DEPARTMENT OF CSE, NIT-ROURKELA
Autumn Semester Examination 2020

SUBJECT: Data Structures & Algorithm Design-I **CODE: CS 6103**

FULL MARKS : 25 **Duration of Examination: 1 Hours**

All question should be answered by own hand writing and uploaded to MS team

Answer Any FIVE Questions from the following

[Start time 2.50PM, Finish time 3.50PM, Upload on or before 4.05PM]

1[a] Choosing a random pivot point improves ***quick sort*** by removing the worst case due to bad data. What effect would happen to Insertion Sort if we chose a random element to insert rather than the next one in the input sequence?

1[b] What is the complexity class Zero-error Probabilistic Polynomial time **(*ZPP*)?**

1[c] What is reducibility in the context of NP-completeness?

1[d] Explain the steps to prove a problem to be NP-Complete?

1[e] How does the Dynamic Programming paradigm differs from the Greedy paradigm?

[02] What are the different approaches to prove the correctness of an algorithm Explain Loop Invariants associated with an algorithm? Use binary search algorithm to discuss the process of proving correctness?

[03] What is the main difference between *Las Vegas* and *Monte Carlo* algorithms? What are the four complexity classes involving randomized algorithms? Explain with examples? Write a Las Vegas to find suboptimal solution for the 0/1 knapsack problem.

[04] Define lower bound of a problem? What is the difference between worst case lower bound and average case lower bound? Show that the lower bound of the time required for heap-sort of n elements is **n log n.**

[05] Why approximation algorithms are used to solve NP-hard problem? What do you mean by polynomial-time approximation algorithm?

[06] What is a randomized algorithm? What is the classification of randomized algorithms? Write a randomized algorithm for 0-1 knapsack problem? Comment on class to which you algorithm belongs with computational complexity?

[07] Hash table of size 10 with 2 slots, contains entries from 0 through 9 and following keys are to be mapped into the hash table from a master file that can accommodate maximum 15 records.

10, 100, 32, 42, 15, 135, 29, 210, 402, 93, 92, 22, 42.

[i] Construct Open addressing hash table using linear probing with f (x) = x (mod 10) and find how many collisions occurred?

[ii] Construct Open addressing hash table using quadratic probing with f (x) = x (mod 10) and find how many collisions occurred?

[iii] Define and calculate identifier density and loading density of the above hash table.

[08] What is the main idea of Knuth-Morris-Pratt (KMP) algorithm for pattern matching? Write the KMP algorithm to find the match for a given a test string T of length n and a pattern string P of length m? Comment on its time and space complexity?

[09] Suppose we have an unsorted array A of *n* elements, and we want to know if the array contains any duplicate elements. Clearly outline an efficient method for solving this problem. By efficient, I mean your method should use **O(*n* log *n*) key comparisons** in the worst case. What is the asymptotic order of the running time of your method in the worst case? Clearly explain how you obtain your result.

[10] Give the algorithm of Binary search. Explain how it functions? Devise a ternary search algorithm that first tests the element at position n/3 for equality with some value x, and then checks the element at 2n/3 and either discovers x or reduces the set size to one-third the size of the original. Compare this with binary search?

--------------------Please upload your answer on or before 4.05PM----------------

Instruction:

- You have to upload your scan copy of hand written answer sheet to MS team in appropriate assignment
- Rename your submission file as Rollno_**A1**; the student with roll no 117CS0246 has to rename the answer file for Question set 1 as **117CS0246_A1**.
- Call me on 9937324437 or 9337938766 for any assistance during the examination. My E-mail id is bdsahu@nitrkl.ac.in, bibhudatta.sahoo@gmail.com.

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