NATIONAL INSTITUTE OF TECHNOLOGY, PATNA
END SEMISTER EXAMINATION, Jan 2021

Program: M.Tech (IS/CN)/Ph.D.

Department: CSE

Subject: CS410101/ CS420101 (Advanced Algorithms)   **Semester: 1st/2nd Semester**

Date and Time: 21 Jan 2021, Two Hours (10:00 AM to 12:00 Noon with an extra time of half an hour (i.e., up to 12:30 PM)
Maximum: 40 Marks

Answer any Four questions. Each question carries equal marks.

NOTE:
1. Use Blue / Black pen and suitable paper to write an exam and then scan and create Single PDF file for upload through MST only. Other mode of submission will not be evaluated.
2. Before answering a question write the question number and write answer neat and clean.
3. Please write following information on the **TOP of Every Page** of answer sheet.
   Name: Roll No.:
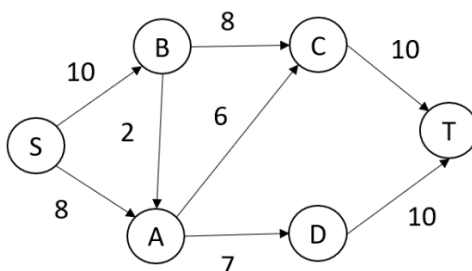   Program Code: Branch:
   Course Title: Course Code:
   Exam date:
4. Write the **Page number at the bottom** of every page.

1. Write a Dinic algorithm for finding maximum flow of a network. Apply DinicMaxFlow algorithm to find out the maximum flow in the network given below.

2. Write Hungarian algorithm and show time analysis of each statement in the algorithm. Suppose four jobs (J1, J2, J3, and J4) need to be executed by four workers (W1, W2, W3, and W4), one job per worker. The matrix below shows the

cost of assigning a certain worker to a certain job. The objective is to minimize the total cost of the assignment. Find the total cost of the optimal assignment using Hungarian's algorithm.

	J1	J2	J3	J4
W1	82	83	70	92
W2	77	37	49	92
W3	11	30	5	70
W4	8	9	98	23

3. Given these points { [2,3], [12,30], [40,50], [5,1], [12,10], [3,4], [22,13] }. Find the pair of points, whose distance is minimum. Also state the minimum distance between them. Write down the time complexity of the method used.

<div align="center">OR</div>

Write down the skip list algorithm with expected linear time complexity and also provide the proof whether it is Monte Carlo or Las Vegas.

4. As we have discussed that some of convex hull algorithms resemble well-known algorithms for sorting: like, Jarvis's march resembles selection sort. Describe a convex hull algorithm that closely resembles merge sort that is partition the set of points into two subsets of equal size, recursively compute the convex hull of each subset, and then merge the two sub-hulls into a single convex hull. How do we merge two subhulls in O(n) time?

5. Given items of different weights {9, 8, 2, 2, 5, 4, 7, 6, 3} and bins each of capacity '10', assign each item to a bin such that number of total used bins is minimized. It may be assumed that all items have weights smaller than bin capacity. Show usage of both best fit and next fit method of bin packing.