



Final Assessment Test – November 2018

Course: CSE3021 - Social and Information Networks

Class NBR(s): 6038 / 6041 / 6043 / 6045 / 6048 / 6054 / 6056 / 6060 / 6157

Time: Three Hours

Slot: A1+TA1

Max. Marks: 100

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Why has social media become a quick success? Discuss in detail about the macro-structure of social networks. [6+4]
2. What are the limitations of current Web? Explain the development of semantic Web and the emergence of Social Web. Explain how "Friend Of a Friend (FOAF)" project provides a widely accepted vocabulary for "semantic web" description. [4+3+3]
3. For the graph given in Figure. I, find Global clustering coefficient and local clustering coefficient. [5+5]

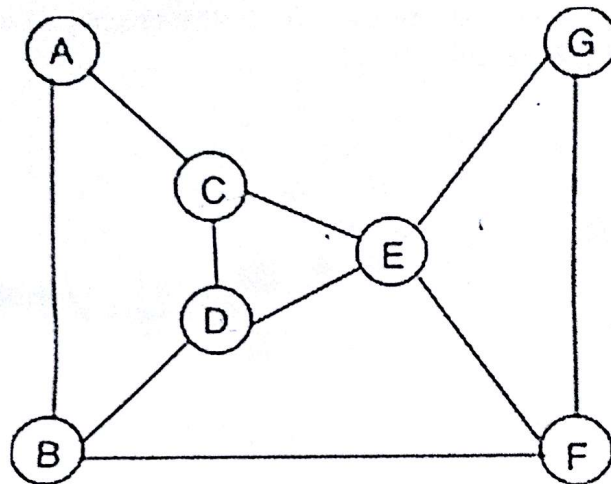


Fig. I

4. Find the density, mean nodal degree, eccentricity and diameter of the graph given below (Fig-II&III). Compute normalized closeness and normalized betweenness centrality measure for all the actors in the network given above (Fig. I). [10]

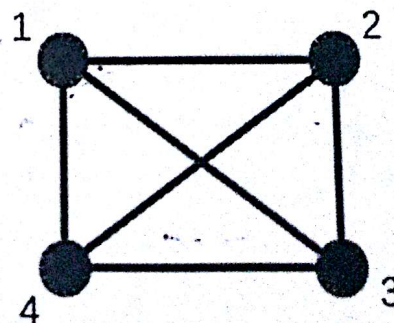
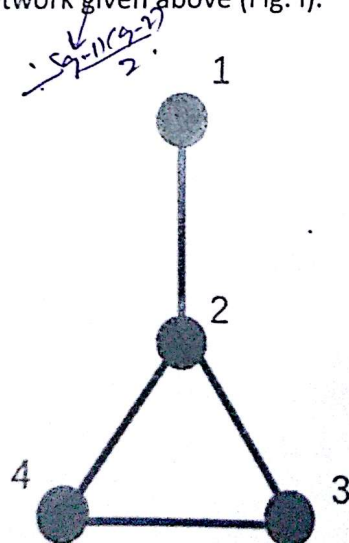


Fig. II & III

5. a) For a 7 node Random Graph, find the phase transition. Calculate the following properties [3]
 i) Average degree ii) Average path length iii) Expected number of edges.

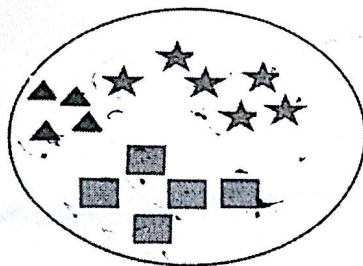
- b) For a random graph generated by $G(n, p)$, node v has degree d , where $d \leq n - 1$ with [5]

$$P(d_v = d) = \binom{n-1}{d} p^d (1-p)^{n-1-d},$$

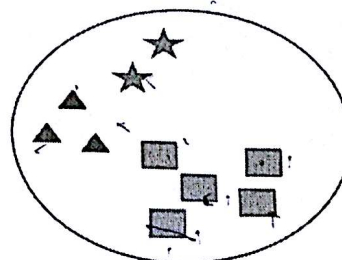
probability is a binomial degree distribution. Assuming that n is fixed, prove that if you increase (limit) the value of n as ∞ (infinity), then $P(d_v = d)$ will behave as Poisson distribution.

