2

Basic Network Analysis 1

```
print('Question 1, Basic Network analysis')



print('there are', nx.number_of_nodes(random_graph), 'nodes in the random gr
print('there are', nx.number_of_nodes(acquaintance_graph), 'nodes in the acq
```

```
Question 1, Basic Network analysis
there are 60 nodes in the random graph. There are 174 links
there are 41 nodes in the acquaintance graph. There are 63 links
```

4

Basic Network Analysis 2

```
[33] print('Question 2, Basic Network analysis')



    print(maxdeg_node_rand, 'has the max degree of', max_deg_random, 'of the random graph')
    print(degree_dict_acq.get(max_deg_acq), 'has the max degree of', max_deg_acq, 'of the acquaintance graph')
```

```
Question 2, Basic Network analysis
7 has the max degree of 13 of the random graph
4 has the max degree of 10 of the acquaintance graph
```

```
rand_graphs = [random_class_graph, random_model, small_world_model, brabasi_model]
```

```
the average number of links: 5.8
the C(p) value that is calculated is: 0.4374000000000006
```

Questions 1-5 for the random class network.

Check above cell for analytical calculation of C(p)

```
[27] createNfill_table(rand_graphs, rand_graph_names)
```

```
graph index: 0
graph index: 1
graph index: 2
graph index: 3
```

	Network	Average Clustering Coeff	Average Degrees	Average Shortest Path	Num Nodes	Num Links
0	ClassNetwork_Random	0.102122	5.800000	2.500000	60.0	174.0
1	Random Graph Model (p=0.1, N=60)	0.119309	6.766667	2.310734	60.0	203.0
2	Small World Model (p,k,n)(p=0.0999999999999999...	0.297778	4.000000	3.758757	60.0	120.0
3	Barabasi Albert Model (N=60, Kmin=3)	0.281972	5.700000	2.357627	60.0	171.0

Question 7 and 8:

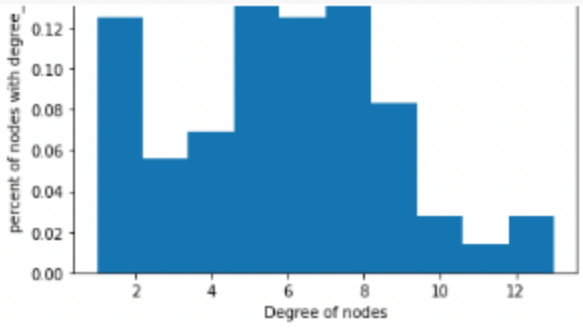
7) Lets look at the random class network that we created first. By name and practice, we should get a fairly random network. Indeed we see this to be true, Both the clustering coefficient and the average shortest path are nearly identical for the random model that we created, and the average degree is not far off. The other models are fairly far off, close to 2X the clustering coefficient and 1.5X higer average shortest path. The histograms are harder to infer things since we don't have many nodes to go off of. However we can see a sort of resemblance between the random model and our class sample. Then we look at the acquaintances graph. the numbers in the small world model match most closely with the key attributes of Clustering Coeff and average shortest path. The number of links is a little higher, but this is as we expected because we are looking at a "social network" which is as good of an example of a small world network as we can get. Once again the histograms are hard to conclude info from.

8) The second empirical network has the small world network property because it has us identifying who we know. Mostly neighborhoods will be tight with here and there a person will connect with another person from outside the neighborhood. This will allow for smaller shortest distance. Social networks, such as the one we created, are great examples of small world networks. Everyone is connected to everyone else somehow(within 6 links)!

