Exam.Code:0915
Sub. Code: 33421

2124

B.E. (Computer Science and Engineering)
Third Semester
CS-301: Data Structures

Time allowed: 3 Hours **Max. Marks: 50**

***NOTE:** Attempt <u>five</u> questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions each from Section B-C.*

x-x-x

	Section-A	
Q1.	a) Define term algorithm. Why do we require algorithmic complexity. b) Which data structure is used in recursion. Explain reason and its use in variables and memory usage. c) State properties of good hash function. d) What is the best case and worst-case heights of B+ trees? e) If a weighted graph contains negative-weight edges, does it affect the MST?	10
	Section-B	

Q2.	a)Compute complexity of the following pseudo-codes giving proper justifications.
	i) for (int i = 1; i<= n; i++)
	for(int j = 1; j <= i; j++)
	for(int k = 1; k<= j; k++)
	{. A constant time operation }
	ii) m = n;
	while (n> 0)
	{ for(int i = 0; i< m; i++)
	n = n/3; }
	b)An array containing four occurrences of zero, five occurrences of 1 and three occurrences of 2 in any order. The array is to be **sorted** using adjacent swap operations (elements need to be swapped should be adjacent)
	i. What is the minimum number of swaps needed to sort such an array in the worst case?
	ii. Give separate orderings of elements in the above array so that the minimum and maximum number of swaps are required.
		4
		6

Q3.	a)Given a queue and an integer k, reverse the first k elements of the queue while keeping the order of the remaining elements intact. b)For given array, design an algorithm/pseudocode with $O(n)$ time complexity to determine the next greater element for each element in array using a stack. The next greater element for an element x is the first larger element found on the right-hand side of x in the array. If no such element exists, the next greater element should be set to -1. You are allowed to use stack STL functions. Input: $A = \{13, 7, 6, 12\}$ Output: $\{-1, 12, 12, -1\}$	5 5
Q4.	a)Given a linked list, write procedure/function to find the last n b)If the array [12, 4, 7, 9, 2, 5] is sorted using Quick Sort and always choosing the median as the pivot, what will the sequence of pivots be? Show the steps.	5 5

P.T.O.

	Section-C	
Q5.	a) Given a sequence of numbers, you are supposed to count the frequencies of all numbers using BST. Write algorithm for the same. b)Explain Delete-Max operation in a Max-Heap and show how it maintains the heap property with an example.	5 5
Q6.	a)Given a complete binary tree, explain how to implement it using an array to represent a Max-Heap. b)If an AVL Tree has **n** nodes, what is the minimum possible height of the tree? Also find the minimum number of nodes required to form an AVL tree for height of 6	4 6
Q7.	a)Use double hashing with a table size of 11 and hash functions - h1(k)=kmod 11and h2(k)=1+(kmod 10)to insert the keys 18, 41, 22, 44, and 59. Show the hash table after each insertion. b)Describe Kruskal's algorithm for finding the MST of a connected graph. Provide a step-by-step example, including the concept of cycle detection with Union-Find.	4 6

x-x-x