Structural Descriptors

Continuous assessment activity #1

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Short explanation:

- Software

The work was done on Jupiter notebook using the package NetworkX. The choice was dictated by the fact that Python is the only programming language I know and I easily found all the documentation I needed about NetworkX.
I also tried iGraph but I already started working with NetworkX so I went on with it.

- Exercise a)

NetworkX stores networks in pajek format as multigraphs but we needed them as graphs, so when storing the networks I converted them using nx.Graph(G).
I stored all the networks with their numerical descriptors in a Pandas dataframe. This way it would be simple to manipulate these data and export them when needed.

- Exercise b)

I did the same for the nodes of the airports network.

- Exercise c)

For each network I plotted PDF, CDF and CCDF in both lin-lin scale and log-log scale (and using logarithmic binning), to better visualize everything and understand graphically the distributions. After that, I chose the scale that makes the plots more readable and exported the image with the PDF and CCDF.

Tables:

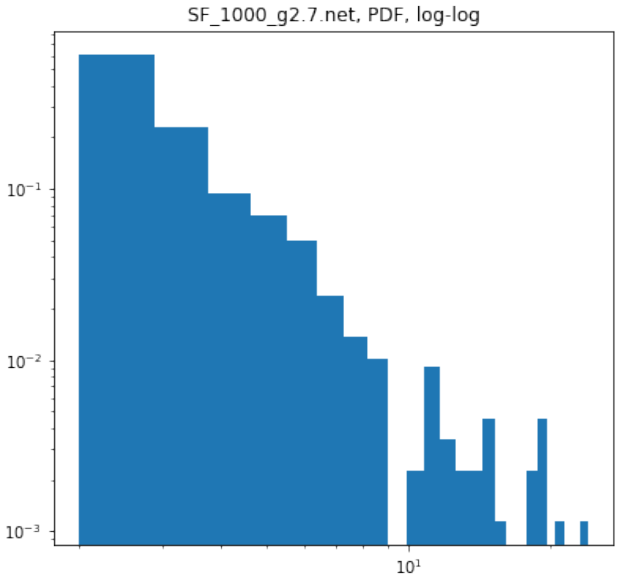
-a)

	Name	number of nodes	number of edges	minimum degree	maximum degree	average degree	average clustering coeff.	Assortativity	Average path length	diameter
0	SF_1000_g2.5.net	1000	1905	2	30	3.8100	0.0096	0.0200	4.6149	10
1	SF_1000_g2.7.net	1000	1668	2	24	3.3360	0.0067	-0.0020	5.4688	12
2	homorand_N1000_K6_0.net	1000	2994	5	6	5.9880	0.0038	0.1919	4.1913	6
3	homorand_N1000_K4_0.net	1000	2000	4	4	4.0000	0.0020	NaN	5.6400	9
4	ER1000k8.net	1000	3956	1	17	7.9120	0.0080	-0.0168	3.5698	6
5	SF_1000_g3.0.net	1000	1517	2	26	3.0340	0.0052	-0.0085	5.9651	13
6	ws2000.net	2000	6000	3	13	6.0000	0.0033	-0.0762	4.5111	7
7	BA1000.net	1000	3990	4	115	7.9800	0.0354	-0.0542	3.1833	5
8	256_4_4_4_13_18_p.net	256	2299	10	25	17.9609	0.5113	0.0007	2.6511	4
9	ER5000k8.net	5000	19980	4	17	7.9920	0.0014	-0.0555	4.3797	6
10	SF_500_g2.7.net	500	859	2	22	3.4360	0.0078	-0.0256	4.8759	12
11	256_4_4_2_15_18_p.net	256	2274	15	23	17.7656	0.7331	0.0286	2.7821	5
12	rb125.net	125	410	4	100	6.5600	0.8373	-0.1730	2.3032	4
13	ws1000.net	1000	3000	3	13	6.0000	0.0044	-0.0999	4.0913	6
14	zachary_unwh.net	34	78	1	17	4.5882	0.5706	-0.4756	2.4082	5
15	dolphins.net	62	159	1	12	5.1290	0.2590	-0.0436	3.3570	8
16	airports_UW.net	3618	14142	1	250	7.8176	0.4957	0.0462	4.4396	17
17	PGP.net	10680	24316	1	205	4.5536	0.2659	0.2382	7.4855	24
18	rb25.net	25	66	4	20	5.2800	0.9023	-0.1635	2.0333	4
19	wheel.net	9	16	3	8	3.5556	0.6243	-0.3333	1.5556	2
20	graph3+1+3.net	7	8	2	3	2.2857	0.6667	-0.6000	2.1905	4
21	20x2+5x2.net	50	404	4	22	16.1600	0.9716	0.9186	2.3878	4
22	graph4+4.net	8	13	3	4	3.2500	0.8750	-0.0833	1.8571	3
23	grid-p-6x6.net	36	72	4	4	4.0000	0.0000	NaN	3.0857	6
24	star.net	9	8	1	8	1.7778	0.0000	-1.0000	1.7778	2
25	circle9.net	9	9	2	2	2.0000	0.0000	NaN	2.5000	4

