

# Problem Set 1

## POLI 100F - Social Networks

August 8, 2022

Consider the social network in Figure 1 below, and answer the following questions:

1. How many nodes are in this network? 9
2. How many directed edges are in this network? 15
3. Which node has the most neighbors? b has 4
4. How many components does the network have? 2
5. How many connected dyads are there in the network? 6
6. List all pendant nodes. f, g, i
7. What is the diameter of the network? 4 (give credit for 3)
8. How many connected triads are there in the network? 1 (*abd*)
9. Identify all cliques in the network. *abd*
10. Identify all cycles. *abd, bda, dab, adb, dba, bad, bch, chb, hbc*
11. Which node has the highest in-degree? b and d with 3 each
12. Which node has the lowest out-degree? e with 0
13. Give the adjacency matrix of the network ( $A_{ij} = \dots$ ) see next page
14. Can we characterize any of these nodes as a bridge (or broker)? a, b, d, h
15. List the nodes that make up the geodesic between *h* and *e*. *hbae* (give credit for *ba*)
16. What is the in-degree centrality of the smallest component in the network? 1 (*i:g*)
17. What is the closeness centrality of node *d*? 10 (or 1/10)
18. What is the betweenness centrality of node *b*? 14
19. What is the clustering coefficient of node *b*? 1/3
20. If the entire network were fully transitive, how many links would we expect it to have?  
72 (9x8=72...give partial credit for 36 (case of undirected links:  $\binom{n}{2}$  where n=9))
21. (Extra Credit) What is the average path length of the network? 1.97368

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0 1 0 1 1 0 0 0 0
1 0 1 1 0 0 0 0 0
0 0 0 0 0 0 0 1 0
1 1 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 1
0 1 1 0 0 0 0 0 0
0 0 0 0 0 0 1 0 0
```

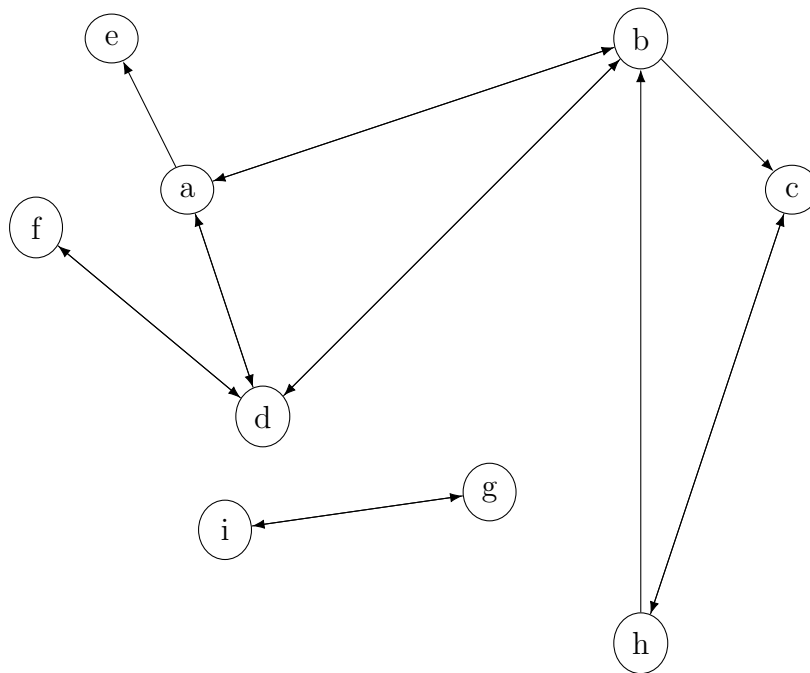


Figure 1: A social network.