

M.Sc. Examination, 2018
Semester-III
Computer Science
Course : MCSO-34
(Selected Topics in Advance Algorithms)

Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer Question No.1 and **any four** from the rest.

1. a) TSP \in NP. – Justify.
b) Prove that the independent set problem is NP-Hard by presenting a reduction from the CLIQUE problem.
c) Prove that the set of all vertices in a maximal matching is a vertex cover solution with ratio error at most two.
d) Define Monte-Carlo and Las-vegas randomized algorithms. 4×2=8
 2. a) Formulate the set cover problem as an integer program.
b) Present a randomized approximation algorithm for the set cover problem with ratio error at most $O(\log n)$.
c) Prove correctness of the algorithm. 2+4+2=8
 3. a) Present Christofide algorithm to find 1.5 approximation algorithm for the Travelling Salesman problem.
b) Prove correctness and find time complexity of the algorithm. 4+(3+1)=8
 4. a) Define Bottleneck Disjoint path matching problem.
b) Present a 2-approximation algorithm for the problem.
c) Prove correctness of the algorithm. 1+4+3=8
 5. a) Define the knapsack problem.
b) Present a dynamic programming exponential time algorithm to obtain the exact solution of the problem and use it to design a fully polynomial time approximation algorithm for the problem. 1+(3+4)=8
 6. a) Two computers are physically at distant places and connected in a network. Each computer maintains a large database. Present a randomized algorithm to test if the data bases are the same using $O(\log n)$ communication complexity, where n is the size of both data bases.
b) Prove correctness of the above algorithm. 3+5=8
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