

**Math 168, Networks, UCLA, Spring 2018**  
***Problem Sheet 3* (revised 4/17/18)**

(submit to CCLE by 23 April 2018 at 5:00 pm)

1. *Reading.* Read Sections 7.1, 7.9–7.10, 8.1–8.4, 8.6, and 15.1 of Newman’s book.
2. Do Problem 6.7 of Newman’s book.
3. Do Problem 8.1 of Newman’s book.
4. Do Problem 8.2 of Newman’s book.
5. *Clustering coefficients.* Draw a small network in which the global clustering coefficient and mean local clustering coefficient have different values. Write down the adjacency matrix for this network.
6. *Degree versus local clustering.* Consider two small unweighted, undirected networks of somewhat different sizes (e.g., one of them should have roughly 5–10 times as many nodes as the other) that are constructed from empirical data.
  - (a) Compute the global clustering coefficient and mean local clustering coefficient for each of the two networks. Also compute the edge density of each network. Should either of these networks be construed as “sparse”?
  - (b) For each network, also draw a scatter plot of the degree versus local clustering coefficient. Based on these calculations as well as your previous ones, are you able to draw any conclusions about any similarities or differences between the two networks? What other observations can you make? Do these observations have any implications for the original data set?
7. *More on ER graphs.*
  - (a) Calculate the global clustering coefficient  $C$  of an ER graph (in expectation over the ensemble).
  - (b) Is the ER network ensemble a good model for a human social network? Why or why not? How can it be adjusted to produce a better model?
8. *More on group projects.* [4/17/18: **problem 8 has been moved to homework 4**]
  - (a) Write a short abstract and (roughly) half-page outline of what you plan to do for your project. (These plans will almost certainly change, so this should just reflect your current view.) The same thing will be submitted for each group member.
  - (b) For these plans, indicate briefly what each person plans to do for the project. (Surely, this will also change.) The same thing will be submitted for each group member.
  - (c) Each person should *individually* indicate what they hope to get out of the project and what they hope to learn with the project. (A couple of sentences will suffice.)
  - (d) Indicate what data you hope to use — or plan to use, if you have gotten that far — for the project. I suggest you spend a bit of time on this to see if it’s feasible (with available and sufficiently clean data). This is the type of thing that can cause plans to change and is a key topic for us to discuss when I meet with each group.