-b)

	Node	Degree	Strenght	Clustering coefficient	Average path length	Maximum path length	Betweenness	Eigenvector centrality	PageRank
0	ADA	7	10704.0	0.714286	3.632394	11	0.000013	0.010688	0.000205
1	AGU	7	7678.0	0.761905	3.664455	11	0.000006	0.005134	0.000119
2	AMS	192	481335.0	0.142834	2.731343	10	0.040492	0.171452	0.005384
3	ATL	172	1129605.0	0.137835	2.915423	11	0.024896	0.122071	0.008603
4	BCN	80	289105.0	0.328481	3.273079	11	0.001932	0.089146	0.002816
5	CHC	20	64158.5	0.252632	3.565229	10	0.003367	0.004188	0.001615
6	DJE	20	10198.5	0.700000	3.578220	11	0.000146	0.031831	0.000181
7	FRA	237	697513.5	0.116963	2.682145	10	0.065578	0.195546	0.007704
8	LON	242	1464828.0	0.112342	2.635158	10	0.084989	0.200372	0.015606
9	MOW	186	217145.0	0.095844	2.877557	10	0.052211	0.116645	0.005884
10	NYC	179	1524349.5	0.157554	2.708402	11	0.069283	0.160584	0.012471
11	PAR	250	1023424.5	0.089157	2.687673	10	0.093420	0.180287	0.012729
12	TBO	2	234.0	1.000000	4.583195	12	0.000000	0.000123	0.000080
13	WAW	55	86836.5	0.458586	3.243505	11	0.001557	0.075199	0.001120
14	ZVA	1	19.0	0.000000	7.575180	15	0.000000	0.000000	0.000095

-c)


SF_1000_g2.7.net, PDF, log-log
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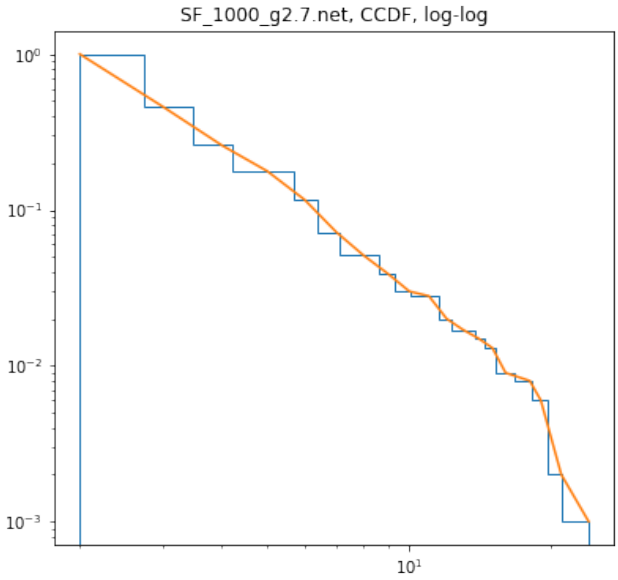
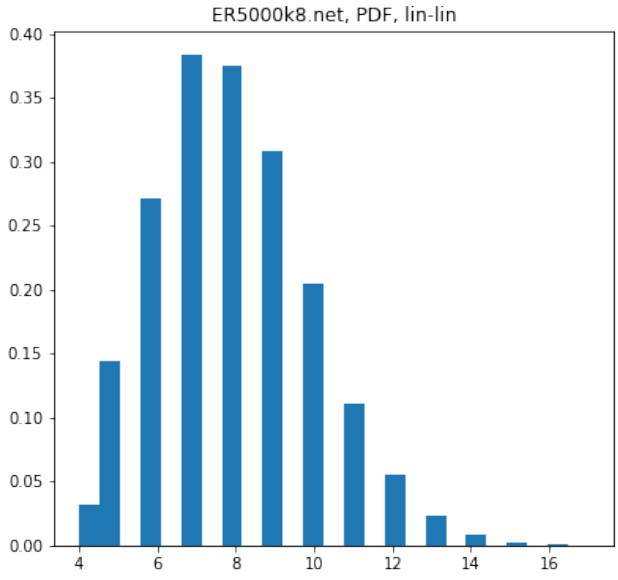
10^{-2}
10^{-3}
10^{1}


