LNMIIT
The LNM Institute of Information Technology

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Computer Science & Engineering

Design & Analysis of Algorithm (CSE325)

Exam Type: End Term

Time : 135 minutes | Date:02/05/2018 | Max. Marks: 30

Name: Parul Enrollment No: 16UCS126.

Instruction:

- **Attempt all the questions.**
- **Marks for each question are written against them.**
- ***Do not write anything* in *question-paper* except Name and Enrolment Number.**
- **Though careful proof reading has been done for question paper. Even then if you have any doubt/confusion regarding the question you can make your assumption. You must write your assumption clearly before you start attempting that question. If Instructor thinks that your doubt/confusion and assumption is genuine then only he will entertain that assumption and check the question based on assumption otherwise your doubt/confusion/assumption will be ignored.**

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1. A road network can be considered as a graph with positive weights. The nodes represent road junctions and each edge of the graph is associated with a road segment between two junctions. The weight of an edge may correspond to cost of traveling the segment. Directed edges could also possible in order to model one-way streets (means the road network graph could have directed as well as undirected edges). Develop an algorithm to find the top three ranked route list (means shortest path should be at the top of the list) with at max 40% common vertices (means any pair of different paths could have at max 40% common vertices) from all possible routes (simple path) between a given source and a given destination. **(6 Marks)**

2. Let G=(V,E) be a connected, undirected graph with edge-weight function w:E->R (real value), and assume all edge weights are distinct. Consider a cycle $<v_1,v_2,\ldots,v_k,v_{k+1}>$ in G, where $v_{k+1}=v_1$, and let (v_i,v_{i+1}) be the edge in the cycle with the largest edge weight. Prove that (v_i,v_{i+1}) does not belong to the minimum spanning tree T of G. **(6 Marks)**

3. Design an algorithm to find cost of matrix chain multiplication problem in which the goal is to parenthesize the sequence of matrices so as to maximize, rather than minimize, the number of scalar multiplications. Also write an algorithm to print the optimal parenthesization of the sequence. **(6 Marks)**

4. Design an algorithm for job scheduling in a multiprogrammed parallel system. In the system, there are M identical processors. Assume that we are given a set S of n jobs J_1, $J_2,\ldots,J_n$, where job J_i requires x_i processors for parallel execution. We need to find a subset S' of jobs to execute simultaneously in such a way that system utilization is maximized. We try to schedule as many jobs as possible to maximize system throughput. **(6 Marks)**

5. Hero MotoCorp a motorbike manufacturing company has M assembly line. A bike chassis enters each assembly line, has parts added to it at N number of stations, and a finished bike exit at the end of the line. Each assembly lines has N stations. j^{th} station in i^{th} assembly line is denoted by $S_{i,j}$. A j^{th} station in each assembly line perform the same job. The stations were built at different times and with different technologies, so that the time required at each station varies, even between the stations at the same position on different assembly lines. Let time required at station $S_{i,j}$ is $a_{i,j}$. A chassis enters station 1 of one of the assembly lines, and it progress from each station to the next. There is also an entry time e_i for the chassis to enter and an exit time x_i for i^{th} assembly line. The time to transfer a chassis away from i^{th} assembly line to k^{th} assembly line after having gone through station $S_{i,j}$ is $t_{i,k,j}$. Design an algorithm to determine which stations should be chosen from different assembly lines in order to minimize the total time through the factory for one bike. **(6 Marks)**