Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (INFORMATION TECHNOLOGY/COMPUTER AND COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: PROGRAM ELECTIVE III – SOCIAL NETWOTK ANALYTICS [ICT 4021]

REVISED CREDIT SYSTEM
(26/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL questions.
- Write the detailed steps for all the problems.
- Missing data, if any, may be suitably assumed.

1A. Write the Girvan-Newman (GN) algorithm. Find the edge betweenness for each edge of the network depicted in Fig.Q.1A by applying the GN algorithm.

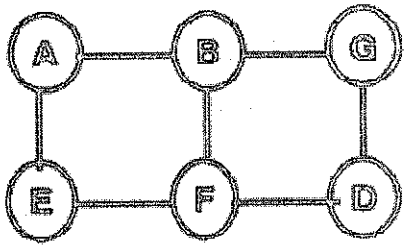

Fig.Q.1A 5

1B. Consider a 2-mode network shown in the Table Q.1B which gives the information of the membership of people in five different groups. Convert this into an *interpersonal network* in which ties between people are the number of groups in common and an *intergroup network* in which ties between groups are the number of people held in common. Draw neat diagrams of the resultant 1-mode networks.

Table Q.1B

	1	2	3	4	5
A	0	0	0	0	1
B	1	0	0	0	0
C	1	1	0	0	0
D	0	1	1	1	1
E	0	0	1	0	0
F	0	0	1	1	0

3

1C. Define a "connected component". Give one example. 2

2A. Consider a web graph with four nodes 1, 2, 3 and 4. The links are as follows: 1→2, 2→1, 2→3, 3→2, 4→3, 4→2, 4→1 and 1→3. Compute the PageRank after six iterations for each of the four pages by assuming teleport probability as 0.4. 5

2B. Draw a neat diagram depicting the network with undirected edges between nodes AB, 3

AC, BD, BE, DH, EH, CF, CG, FG, GK. Redraw the network using BFS to determine the shortest path between nodes BK and CH.

2C. What is average shortest distance? Find the average shortest distance for the network given in Q.2B. 2

3A. Explain the following:
(i) Simple contagion
(ii) Milgram's experiment on small world phenomenon
(iii) Homophily
(iv) Weak-ties 5

3B. Describe the "Random Surfer" with an example. Write the detailed steps of deriving the transition probability matrix 'P' given the adjacency matrix 'A' of a random surfer. 3

3C. Differentiate between "within-graph clustering" and "between-graph clustering" with an example. 2

4A. Consider the network depicted in Fig.Q.4A. Assume each node starts with the behavior 'B', and each node has a threshold of q=1/2 for switching to behavior 'A'.
(i) let 'e' and 'f' form a two-node set S of initial adopters of behavior A. If other nodes follow the threshold rule for choosing behaviors, which nodes will eventually switch to 'A'? Explain.
(ii) Find a cluster of density greater than (1-q) in the part of the graph outside S that blocks behavior A from spreading to all nodes, starting from S, at threshold q.

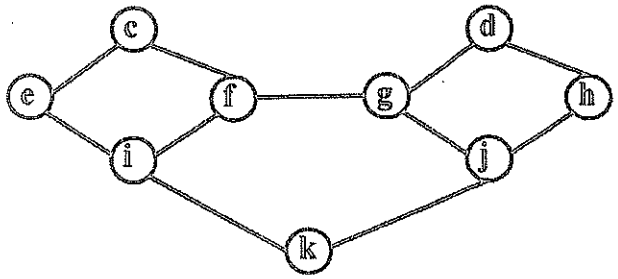

Fig. Q.4A 5

4B. Consider the network shown in Fig.Q.4B. Draw all the bipartite graphs for the instances $K_{s,t}$ (i) s = 2, t = 2 (ii) s = 2, t = 3 (iii) s = 3, t = 2

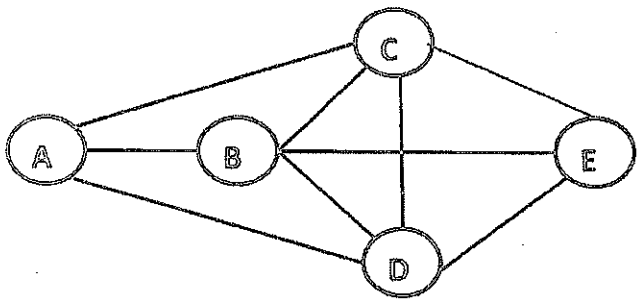

Fig.Q.4B 3

4C. Describe the normalized graph cut criteria. Determine the normalized cut value for the graph given in Fig.Q.4B by considering a cut with edges (AC), (BC), (BE), (BD), (AD) 2

5A. What are hubs and authorities? Explain the method of finding hub and authority scores. Find the hub and authority scores after 3 steps for the network with 4 nodes, where node A is pointing to nodes B, C, D, node B is pointing to A, C, D, and node C to node D. 5

5B. Describe the three key properties of small world networks. 3

5C. Describe any two empirical studies of diffusion. 2