UNIVERSITY OF PETROLEUM AND ENERGY STUDIES, DEHRADUN

Assignment Sheet #1, September 2021

Programme Name: B. Tech (CSE- AI/ML) | **Semester : III**
Course Name : Design and Analysis of Algorithms | **Max. Marks : 30**
Course Code : CSEG 2021 | **Circulation : 13/09/2022**
Nos. of page(s) : 02 | **Submission : 20/09/2022**
Instructions : Answer the following questions

S. No.		Marks	CO
Q1	What do you understand with Algorithm and its efficiency?	1	CO1
Q2	a) What are the basic properties of an algorithm? b) Distinguish between algorithm and pseudo code.	2	CO1
Q3	a) What is Asymptotic Time/Space Complexity? b) Differentiate big-O and small-o notation.	2	CO1
Q4	Define basic principal of Divide and Conquer approach with an example of Binary Search.	1	CO1
Q5	Prove that: For any two functions $f(n)$ and $g(n)$, we have $f(n) = \Theta(g(n))$ if and only if $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$.	1	CO1
Q6	Justify your answer: a) Is $2^{n+1} = O(2^n)$? b) Is $2^{2n} = O(2^n)$?	2	CO1
Q7	*Solve using Recurrence method:* *a)* $T(n) = \begin{cases} 1, & if\ n = 0 \\ T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + 1, & if\ n \geq 1 \end{cases}$ *b)* $T(n) = 4T\left(\frac{n}{2}\right) + n$	3	CO2
Q8	Solve using Master Theorem: **Annexure #1** *(find at last page of the assignment)*	0.5*22	CO2
Q9	Explain Iteration and Recurrence tree method and solve the following: a) $T(n) = \begin{cases} 1, & if\ n = 0 \\ 3T\left(\frac{n}{2}\right) + n, & if\ n \geq 1 \end{cases}$ Solve using changing variable method: a) $T(n) = T(\sqrt{n}) + lgn$ b) $T(n) = \sqrt{n}\,T(\sqrt{n}) + n$	2+3	CO2
Q10	What are the real time applications of Quick Sort? Write the algorithm of Quick Sort and Analyze its balanced case running time complexity.	2	CO3

Note: *Plagiarism is strictly prohibited in the assignment. A viva based on assignment questions will be conducted at the time of assignment submission to validate Academic Integrity.*

Annexure #1

1. $T(n) = 3T(n/2) + n^2$
2. $T(n) = 4T(n/2) + n^2$
3. $T(n) = T(n/2) + 2^n$
4. $T(n) = 2^n T(n/2) + n^n$
5. $T(n) = 16T(n/4) + n$
6. $T(n) = 2T(n/2) + n \log n$
7. $T(n) = 2T(n/2) + n/\log n$
8. $T(n) = 2T(n/4) + n^{0.51}$
9. $T(n) = 0.5T(n/2) + 1/n$
10. $T(n) = 16T(n/4) + n!$
11. $T(n) = \sqrt{2}T(n/2) + \log n$
12. $T(n) = 3T(n/2) + n$
13. $T(n) = 3T(n/3) + \sqrt{n}$
14. $T(n) = 4T(n/2) + cn$
15. $T(n) = 3T(n/4) + n \log n$
16. $T(n) = 3T(n/3) + n/2$
17. $T(n) = 6T(n/3) + n^2 \log n$
18. $T(n) = 4T(n/2) + n/\log n$
19. $T(n) = 64T(n/8) - n^2 \log n$
20. $T(n) = 7T(n/3) + n^2$
21. $T(n) = 4T(n/2) + \log n$
22. $T(n) = T(n/2) + n(2 - \cos n)$