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B Tech

No. of Pages : 2

Fourth Semester (End Sem) Examination April 2016

Design and Analysis of Algorithm (CS106)

Branch : CSE & IT

Time 3 Hours

Max Marks : 50

Answer any five questions.(Q.1 is compulsory.)

1) (a) What is the running time of Quick sort when all elements of array A have the same value? **[2X5]**

(b) The elements 32, 15, 20, 30, 12, 25, 16 are inserted one by one in the given order into a Max Heap. The resultant Max Heap is

(c) What is the return value of following function for 484? What does it do in general?

```
bool fun(int n)
{
  int sum = 0;
  for (int odd = 1; n > sum; odd = odd+2)
    sum = sum + odd;
  return (n == sum);
}
```

(d) We are given 9 tasks T1, T2.... T9. The execution of each task requires one unit of time. We can execute one task at a time. Each task **Ti** has a profit **Pi** and a deadline di. Profit Pi is earned if the task is completed before the end of the di^{th} unit of time.

Task	T1	T2	T3	T4	T5	T6	T7	T8	T9
Profit	15	20	30	18	18	10	23	16	25
Deadline	7	2	5	3	4	5	2	7	3

Are all tasks completed in the schedule that gives maximum profit?

(e) Prove that if NP ≠ co-NP, then P ≠ NP.

2) Give asymptotic upper bounds for T(n) in each of the following recurrences. Assume that T(n) is constant for sufficiently small n. **[5X2]**

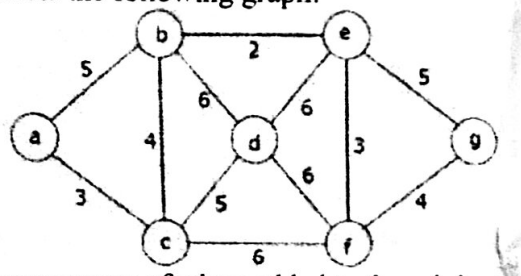
(a) $T(n) = T(n/2) + T(n/4) + T(n/8) + n$

(b) $T(n) = 4T(n/3) + n \lg n$

3) (a) Show that the solution of $T(n) = T(n-1) + n$ is $O(n^2)$ **[5X2]**

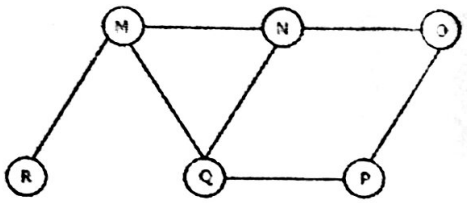
(b) Give pseudocode to reconstruct an LCS from the completed C table and the original sequences $X = \langle x_1, x_2, .., x_m \rangle$ and $Y = \langle y_1, y_2, .., y_n \rangle$ in O(m+n) time, without using the b table.

4) (a) Consider the following graph: **[5X2]**

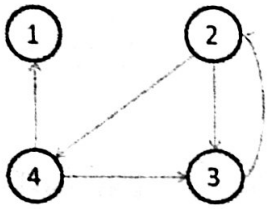


Find the sequence of edges added to the minimum spanning tree using Kruskal's algorithm?

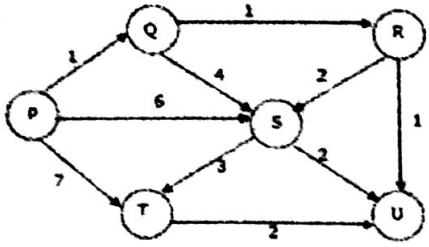
(b) The Breadth First Search algorithm has been implemented using the queue data structure. Find all possible order of visiting the nodes of the following graph by taking M as the source vertex.



5) (a) Define transitive closure of a graph and compute it for the following graph. **[5X2]**



(b) Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source. In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized? Show all steps.



6) (a) Working modulo q = 11, how many spurious hits does the Robin-Karp matcher encounter in the text T = 3141592653589793 when looking for the pattern P = 26? **[5X2]**

(b) Show how to implement an FFT algorithm with the bit-reversal permutation occurring at the end , rather than at the beginning of the computation.

7) The 5 Queen is the problem of placing 5 chess queens on an 5×5 chessboard so that no two queens attack each other. Create a permutation tree of the above problem. Solve the problem using back tracking approach, branch and bound approach. **[5+5]**