Institute of Engineering & Management
Department of Computer Science & Engineering
PCCCS494
Design & Analysis of Algorithm Lab

Assignment List

Difficulty Level - Easy:

Assignment 1. Given a sorted array and a number X, search two elements of the array such that their sum is X. Expected time complexity is O(n).

Assignment 2. Implement Binary Search using Divide and Conquer.

Assignment 3. Apply Binary Search on 2D NxM array (A) having numbers stored in non-decreasing order under row-major scanning.

Assignment 4. A Bitonic Sequence is a sequence of numbers which is first strictly increasing then after a point strictly decreasing. A Bitonic Point is a point in the bitonic sequence before which elements are strictly increasing and after which elements are strictly decreasing. Find bitonic points in a bitonic sequence.

Assignment 5. Apply Merge Sort to count inversion pairs in an array. Two elements a[i] and a[j] form an inversion pair if a[i] > a[j] and i < j. Example: The sequence 2, 4, 1, 3, 5 has three inversions (2, 1), (4, 1), (4, 3).

Assignment 6. Implement a greedy algorithm to solve the fractional knapsack problem.

Difficulty Level - Medium:

Assignment 7. Find the second largest and second smallest number simultaneously in an array using Divide & Conquer Principle.

Assignment 8. Given a sorted array and a number x, write a function that counts the occurrences of x in the array. Expected time complexity is O(logn).

Assignment 9. Median of two sorted arrays: There are 2 sorted arrays A and B; each of size n. Write an algorithm to find the median of the array obtained after merging the above 2 arrays (i.e. array of length 2n). The complexity should be O(log(n)).

Assignment 10. Given an array of digits, sort them with time complexity O(n).

Assignment 11. Find neighbors of the median element in an array using the partitioning strategy of the Quick-Sorting method.

Assignment 12. Given an array p[] which represents the chain of matrices such that the i-th matrix Ai is of dimension p[i-1] x p[i]. We need to write a function that should return the optimal

parenthesizing expression resulting in a minimum multiplication cost to multiply the chain.

Assignment 13. Given weights and values of n items, put these items in a knapsack of capacity W to get the maximum total value in the knapsack. You cannot break an item, either pick the item, or don't pick it.

Assignment 14. Implement the greedy algorithm to solve the problem of the Job Sequencing with deadlines.

Assignment 15. Implement a greedy algorithm for finding the single-source shortest paths. Suggest an algorithm if the given graph contains negative weights and non-negative weight cycle and implement it.

Difficulty Level - Hard:

Assignment 16. Apply Strassen's Matrix Multiplication strategy for odd dimensional square matrices.

Assignment 17. Given a cost 2D-matrix and a position (m, n), write a function that returns the minimum cost-path to reach (m, n) from (0, 0).

Assignment 18. Given a value V and an infinite supply of coins of m-denominations {C1=1 < C2<C3<.....<Cm}, we want to make change for Rs. V. Apply DP strategy to find out the minimum number of coins to make the change?

Assignment 19. Given a set of non-negative integers, and a value sum, determine if there is a subset of the given set with sum equal to given sum.

Assignment 20. Implement DP strategy to solve the Traveling Salesman Problem (TSP).

Assignment 21. Implement all pairs of the Shortest path algorithms for a graph using Floyd-Warshall's strategy.

Assignment 22. Students need to develop a software or tool using any language for Plagiarism Checker. The primary objective of this project is that they have to implement a data structure concept and algorithm and show us how they implement it.

Assignment 23. Professor Sarkar thinks he has discovered a remarkable property of binary search trees. Suppose that the search for key k in a binary search tree ends up in a leaf. Consider three sets: A, the keys to the left of the search path; B, the keys on the search path; and C, the keys to the right of the search path. Professor Bunyan claims that any three keys $a \in A$, $b \in B$, and $c \in C$ must satisfy $a \leq b \leq c$. Give a smallest possible counterexample to the professor's claim.

Assignment 24. KMP String Matching: Given a text txt[0..n-1] and a pattern pat[0..m-1], write a function search(char pat[], char txt[]) that prints all occurrences of pat[] in txt[]. You may assume that $n > m$.

Text: A A B A A C A A D A A B A A B A
Pattern: A A B A

Assignment 25. Implement a routine management system that will work for the next semester.

Major Constraints:
i. To calculate the weekly load of each faculty.
ii. Keep the student to faculty ratio as 20:1.
iii. To keep 6 classes per day and each class hour should be of 1 hour.
iv. The routine will be the same for every week.
v. 2 credit subjects should have 2 theory classes per week, 3 credit subjects should have 3 theory classes per week.
vi. For every lab. subject there should be at least 10 labs. in total per semester.
vii. For every theory subject there should be at least 35 theory classes in total per semester.

You can add more constraints to your project to increase your novelty of work.
