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CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

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Practical List

Academic Year	:	2023-24	Semester	:	4th
Course code	:	CE264	Course name	:	Design and analysis of algorithms

Sr. No.		Aim	Hours	CO
1.	**Implement and analyse algorithms given below.**		**02**	**1**
	1.1	Factorial (Iterative and Recursive)		
	1.2	Fibonacci Series(Iterative and Recursive)		
	1.3	GCD (Iterative and Recursive)		
2.	**Implement and analyse algorithms given below.**		**02**	**1**
	2.1	Binary search		
	2.2	Insertion Sort		
	2.3	Given an array of integers *nums* and an integer *target*, return *indices* of the two numbers such that they add up to target. You may assume that each input would have exactly one solution, and you may not use the same element twice. You can return the answer in any order. Can you come up with an algorithm that is less than $O(n^2)$ time complexity? https://leetcode.com/problems/two-sum/		
3.	**Divide and Conquer**		**02**	**4**
	3.1	Implement and analyze Quick Sort algorithm.		
	3.2	Your task is to calculate a^b mod 1337 where a is a positive integer and b is an extremely large positive integer given in the form of an array. https://leetcode.com/problems/super-pow/		
4.	**Greedy Approach**		**08**	**2**
	4.1	A Burglar has just broken into the Fort! He sees himself in a room with n piles of gold dust. Because each pile has a different purity, each pile also has a different value (v[i]) and a different weight (w[i]). A Burglar has a bag that can only hold W kilograms. Calculate which piles Burglar should completely put into his bag and which he should put only fraction into his bag. Design and implement an algorithm to get maximum piles of gold using given bag with W capacity, Burglar is also allowed to take fractional of pile.		
	4.2	Implement the program to find the shortest path from one source to all other destinations in any city graph.		

	4.3	Find Minimum Cost spanning tree of an undirected graph using Kruskal's algorithm.		
	4.4	You are given an array prices where prices[i] is the price of a given stock on the i^{th} day. You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock. Return the maximum profit you can achieve from this transaction. If you cannot achieve any profit, return 0. https://leetcode.com/problems/best-time-to-buy-and-sell-stock/		
	4.5	You are given an integer array heights representing the heights of buildings, some bricks, and some ladders. You start your journey from building 0 and move to the next building by possibly using bricks or ladders. While moving from building i to building i+1 (0-indexed), • If the current building's height is greater than or equal to the next building's height, you do not need a ladder or bricks. • If the current building's height is less than the next building's height, you can either use one ladder or (h[i+1] - h[i]) bricks. Return the furthest building index (0-indexed) you can reach if you use the given ladders and bricks optimally. https://leetcode.com/problems/furthest-building-you-can-reach/		
	4.6	There are some spherical balloons taped onto a flat wall that represents the XY-plane. The balloons are represented as a 2D integer array points where points[i] = [xstart, xend] denotes a balloon whose horizontal diameter stretches between xstart and xend. You do not know the exact y-coordinates of the balloons. Arrows can be shot up directly vertically (in the positive y-direction) from different points along the x-axis. A balloon with xstart and xend is burst by an arrow shot at x if xstart <= x <= xend. There is no limit to the number of arrows that can be shot. A shot arrow keeps traveling up infinitely, bursting any balloons in its path. Given the array points, return the minimum number of arrows that must be shot to burst all balloons. https://leetcode.com/problems/minimum-number-of-arrows-to-burst-balloons/		
	4.7	You are given an array people where people[i] is the weight of the ith person, and an infinite number of boats where each boat can carry a maximum weight of limit. Each boat carries at most two people at the same time, provided the sum of the weight of those people is at most limit. Return the minimum number of boats to carry every given person. https://leetcode.com/problems/boats-to-save-people/		
5.	**Dynamic Programming Approach**		**08**	**3**
	5.1	Let S be a collection of objects with profit-weight values. Implement the 0/1 knapsack problem for S assuming we have a sack that can hold objects with total weight W.		
	5.2	Implement a program to print the longest common subsequence for the following strings.		

Test Case	String1	String2
1	ABCDAB	BDCABA
2	EXPONENTIAL	POLYNOMIAL
3	LOGARITHM	ALGORITHM

	5.3	Given a chain < A1, A2,…,An> of n matrices, where for i=1,2,…,n matrix Ai with dimensions. Implement the program to fully parenthesize the product A1,A2,…,An in a way that minimizes the number of scalar multiplications. Also calculate the number of scalar multiplications for all possible combinations of matrices.		

Test Case	n	Matrices with dimensions
1	3	A1: 3*5, A2: 5*6, A3: 6*4
2	6	A1: 30*35, A2: 35*15, A3: 15*5, A4: 5*10, A5: 10*20, A6: 20*25

	5.4	Given a rod of length n inches and an array of prices that includes prices of all pieces of size smaller than n. Implement a program to determine the maximum value obtainable by cutting up the rod and selling the pieces. https://www.geeksforgeeks.org/cutting-a-rod-dp-13/		
	5.5	You are given a 0-indexed 2D integer array questions where questions[i] = [$points_i$, $brainpower_i$]. The array describes the questions of an exam, where you have to process the questions in order (i.e., starting from question 0) and make a decision whether to solve or skip each question. Solving question i will earn you $points_i$ points but you will be unable to solve each of the next $brainpower_i$ questions. If you skip question i, you get to make the decision on the next question. For example, given questions = [[3, 2], [4, 3], [4, 4], [2, 5]]: If question 0 is solved, you will earn 3 points but you will be unable to solve questions 1 and 2. If instead, question 0 is skipped and question 1 is solved, you will earn 4 points but you will be unable to solve questions 2 and 3. Return the maximum points you can earn for the exam. https://leetcode.com/problems/solving-questions-with-brainpower/		
	5.6	You are given an integer array cost where cost[i] is the cost of ith step on a staircase. Once you pay the cost, you can either climb one or two steps. You can either start from the step with index 0, or the step with index 1. Return the minimum cost to reach the top of the floor. https://leetcode.com/problems/min-cost-climbing-stairs/		
	5.7	Given an amount and the denominations of coins available, determine how many ways change can be made for amount. There is a limitless supply of each coin type. https://www.hackerrank.com/challenges/coin-change/problem?isFullScreen=true		
6.	**Backtracking & Branch & Bound**		**04**	**5**

	6.1	You are given an integer N. For a given N x N chessboard. Implement a program to find a way to place 'N' queens such that no queen can attack any other queen on the chessboard. A queen can be attacked when it lies in the same row, column, or the same diagonal as any of the other queens. You have to print one such configuration**.**		
	6.2	Amar takes 2, 6 and 7 hours of time to perform cooking, gardening and cleaning respectively. Akbar takes 4, 8 and 3 hours of time to perform cooking, gardening and cleaning respectively. Anthony takes 9, 5 and 1 hours of time to perform cooking, gardening and cleaning respectively. Find out optimal job assignment for Amar, Akbar and Anthony.		
7.	**String Matching**		**02**	**6**
	7.1	Two strings, a pattern 'P' and a text 'T' are given. The task is to implement program to determine if the pattern occurs in the text using Rabin Karp algorithm, and if it does, print all of its occurrences; else, print -1.		
8.	**Mini Project**		**02**	**2,3,4,5,6**