Mandatory Assignment INF246

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1 Generating Erdős-Rényi Networks

Generating Erdős-Rényi Networks. Relying on the $G(N, p)$ model, generate with a computer three networks with $N = 500$ nodes and average degree (a) $\langle k \rangle = 0.8$, (b) $\langle k \rangle = 1$ and (c) $\langle k \rangle = 8$. Visualize these networks.

I have included two visualizations of each graph with the different value given in the assignment. The visualization on the left is just a random ordering of the nodes. On the one to the right I have tried to order the nodes by the size of their components. This clearly shows that the graphs become more connected when we increase $\langle k \rangle$. With $\langle k \rangle = 0.8$ we get 314 components. With $\langle k \rangle = 1$ we get 234, and $\langle k \rangle = 8$ gives us only 2 components. One with only one node.

Figure 1: $N = 500$ $\langle k \rangle = 0.744$ $E = 372$
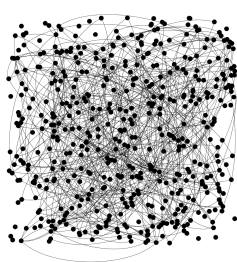

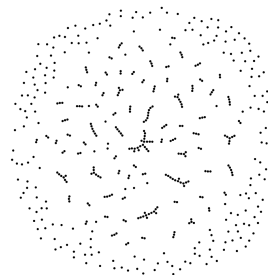Figure 2: Randomized ordering

Figure 3: Component ordering

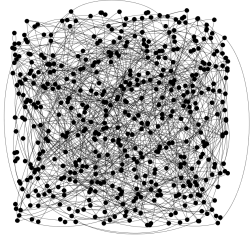Figure 4: $N = 500$ $\langle k \rangle = 1.064$ $E = 532$
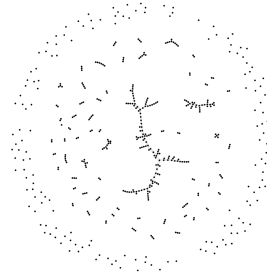

Figure 5: Randomized ordering

Figure 6: Component ordering

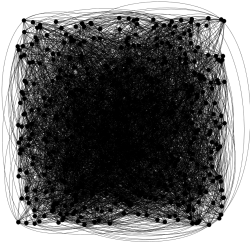Figure 7: $N = 500$ $\langle k \rangle = 8.036$ $E = 4018$
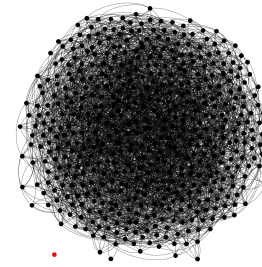

Figure 8: Randomized ordering

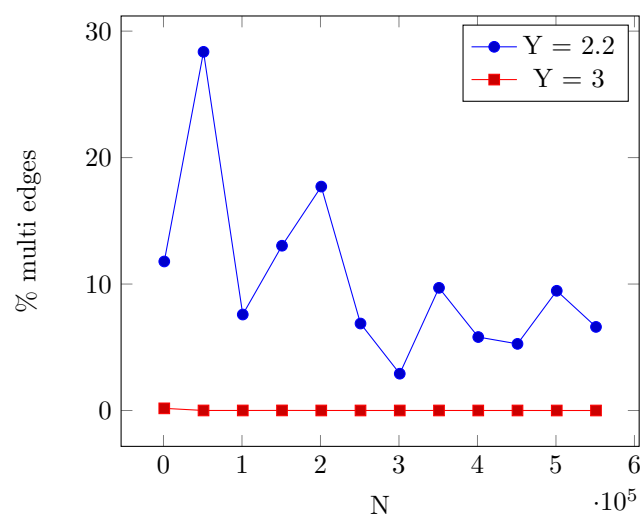Figure 9: Component ordering

2 Generating Scale-Free Networks
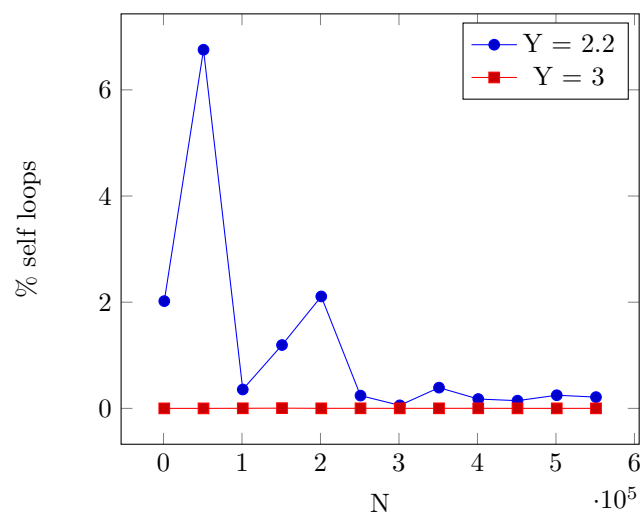
Table 1: Different values of N, with Y = 2.2

N	Y	%self loops	%multi edges	#self loops	#multi edges	#Edges
1000	2.2	2.02020202	11.78451178	24	140	1188
51000	2.2	6.755534499	28.36161599	6274	26340	92872
101000	2.2	0.355801411	7.589329918	539	11497	151489
151000	2.2	1.193059456	13.03030551	2914	31826	244246
201000	2.2	2.108484605	17.70649522	7241	60808	343422
251000	2.2	0.240740838	6.877330282	913	26082	379246
301000	2.2	0.057115373	2.910571662	247	12587	432458
351000	2.2	0.390826958	9.70021995	2230	55348	570585
401000	2.2	0.176324371	5.809137528	1069	35219	606269
451000	2.2	0.145218103	5.269342587	1001	36322	689308
501000	2.2	0.247615187	9.467032587	2040	77995	823859
551000	2.2	0.212478473	6.610545741	1810	56312	851851

Table 2: Different values of N, with Y = 3

N	Y	%self loops	%multi edges	#self loops	#multi edges	#Edges
1000	3	0	0.170648464	0	1	586
51000	3	0	0.00329511	0	1	30348
101000	3	0.001644737	0.003289474	1	2	60800
151000	3	0.004403007	0.006604511	4	6	90847
201000	3	0.000829029	0.002487088	1	3	120623
251000	3	0.001330955	0.001996433	2	3	150268
301000	3	0.000553937	0.00166181	1	3	180526
351000	3	0.000947306	0.002841918	2	6	211125
401000	3	0.001252035	0.001252035	3	3	239610
451000	3	0.000368968	0.001844841	1	5	271026
501000	3	0	0.000332383	0	1	300858
551000	3	0.000605373	0.000302686	2	1	330375