SF_1000_g2.7.net, CCDF, log-log
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{1}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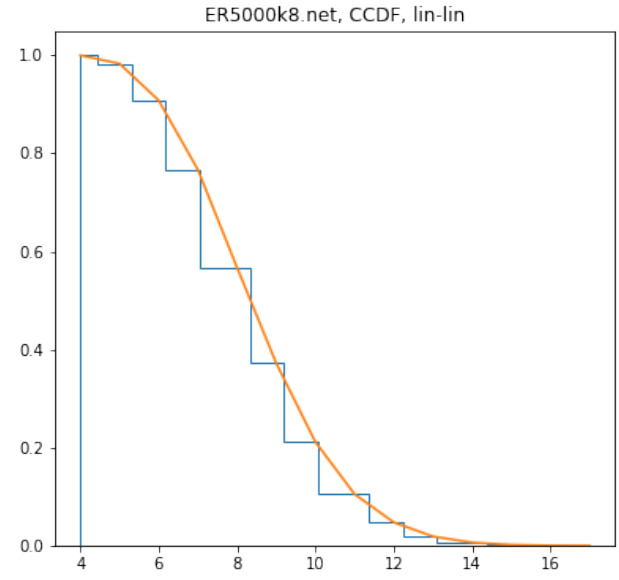
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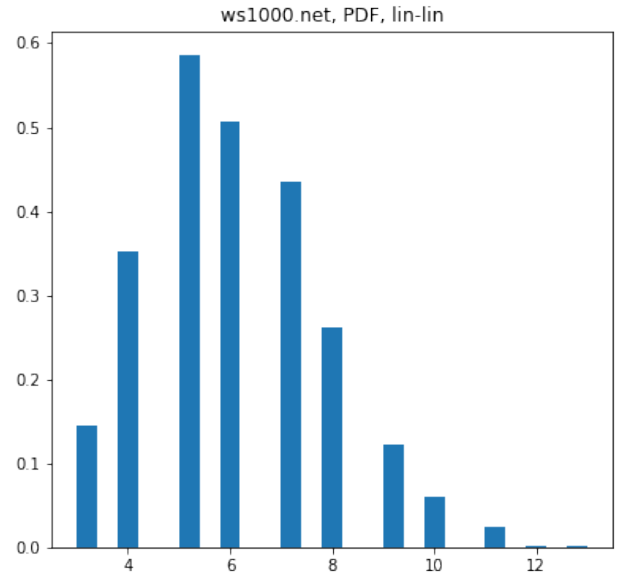
ws1000.net, PDF, lin-lin
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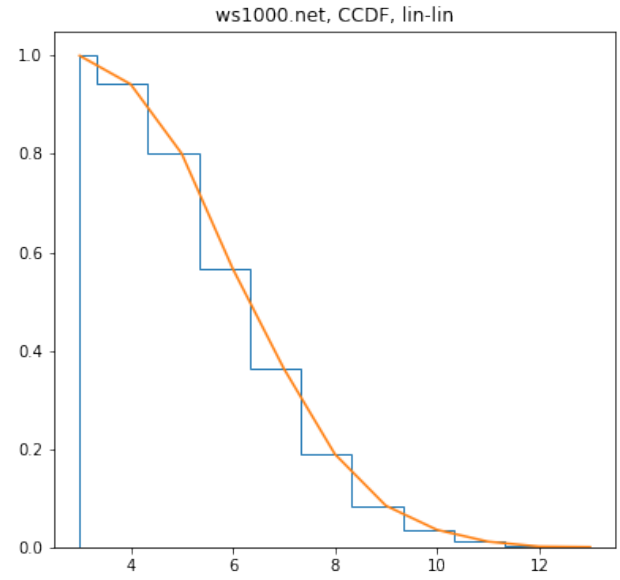
