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Indian Institute of Information Technology Allahabad

End- Sem Question Paper

Course Name: Social Network Analysis **Course Instructor/ Co-ordinator:** Prof. Vrijendra Singh

Course Code: SNA **Program Name(s):** B.Tech (6th sem)/M.Tech (1st sem)/Phd

Exam Date: 07/05/2024 **MM:** 40 **Time:** 3hrs

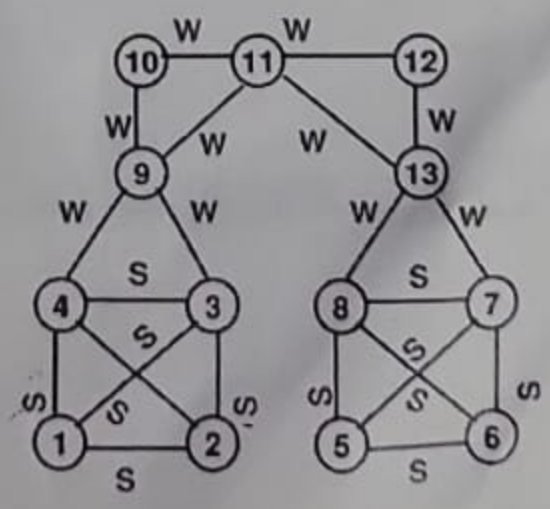
Note: Use of Calculator is not allowed.

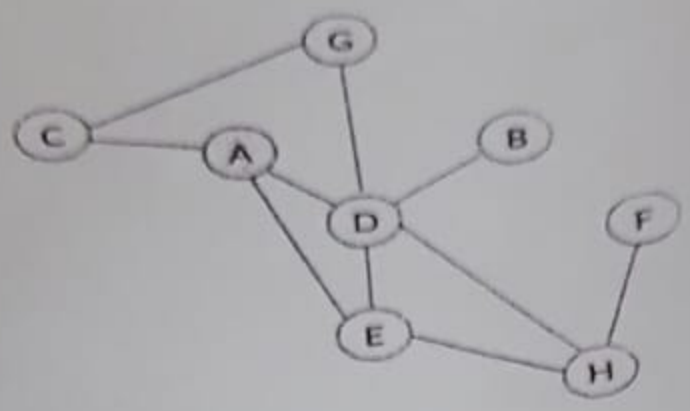
1. In the preferential attachment, a new coming node will prefer to make the connection with the node having? **[1]**
   a. fewer friends
   b. More friends
   c. Average number of friends
   d. None of the above

2. Which of the following is not an issue with link prediction? **[1]**
   a. Temporal dynamics of the network
   b. Directionality of edges
   c. Missing links in the network
   d. Sign and weights of links

3. How does the power law degree distribution come by in real-world networks? **[1]**
   a. By preferential attachment,
   b. By random linking,
   c. By uniform edge connection
   d. No hypothesis is found

4. For a given threshold NOVER Score, following network is provided. Check if the strong triadic closure property is violated for any node? **[2]**

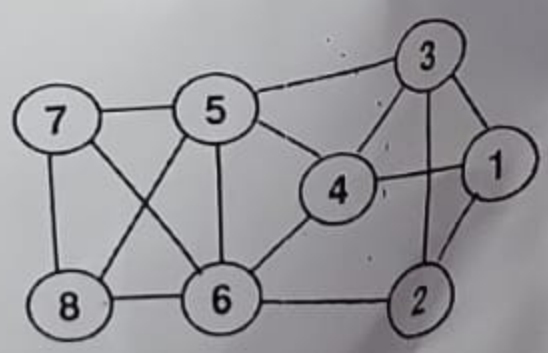




9. Assume there are two communities in this network: {A, B, C, D, G} and {E, F, H}. Calculate
   a) Common Neighbor Soundarajan-Hopcroft score of node A and node G [2.5]
   b) Resource Allocation Soundarajan-Hopcroft score of node A and node G [2.5]

10. A political party approaches you with the network of an online social network. Links in the network are undirected, and and edge (u, v) indicates that user u and v have tweeted about the same topic and also follow each other. The party wants to know what are the topical clusters in this network so that they know how to frame the manifesto to attract all types of voters. State an algorithm that would work here and why? What are this algorithms pros and cons. [3]

11. Find the number of best possible community in given network and calculate the modularity score of the communities using **[6:3 ea]**
    (a) modularity maximization and
    (b) complete clustering linkage.



12. Explain any two from the following with examples: **[6:3ea]**
    (a) Minimum Connected Dominating Set (MCDS)
    (b) Information cascades
    (c) Link partition

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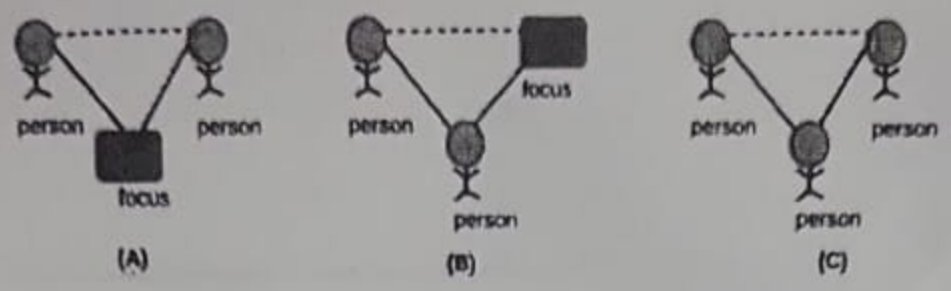
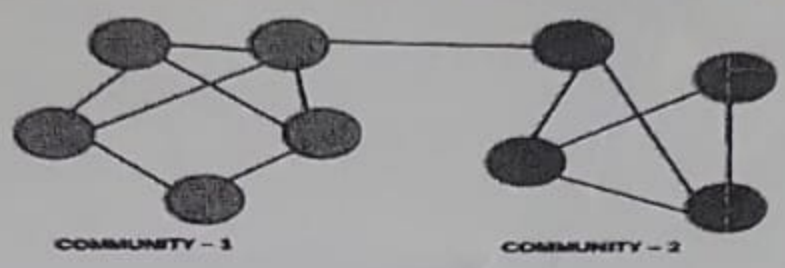
5. Consider figures A, B and C in Fig and write and explain the right kind of closure they represent (Please note that the solid line represents the existing friendship and, the dotted line represents the new friendship) [2]

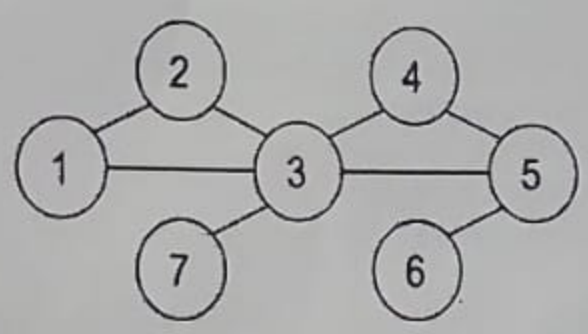


6. What are the densities of communities 1 and 2 in the network shown in Figure? [2]



7. For the network shown in the Figure, calculate the following similarity measures of nodes 3 and 5. **[6: 2ea]**

   a) Jaccard similarity
   b) Preferential attachment
   c) Adamic Adar



Use the network below for both Questions 8 and 9

8. **Calculate the following:**

   a) Suppose we want to apply the common neighbours' measures to add an edge from node H. Which is the most probable node to connect to H and why? **[2]**

   b) if we apply Resource Allocation method to predict the new edges, what is the value of the Allocation index of node C and D? **[3]**