MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH.(DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING) END SEMESTER EXAMINATIONS, JUNE/JULY 2022

SUBJECT: ALGORITHMIC FOUNDATIONS OF DATA SCIENCE (CSE - 5002)

REVISED CREDIT SYSTEM

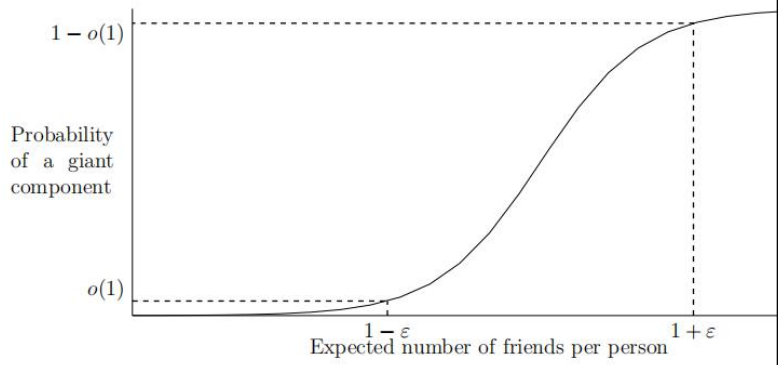
(01/07/2022)

Time: 2:00 - 5:00 pm MAX.MARKS: 50

INSTRUCTIONS TO CANDIDATES:-

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

Q.no	Questions	M	CLO	AHEP2LO	Blooms
1 A.	Volume is concentrated in a small annulus of width O(1/d) near the boundary. For the given scenario, calculate the volume of the unit ball in d-dimensional space.	4M	1	M1, M3	5
1 B.	Find the singular value decomposition of a matrix. $\begin{bmatrix} 4 & 0 \\ 3 & -5 \end{bmatrix}$	4M	1	M1, M3	4
1 C.	Design a Markov chain whose stationary distribution is a given target distribution.	2M	2	M2, M3	3
2 A.	Discuss the following questions - a) What is the expected time for a random walk starting at a vertex x to reach a target vertex y? b) What is the expected time until the random walk returns to the vertex it started initially? c) What is the expected time to reach every vertex?	3M	2	M2, M3	2
2 B.	Show matrix multiplication using sampling method. Give proper equations.	4M	3	M2, M3	3
2 C.	Illustrate with an example, the perceptron algorithm.	3M	3	M2, M3	2
3 A.	Formulate the learning problem of finding a classification rule that performs well on new input	5M	4	M1, M3	6

	data.				
3 B.	For probability distribution in spectral clustering "means separated by six standard deviations" suffice different distribution. Obtain the mathematical equation with an example.	3M	3	M2, M3	6
3 C.	Suppose data points are drawn from some probability distribution D over R^d, and that the clusters correspond to high-density regions surrounded by lower-density regions. Write the assumptions for the given scenario with respect to robust version of single linkage.	2M	4	M1, M3	2
4 A.	Describe the Factor Graphs using Tree algorithm.	5M	5	M1, M2	2
4 B.	Design a graph with single cycle for the message passing algorithm.	3M	5	M1, M2	5
4 C.	Analyze the given graph for the basic model of random graph G(n,p) where n is the number of vertices and p is the edge probability. 	2M	4	M1, M3	3
5 A.	The threshold for the existence of cycles in any graph is 1/n. Derive the proof with valid justification.	4M	5	M1, M2	4
5 B.	Describe the process of semi-definite programming.	4M	5	M1, M2	2
5 C.	Write the characteristics features of Deep Learning network.	2M	3	M2, M3	2