10,11,12,19
14 has degree 8
15 has neighbours 3,4,7,8,9,10,12,16
15 has degree 8
16 has neighbours 0,1,2,4,8,10,15,18
16 has degree 8
17 has neighbours 0,3,6,8,9,12,19
17 has degree 7
18 has neighbours 0,3,5,10,12,16
18 has degree 6
19 has neighbours 0,4,6,7,8,14,17
19 has degree 7
```

```
In [7]: T = 1000000
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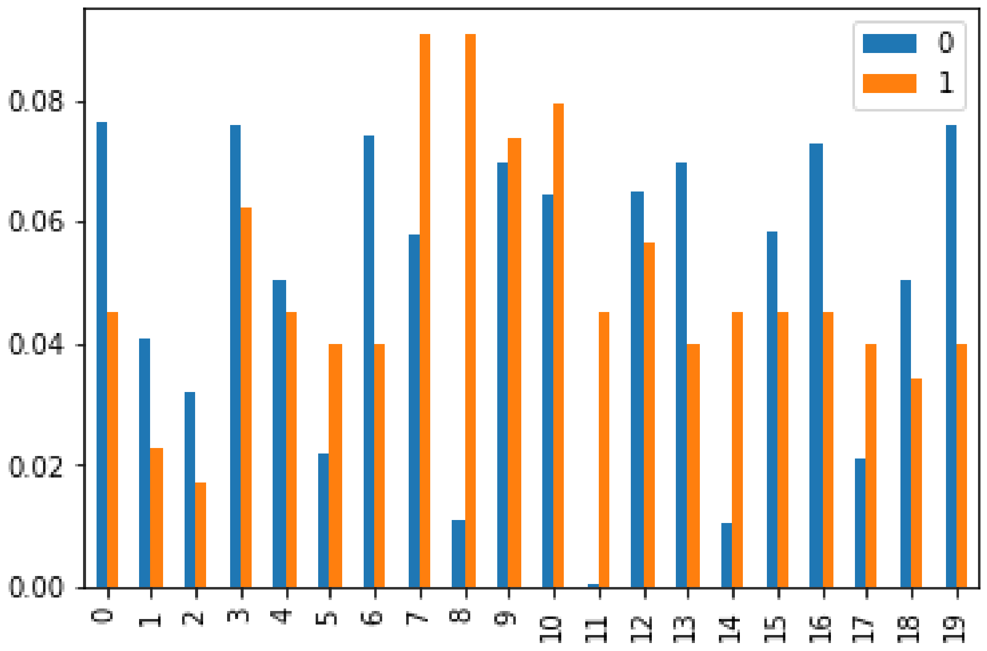
```
        def simple_walk_from(x):
            return random.choice(G.neighbors(x)) # sample uniformly among neighbors of x

        def run_chain_starting_from(x_zero):
            visited_nodes = []
            current_node = x_zero
            for i in range(T):
                visited_nodes.append(current_node)

                proposal = simple_walk_from(current_node)
                x, y = current_node, proposal
                accept_prob = min(1, float(abs(math.cos(y)) * G.degree(x)) / float(abs(math.cos
                accept = np.random.binomial(1, accept_prob)

                if accept:
                    current_node = proposal

            return visited_nodes


        from collections import Counter
        counts = Counter(run_chain_starting_from(18))

In [8]: def proportion_of_time_node_was_visited(node):
            return counts[node]/float(T)

        def simple_walk_stationary_distribution(node):
            return G.degree(node)/float(2*len(G.edges()))


        data = dict( (
                        node, (
                            proportion_of_time_node_was_visited(node), # first column
                            simple_walk_stationary_distribution(node)) # second column
                     )
                    for node in G.nodes())
        df = pd.DataFrame(data).transpose()
        df.plot(kind="bar")

Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x7ff673790510>
```



0.08
0.06
0.04
0.02
0.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19