Week 1: Graph Theory, Traversals & Social Simulation

Name: Arnav Harshit

Roll NO.: 230200

WEEK 1 Task:

1. **Network Generation Logic:**
    a. So, the overview is i added extracurricular activities(features) to students(nodes) and link is added between those nodes which have similarity score value is greater than chosen threshold value. (since, generally students in same club, classes, branch are more likely to become friends). So, I assigned each student randomly to any clubs and branch and year and since, clubs has limited no. of seats so , I assigned a limit to each club and generate the friendship network between them.
    b. So, firstly I generated students assigned each of them a random year, branch and random number clubs between 0 to 3 since, some students try to join more than 1 club and some don't even join too and some of them tend to become popular so I marked 10% of them as popular means they will have more friends (degree).
    c. Now, I computed similarity score between student 1 and student 2 based on +1 if same year, +1 if same branch and +N for N common clubs, since students in same year, branch or clubs tends to become friend easily.
    d. I chose a threshold for becoming friends (forming links between them).
    e. Now I assigned weights in a way that more similarity = lower weight (closer friendships) so, weights are formed in scale of 1-10 between them.
2. **Number and size of friendship groups:**
    a. Number of friendship groups are generally increasing with increasing no. of students, clubs and size also varies in them. There is usually a few big groups and some isolated or small groups.
3. **Sample shortest paths:**
    a. Using dijkstra method and A* method both gave same path (shortest one).
4. **Optional bridge observation:**
    a. For bridge observation I removed all the nodes one by one and checked the number of connected groups in original graph and new graph by removing one node if there is increase in number of connected groups then that node is surely a bridge node. So, in this way I observed and found the bridge nodes.
5. **Reflections & Patterns:**
    a. So, my graph was built based on different features similarity using threshold value. Everytime the code runs the students got assigned to a club, year and branch randomly and then using similarity score link gets formed between them(friendship formed).
    b. Friend groups are usually a big cluster of nodes and few small isolated and small groups are formed and visualised on graph. Sometimes there are no isolated groups everyone is friend and only a single group is formed only and sometimes there are more.

c. Shortest path algorithm such as Dijkstra or A* algorithm made a shortest path between two random student of same group using smallest friendship path between them. Both algorithms gave same paths which was expected also.

d. Bridges were also found in groups and removing it increases the total number of groups which I have shown in last of output too.