COMSATS University Islamabad, Lahore Campus

☐ Sessional-1 ☑ Sessional-II ☐ Terminal Examination – SPRING 2021

Course Title:	Design and Analysis of Algorithms			Course Code:	CSC301	Credit Hours:	3
Course Instructor/s:	Dr. Hasan Jamal			Programme Name:	BS Computer Science		
Semester:	5th	Batch:	SP19-BCS	Section:	A, B, C	Date:	08/05/2021
Time Allowed:	**90 Minutes**			**Maximum Marks:**			**25**
Student's Name:				Reg. No.			

Important Instructions / Guidelines:

- Make sure to write your name and registration number on all the pages. Any page without name and registration number will not be graded.
- Show all your work, as partial credits will be given. You will be graded not only on the correctness of your answer, but also on the clarity with which you express it. Please be neat.
- In case of late submission, one mark will be deducted for each minute over the submission deadline
- Any solution found to be copied would strictly result in zero marks
- **Good luck!**

Question 1: **[Marks: 10]**

Solve the following recurrence using the "Recursion Tree Method"

$$T(n) = 5\,T\left(\frac{n}{4}\right) + n$$

Question 2: **[Marks: 5]**

Solve the following recurrence using the "Master Theorem Method"

$$T(n) = 5T\left(\frac{n}{2}\right) + n^2\,lg\,n$$

Question 3: **[Marks: 2 x 5 = 10]**

In not more than five lines each, provide the answers to the following questions. Be reasonable in your assumptions. Justify your answer.

a) You are given a list containing the birth year of all the people who were born in Pakistan in the 21st century. Your task is to determine the year in which least number of people were born. In terms of time complexity, what is the best way to solve this problem?

b) Suppose you have found a piece of code from "Stackoverflow" that takes a list of sorted numbers as input and perform some operations on the sorted list. However, unfortunately, there is a bug in the code that randomly shuffles a few numbers. To save time, instead of fixing the bug, you decide to sort this list again. Which algorithm will you choose to sort this list? Justify your answer.

c) You have a normally distributed set of 10,000 unsorted integers, ranging from 10,000 to 55,000. Which algorithm will you choose to sort this data set? Justify your answer.

d) You have an unsorted list of birth weights of babies born in Pakistan in April 2021. You would like to sort the data so that you can identify and treat underweight babies. Which algorithm will you choose to sort this list? Justify your answer.

e) You have a uniformly distributed set of unsorted data of 1,000 numbers, ranging from zero to 10,000. Which algorithm will you choose to sort this data set? Justify your answer.