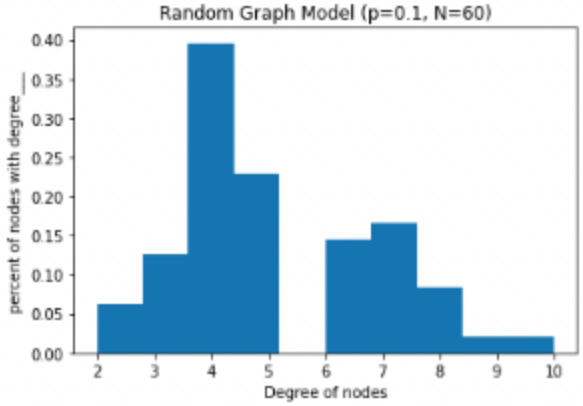
```
[ ]
```

Question 6 for the random class networks

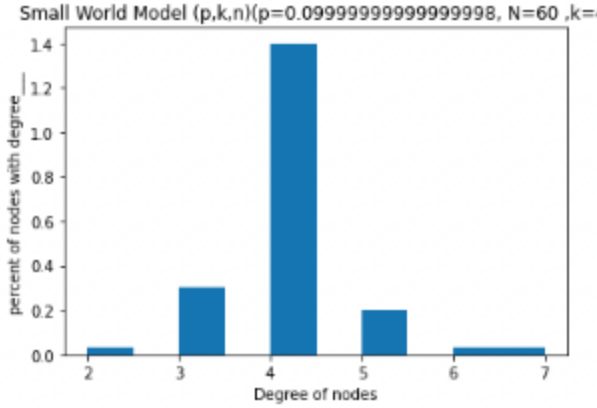
```
[22] create_hists(rand_graphs, rand_graph_names)
```



Random Graph Model (p=0.1, N=60)



Small World Model (p,k,n)(p=0.09999999999999998, N=60 ,k=4)



Barabasi Albert Model (N=60, Kmin=3)

```
[23]
```

```
acq_graphs = [acquaintance_class_graph, random_model, small_world_model, brabasi_model]
```

```
the average number of links: 4.6
the C(p) value calculated is: 0.36450000000000005
```

Question 1-5 for the acquaintances class network

See above cell for analytical C(p) *solution*

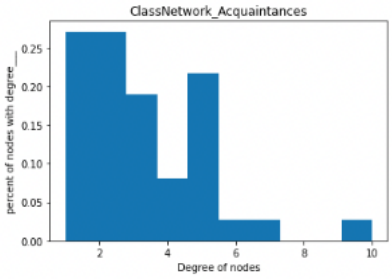
```
[24] createNfill_table(acq_graphs, acq_graph_names)
```

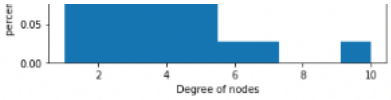
```
graph index: 0
graph index: 1
graph index: 2
graph index: 3
```

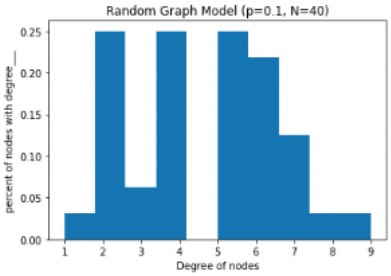
	Network	Average Clustering Coeff	Average Degrees	Average Shortest Path	Num Nodes	Num Links
0	ClassNetwork_Acquaintances	0.308014	3.073171	3.758537	41.0	63.0
1	Random Graph Model (p=0.1, N=40)	0.071567	4.550000	2.482051	40.0	91.0
2	Small World Model (p,k,n)(p=0.0999999999999999...	0.333333	4.000000	3.342308	40.0	80.0
3	Barabasi Albert Model (N=40, Kmin=3)	0.223089	5.550000	2.184615	40.0	111.0

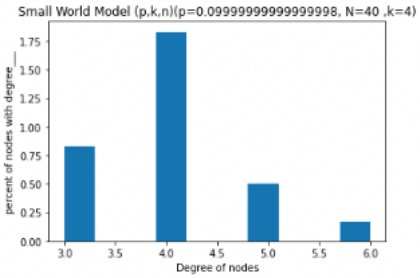
Question 6 for the acquaintances class network

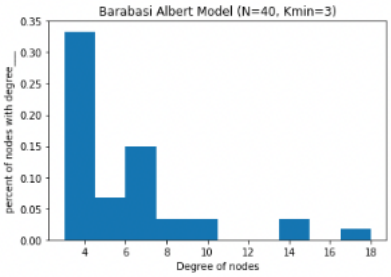
```
[25] create_hists(acq_graphs, acq_graph_names)
```




0.05
0.00
2
4
6
8
10
Degree of nodes


Random Graph Model (p=0.1, N=40)
percent of nodes with degree
0.25
0.20
0.15
0.10
0.05
0.00
1
2
3
4
5
6
7
8
9
Degree of nodes


Small World Model (p,k,n)(p=0.09999999999999998, N=40 ,k=4)
percent of nodes with degree
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Degree of nodes


Barabasi Albert Model (N=40, Kmin=3)
percent of nodes with degree
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4
6
8
10
12
14
16
18
Degree of nodes