Question 1:

(a) For degree centrality, just need to count the number of neighbors a node has.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 8 | 8 | 6 | 3 | 7 | 10 | 7 | 7 | 7 | 5 | 9 | 8 | 8 | 5 | 9 | 9 |

(b) Num. of triangle: 68

I simply loop all three combinations. Test whether they are connected or not. If connected, the num+1

(c) global clustering coefficient=0.527

Follow the formula in lecture notes, the triangle number has got in question (b). Then, I count the number of connected 3 nodes by check each node. Check how many neighbors it has. Choose 2 combination and sum up to get the number of connected 3 nodes.

(d) Num. of triangle: 19

Same as (b). Just need to remove the edge labeled ‘W’.

(e)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 1 | 1 | 0.52 | 0.39 | 0.55 | 0.55 | 0.73 | 0.58 | 0.42 | 0.40 | 0.52 | 0.52 | 0.58 | 0.40 | 1 | 1 |

Follow lecture notes, compute shortest path between every pair of nodes using Dijkstra algorithm. Compute average by dividing 15. Then, take the reciprocal.

(f) 0.6263736263736264

Same method as (c) by removing W edge

(g)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 1 | 1 | 0.66 | 1 | 0 | 0.8 | 0.38 | 0.6 | 0.33 | 1 | 1 | 1 | 0.17 | 0 | 1 | 1 |

First compute the number of 3 nodes that are connected for each node. Then, find the number of 3 combinations. Then, divide them.

Question 2:

(a)Weibo: The strong ties are those mutual followers and followings. Weak ties are those single direction follower or following. These can be got by analyzing network structure.

(b) Twitter: Same as Weibo since they are very similar in social network structure.

(c) QQ: Friendship relationship can be seen as strong ties. People in the same chat group but are not friend can be seen as weak ties.

This can be easily got from network structure.

(d)Whatsapp: Similar to QQ. Friend added from contact can be seen as strong ties. People in the same chat group can be seen as weak ties. This can be easily got by analyzing friend contact and group contact.

(e) Facebook: Friends can be seen as strong ties. People in the same discussion group or other kinds of groups can be seen as weak ties.

This can be got by analyzing network structure.