MID SEMESTER EXAMINATION

October-2021

Course Code: **CDCSC06, COCSC06, CACSC06, CMCSC06**

Course Title: **Design and Analysis of Algorithms**

Time: 1:30 Hours

Max Marks: 15

Note: **Attempt all questions.**
Assume suitable missing data, if any

No.	Question	CO	Marks
1.	a) Given an **nXn** matrix **M** such that the elements in each row and column are sorted in ascending order. Devise a linear time **algorithm** for searching an element in the matrix.	2	2
	b) Given the address (p) of a node (X) in a binary tree and the address (f) of its father, write the **code** to **delete** the left child of node X. The left child may have either one child or none.	3	1
2.	a) The recurrence $T(n) = 7T(n/2) + n^2$ describes the running time of an algorithm A, a competing algorithm A' has a running time $T'(n) = aT'(n/4) + n^2$. Calculate the LARGEST value for a, such that A' is asymptotically faster than A.	1	1
	b) Solve the recurrence relation using Recursion Tree Method: $T(n) = T(n/3) + T(2n/3) + n$	1	2
3.	a) Explain RAM model of computation. For the given piece of code, using the RAM model of computation, find the complexity of the given piece code.	1	1.5

```
for (j=1; j<n; j++){
        key = a[j];
        i = j - 1;
        while(i>=0 && a[i] >key) {
                a[i+1] = a[i];
                i = i-1;
                a[i+1] = key;
        }
}
For (k=0; k<n; k++)
        printf("%d\n",a[i]);
```

	b) Given an array of n numbers where each number is an integer in the range [0, N] for some N>>n, give at least two algorithms to find whether all the n numbers are distinct or not. Also, find the time complexity of each algorithm.		**1.5**
4.	a) Suppose F1, F2, f3, F4, F5 are five sorted files of sizes (20, 30, 10, 5, 40) respectively. Write an algorithm to get an optimal merge pattern (a pattern that requires minimum number of comparisons and record moves) to merge the files to get one sorted file. Evaluate the complexity of your algorithm.	4	**1.5**
	b) Insert these elements in an empty Red-Black Tree 3, 1, 5, 7, 8, 9, 10	3	**1.5**
5.	a) Insert these elements in an empty AVL Tree. 342, 206, 444, 523, 607, 301, 142, 183, 102, 157, 149	3	**1.5**
	b) What are the minimum and maximum number of nodes in an AVL tree of height 3? Height of the root node is 0. Give exact numbers.	3	**1.5**