IEC College of Engineering and Technology, Greater Noida
Department of CSE/IT
Odd Sem., Session 2022-23
Assignment-1

Subject Name with Code: Design and Analysis of Algorithms (KCS-503) Submission Date: 14/11/22

1. **How analyze the performance of an algorithm in different cases?**
2. **Solve the following recurrence using Master method: $T(n) = 4T(n/3) + n^2$**
3. **Compare Time Complexity with Space Complexity.**
4. **Name the sorting algorithm that is most practically used and also write its Time Complexity.**
5. **What are the characteristics of the algorithm?**
6. **Derive the time complexity of Merge sort.**
7. **What is recurrence relation? How a recurrence is solved using master's theorem?**
8. **What is asymptotic notation? Explain Omega (Ω) notation?**
9. **Solve the recurrence**
   - i) **$T(n) = 3T(n/4) + cn^2$ using recursion tree method.**
   - ii) **$T(n) = n + 2T(n/2)$ using Iteration method. (Given $T(1)=1$)**
   - iii) **$T(n) = T(n-1) + n^4$; $T(n) = T(n/4) + T(n/2) + n^2$**
   - iv) **$T(n) = T(n/2) + T(n/4) + T(n/8) + n$. using recursion tree method**
   - v) **$T(n)= n + T(n/10)+T(7n/5)$; $T(n) = 4T(n/2) + n^2$.**
   - vi) **$T(n)=n+T(n/5)+T(4n/5)$. using recursion tree method**
10. **Write Merge sort algorithm and sort the following sequence {23, 11, 5, 15, 68, 31, 4, 17} using merge sort.**
11. **What do you understand by stable and unstable sorting? Sort the following sequence {25, 57, 48, 36, 12, 91, 86, 32} using heap sort.**
12. **Write an algorithm for counting sort? Illustrate the operation of counting sort on the following array: A={4, 0, 2, 0, 1, 3, 5, 4, 1, 3, 2, 3}.**
13. **Write an algorithm for insertion sort. Find the time complexity of Insertion sort in all cases.**
14. **Rank the following by growth rate: n, $2\lg \sqrt{n}$, log n, log (logn), log2 n, (lgn)lgn , 4, (3/2) n , n!**
15. **Use a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(\alpha n) + T((1 - \alpha)n) + cn$, where α is a constant in the range $0 < \alpha < 1$ and $c > 0$ is also a constant.**
16. **The recurrence $T(n) = 7T(n/3) + n^2$ describes the running time of an algorithm A. Another competing algorithm B has a running time of $S(n) = a\,S(n/9) + n^2$. What is the smallest value of 'a' such that A is asymptotically faster than B.?**
17. **Sort the array A of elements using heap sort: A = (23, 9, 18, 45, 5, 9, 1, 17, 6).**
18. **How do you compare the performance of various algorithms?**
19. **Take the following list of functions and arrange them in ascending order of growth rate. That is, if function g(n) immediately follows function f(n) in your list, then it should be the case that f(n) is O(g(n)). $f1(n) = n^{2.5}$, $f2(n) = \sqrt{2^n}$, $f3(n) = n + 10$, $f4(n) = 10n$, $f5(n) = 100n$, and $f6(n) = n^2 \log n$.**
20. **Prove that worst case running time of any comparison sort is Ω(nlogn)**
21. **Among Merge sort, Insertion sort and quick sort which sorting technique is the best in worst case. Apply the best one among these algorithms to Sort the list E, X, A, M, P, L, E in alphabetic order.**
22. **Explain HEAP-SORT on the array. Illustrate the operation of HEAP-SORT on the array A= {6, 14, 3, 25, 2, 10, 20, 7, 6}.**