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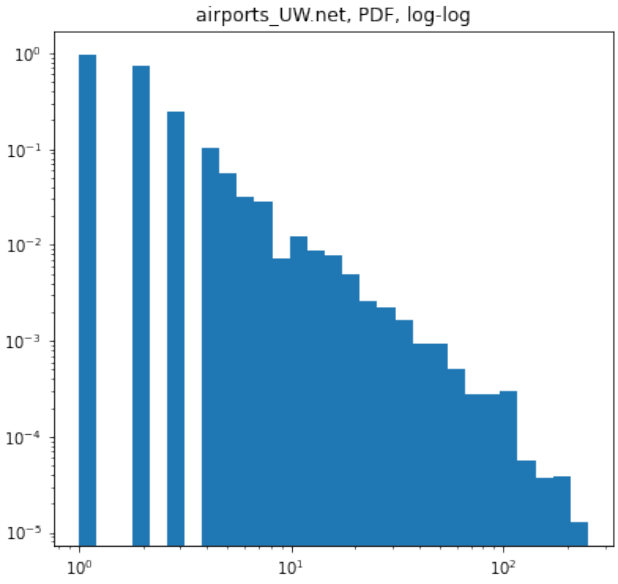
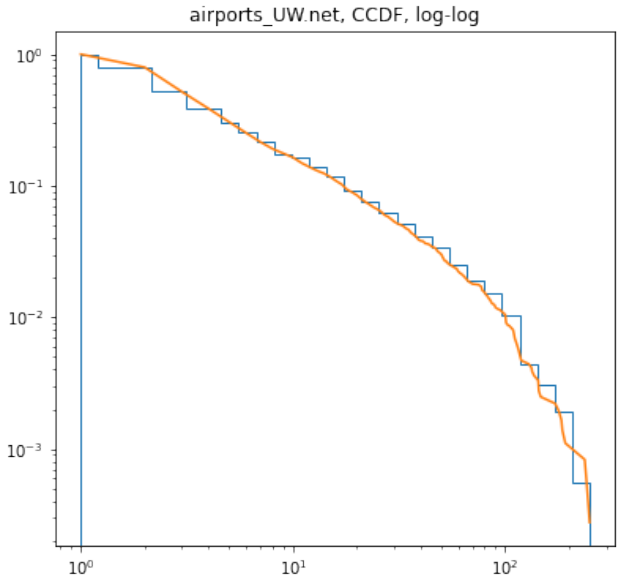
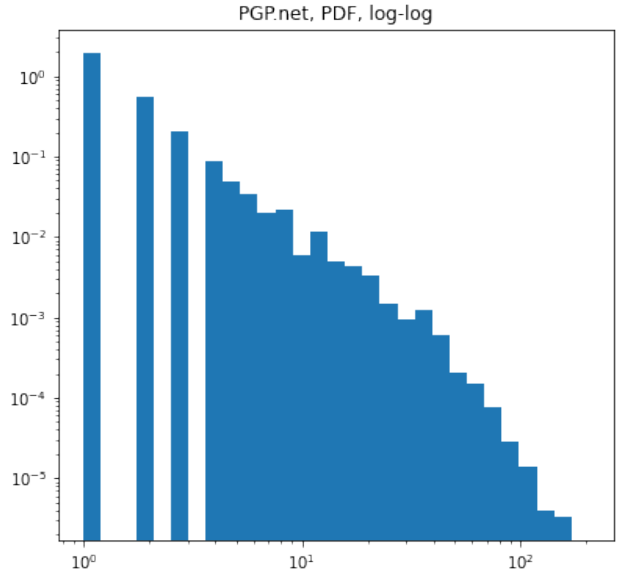
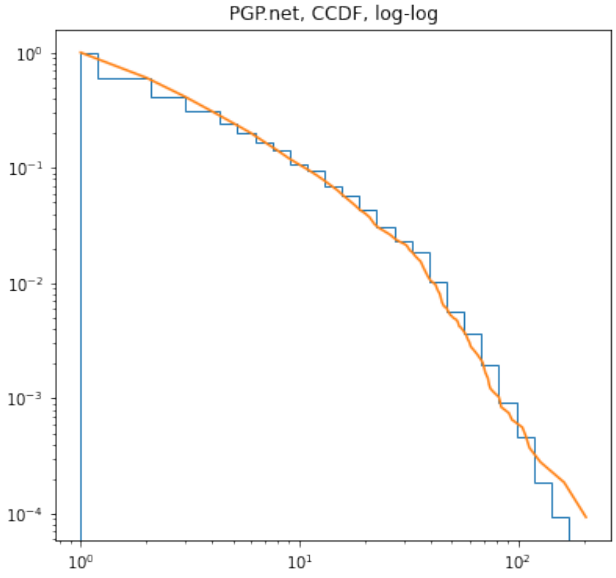

airports_UW.net, PDF, log-log


airports_UW.net, CCDF, log-log


PGP.net, PDF, log-log


PGP.net, CCDF, log-log