Department of Computer Science and Engineering, S V N I T, Surat
END-SEMESTER EXAMINATIONS, April 2024
B. Tech. – III (CSE) – 6th Semester
Course: Core Elective 3 - CS342: Social Network Analysis

Date: 22nd April, 2024 **Time: 9 am to 12 pm** **Max Marks: 50**

Q.1 Answer any Five of the following: [CO1-H, CO2-H, CO3-M, CO4-M, CO5-M] [20 marks]

1 Differentiate strong and weak communities with the help of suitable social network graph. Is clique a strong community? Is a strong community also a weak community? What about vice versa?

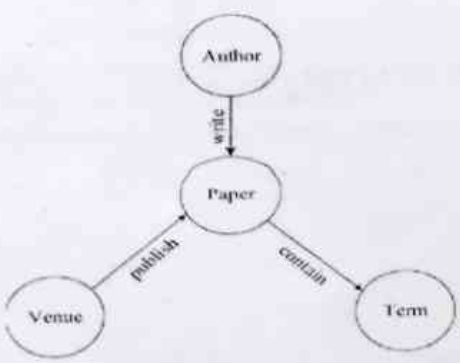
2 Suppose you are looking for a list of famous eateries in the city. The mobile application showing top eateries in the city is using PageRank algorithm to rank the eateries. It seems that all the top-ranked places are non-veg eateries, and you are vegetarian, the list is useless to you.
Propose a solution/method of ranking the eateries in the city to get diverse choices.

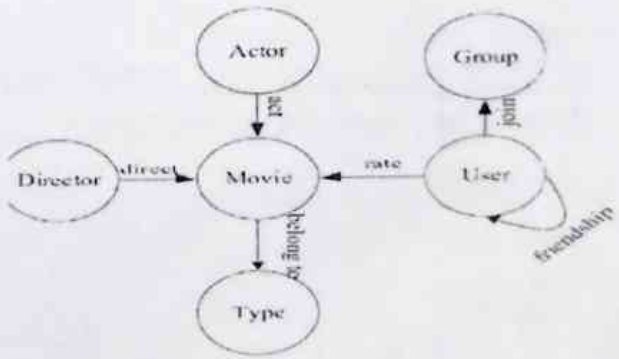
3 In a citation network, two scientific papers might be similar as survey papers if they cite similar result papers, while two papers might be similar as result papers if they are cited by similar survey papers.
Explain how you can apply SimRank in the above application.

4 Consider a restaurant review network containing objects of two types: restaurant (R) and user (U). There exists a review (V) relationship between U and R as shown in below table, where each cell shows the number of reviews given by a user to a restaurant. Find the peer restaurant for Mint.

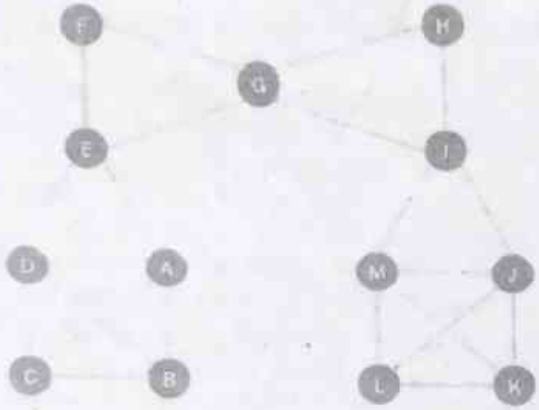
Author	[illegible]	[illegible]	[illegible]	[illegible]
Mint	2	4	0	0
Pavilion	4	0	2	1
Symposium	2	4	0	0
Sky Route	0	0	1	3

5 Identify the possible Meta paths for the following network schemas of (1) Citation network and (2) Movie network. Explain how these paths deliver varying semantic similarity between objects. Consider similarity between only homogeneous objects (e.g. author-author similarity, actor-actor similarity etc.)



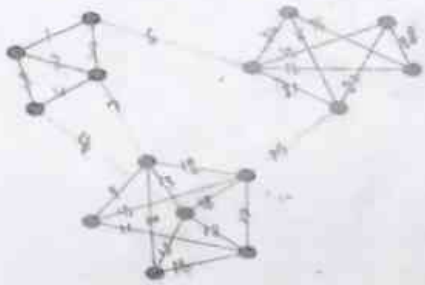


6 Explain how the Neighborhood Overlap (NO) score can be used to identify local bridge in a social network? Which edge can be considered as a local bridge in a below graph?



Q.2 Answer any Two the following: [CO1-H, CO2-H] [10 Marks]

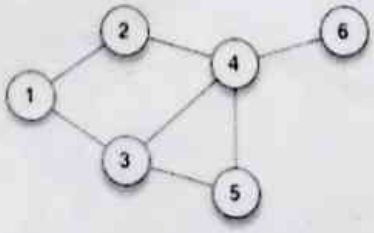
1 Consider the graph shown below. The graph is partitioned into three disjoint communities. Calculate modularity for the graph.



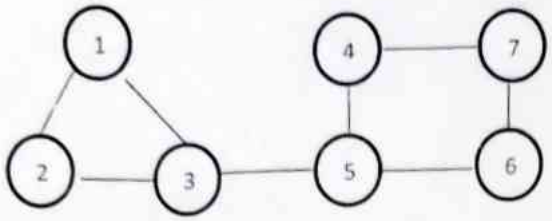
Disjoint Communities

2 Consider the following graph and construct the similarity matrix for the Ravasz algorithm for Agglomerative Clustering. Use the following similarity measure:

$$x_{ij}^{\theta} = \frac{j(i,j)}{\min(k_i, k_j) + 1 - \theta(A_{ij})}$$

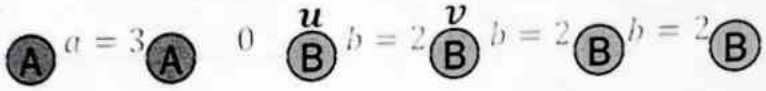


Detect the communities in the following social network using Louvain algorithm. Show all steps. Take node 1 as the seed node.



Q.3 Answer any Three of the following: [CO1-H, CO2-H, CO3-M] [12 marks]

1. What is information Diffusion? How decision-based cascade model help in information diffusion? Elaborate with the help of example.
2. Consider the following scenario in which cost (c) = 2. Calculate the payoff for nodes u and v based on the multiple-choice cascade model. Show each step with a proper figure.



3. What do you mean by SEIR model? Differentiate SIS and SIR models.
4. Delhi got its first coronavirus patient and you have got the job to model it. We assume the the population of Delhi is around 20 million. We assume if you recover once, you are not susceptible to corona. S(t), I(t), and R(t) are the number of susceptible, infected, and recovered people at time t, respectively. s(t) = S(t) / N, i(t) = I(t) / N, r(t) = R(t) / N. Use the SIR model to answer the following:
   a) Can S(t) increase with time? Why or Why not?
   b) How the networks of I(t), S(t) and R(t) look like?
   c) Calculate the maximum number of infected people anytime.

Q.4 Answer the following: [CO1-H, CO2-H] [8 Marks]

1. Anomaly Detection in a Network is an outlier detection or not. Once we find an outlier, we can remove it easily so what is the necessity of Anomaly Detection? Where does it help? Write challenges involved in network-based anomaly detection.
2. Explain community-based static attributed network with the help of the FocusCO example.

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