- c) Prove that for a random graph phase transition happens at c (where c is the expected node degree) & also prove that average path length l in a random graph is $l = \frac{\ln |V|}{\ln c}$. [2]

6. "Community detection, is an (non-convex) NP-hard problem"-give your thought on this comment. [2+1+1+2+4]
 Find a balance cut on Fig-I and draw different components. Find the value of cut ratio and normalized cut (Fig. I). What are the three major criteria's for any community to be an Emic community? Calculate NMI for following 2 clusters.



Cluster-1 (C=1)



Cluster-2 (C=2)

7. a) Consider the network below (Fig-IV) and find the clustering coefficient distribution and calculate its mean and standard deviation? [3]

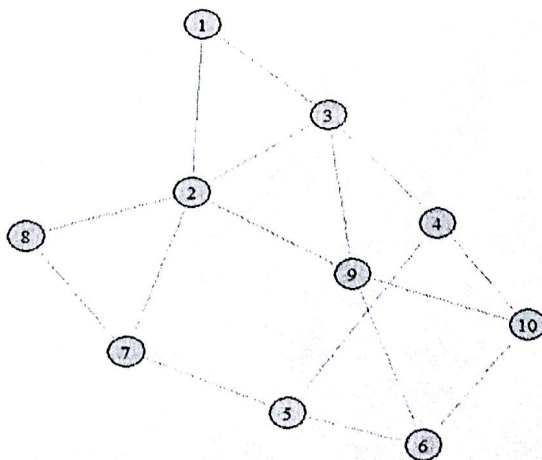


Fig. IV

- b) For the following network (Fig-V); name all nodes and apply modularity method to calculate modular matrix. Also apply spectral clustering method to find Laplacian matrix (Fig-V). [4]

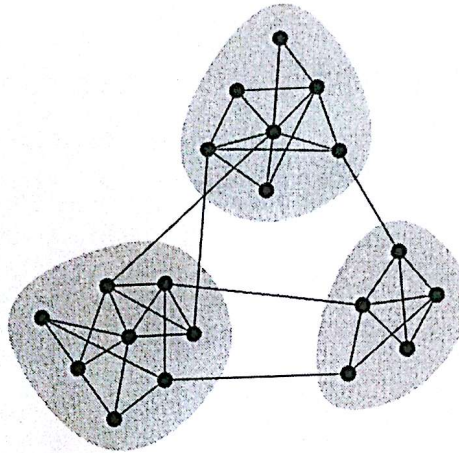


Fig-V

$$L = D - A$$

$$M = A - dd^T$$

- c) Assume that following S matrix has been obtained by applying "spectral clustering" method on a certain network for community detection. Apply K-means clustering method to get n clusters ($1 < n < 3$ where n is an integer). [3]

$$S = \begin{bmatrix} 0.24 & 0.48 \\ 0.76 & 0.43 \\ 0.33 & 0.50 \\ 0.81 & 0.20 \\ 0.25 & 0.11 \\ 0.36 & 0.61 \end{bmatrix}$$

8. Write an example of R programming code to [5+5]
- Create a network with 6 nodes and with 8 edges.
 - Color the edges in red and nodes in green.
 - Plot the network

Write sample R code to construct Random Graph model.

9. Explain five security attacks on online social networks platforms and appropriate countermeasures to circumvent them. [10]
10. Discuss with solid examples on how social media can play an important role in safety warning and emergency rescuing systems for disaster control and management. Discuss also the challenges that are attached to this approach. [6+4]

