NATIONAL INSTITUTE OF TECHNOLOGY KURUKSHETRA

THEORY EXAMINATION

29 NOV 2018

Question paper

Roll No: _____

Month and Year of the Examination: Nov/Dec, 2018 **Branch:** Computer Science

Subject: Design and Analysis of Algorithm **Subject Code:** CSPC-21

Course: B.Tech **Semester:** III

Time Duration: Three (3) Hours **Maximum Marks:** 50

Total No. of Questions: Six (6) **Number of Questions to be Attempted:** Five (5)

Note:

I. Attempt all parts of question together at one place. Marks allotted for each question are shown on the right hand margin. **Write your answer with question no.**

II. The Candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right course no. and right subject title.

III. Unless stated otherwise, the symbols have their usual meanings in context with the subject. **Assume suitably and state, additional data required, if any.**

No.	QUESTIONS	Marks
Q1.		
a)	In the game of Jack Straws a number of straws are dumped on the table and players try to remove them one by one without disturbing the other straws. Given a list of endpoints for **n>1** straws (as if they were dumped on a large piece of graph paper, determine all the pairs of straws that are connected (Touching is connecting, but also two straws can be connected via connected straws).	7
b)	Give asymptotic upper and lower bounds for T(n) in each of the following recurrences: i) $T(n)= T(n/2)+T(n/4)+T(n/8)+n$ ii) $T(n)= T(n-1)+1/n$ iii) $T(n)=\sqrt{n}\,T(\sqrt{n})+n$	3
Q2.		
a)	Show how to sort **n** integers in the range **0 to $(n^3 - 1)$** in O(n) time.	5
b)	Consider inserting the keys {10; 22; 31; 4; 15; 28; 17; 88; 59} into a hash table of length **m=11** using open addressing with the auxiliary hash function $h'(k)= k$. Illustrate the result of inserting these keys using linear probing, using quadratic probing with $c_1 = 1$ and $c_2 = 3$, and using double hashing with $h_1(k)= k$ and $h_2(k)= 1+(k \bmod (m-1))$.	5
Q3.		
a)	Suppose that the edge weights in a graph are uniformly distributed over the half open interval [0, 1). Which algorithm, Kruskal's or Prim's, can you make run faster? Explain your answer.	5
b)	Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is {5; 10; 3; 12; 5; 50; 6}.	5

Q4.		
a)	If a new source vertex is not created in Johnson's algorithm rather just use **G'= G** and let s be any vertex. Give an example of a weighted, directed graph G for which incorporating this idea into JOHNSON causes incorrect answers. Then show that if G is strongly connected (every vertex is reachable from every other vertex), the results returned by JOHNSON with these modifications are correct.	6
b)	Write pseudocode for the procedure of creation of min- heap. How does the running time of MIN-HEAPIFY compare to that of MAXHEAPIFY?	4
Q5.		
a)	Suppose that instead of always selecting the first activity to finish, we instead select the last activity to start that is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields an optimal solution.	5
b)	Show the results of inserting the keys {F, S, Q, K, C, L, H, T, V,W, M,R,N,P,A,B,X, Y,D,Z,E} in order into an empty B-tree with minimum degree 2. Draw only the configurations of the tree just before some node must split and also draw the final configuration.	5
Q6.		
a)	For the n-queens problem observe that for finding inequivalent solutions the algorithm needs only set $x[1]=2,3,\ldots\lceil n/2 \rceil$. i) Modify n-queens so that only inequivalent solutions are computed. ii) Execute the n-queens algorithm devised above for n = 8,9 and 10. Tabulate the number of solutions your program finds for each value.	7
b)	Differentiate between Dynamic and Greedy approach.	3

***** THE END *****