

# Problem Set 2

POLI 100F - Social Networks

August 15, 2022

*Questions #1-#10 refer to the network described in Question #1.*

1. Draw the network given by the following adjacency matrix ( $A_{ij} = \{a\dots e\}$ ):

0	1	1	1	1
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0

2. What is the average degree of the nodes in this network?
3. What is the average path length of this network?
4. What is the clustering coefficient of the node with the highest degree?
5. What is the clustering coefficient of the network as a whole?
6. Identify all structural holes in this network.
7. If triadic closure is operating on this network, what should we expect to see over time?
8. How many directed edges would we need to add to make this network a clique?
9. Which node has the lowest eigenvector centrality? (no calculations necessary.)
10. Describe a real-world scenario that could plausibly be modeled by this network.

Questions #11-#15 refer to the network in Figure 1.

11. How many strongly-connected components does the network in Figure 1 contain?
12. What is the embeddedness of the edge between  $a$  and  $e$ ?
13. Identify a local bridge in this network, and give its span.
14. Where might we expect to see triadic closure occur in this network?
15. Treat the network in Figure 1 as a multi-mode network with two node types, vowels ( $a, e, i$ ) and consonants ( $b, c, d, f, g, h$ ). Does this network exhibit homophily?

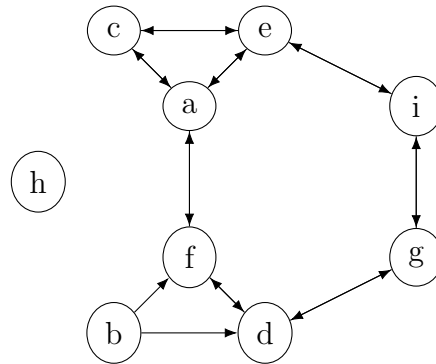


Figure 1: A social network.

Questions #16-#20 require an answer of several sentences (or at most one paragraph).

16. Why is it unlikely for a large network to feature more than one giant component?
17. What role do embedded edges play in fostering social capital?
18. If a network grows via a process of preferential attachment, how will edges be distributed?
19. How do Gilbert et al. explain the surprising success of surrogation in their experimental results?
20. Why does Granovetter think that “removal of the average weak tie would do more “damage” to transmission probabilities than would that of the average strong one”?
21. (Extra Credit) In the network shown in Figure 1, which node has the highest betweenness centrality? What is it?