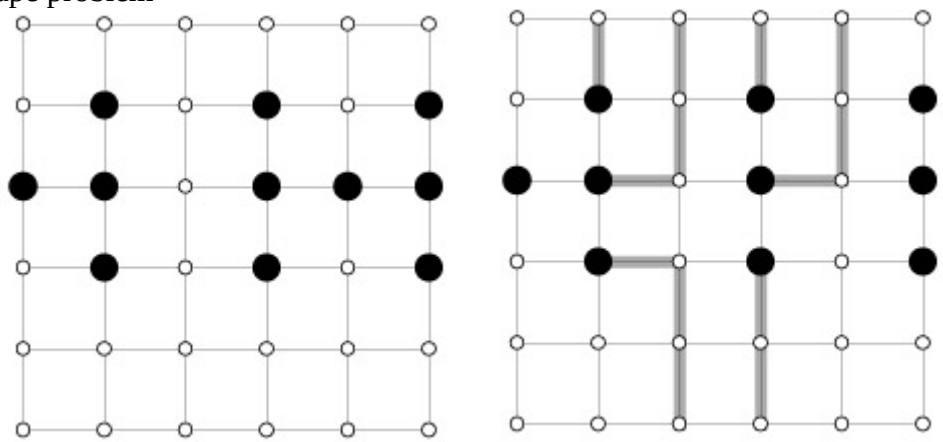
1	a) Asymptotic analysis is one of the characteristics of algorithm complexity analysis and why we prefer asymptotic analysis. Give four reasons. b) Differentiate Between Accounting and Potential Method of complexity analysis. c) Write Knuth Morris Pratt Algorithm for String Comparison d) Discuss Approximation Algorithms and FPTAS
2	a) Gauri wants to throw a party and she is trying to decide who to invite. She has n people to choose from, and she knows which pairs of these people know each other. She wants to pick as many people as possible, subject to two constraints: i) For each guest, there should be at least five other guests that they already know. ii) For each guest, there should be at least five other guests that they don't already know. Write an algorithm that computes the largest possible number of guests she can invite, given a list of n people and the list of pairs who know each other. b) A common super sequence of two strings A and B is another string that includes both the characters of A in order (may not be continuous) and the characters of B in order (may not be continuous). Write an algorithm to compute the length of the shortest common super sequence of two strings A[1..m] and B[1.. n]. You do not need to compute an actual super sequence, just its length. For example, if the input strings are ANTHROHOPOBIOLOGICAL and PRETERDIPLOMATICALLY, your algorithm should output 31, because a shortest common super sequence of those two strings is PREANTHEROHODPOBIOPLOMATGICALLY.
3	a) Discuss three different rules for determining the time complexity for divide and conquer problems using Master Method. b) Write an algorithm for 6-queen problem for a 6X6 chessboard. A queen has the property that it can attack in horizontal, diagonal and vertical positions. The solution should contain the queens in the positions that they are non-attacking. c) Explain (i) Pruning (ii) Branch and Bound d) Write an Algorithm for Linear Search using Non-deterministic Approach.
4	a) A palindrome is any string that is exactly the same as its reversal, like HANNAH. Describe and analyse an algorithm to find the length of the longest subsequence of a given string that is also a palindrome. For example, the longest palindrome subsequence of HDYNAMICPROGRAMZLETMESHOWYOUTH is HYMRORMYH, so given that string as input, your algorithm should return the integer 9. b) The citizens of a country use coins whose values are powers of two. That is, for any non-negative integer k, there are coins whose value is 2^k bits. Consider the natural greedy algorithm to make x bits in change: If $x > 0$, use one coin with the largest denomination $d \leq x$ and then recursively make x - d bits in change. (Assume unlimited supply of coins) (i) Prove that this algorithm uses at most one coin of each denomination. (ii) Prove that algorithm finds minimum number of coins whose total value is x.
5	a) Write an algorithm for Floyd-Warshall Algorithm for All Pair Shortest Path Problem. b) Write an algorithm for Merge Sort taking care of all kinds of inputs. Input to the program is n and n numbers to be sorted. c) Write a note on Genetic Algorithms. d) Discuss Depth First Search Algorithm using Recursion with example.
6	a) Suppose we are given an array A[1 ..m][1 .. n] of non-negative real numbers. We want to round A to an integer matrix, by replacing each entry x in A with either floor of x or ceiling of x, without changing the sum of entries in any row or column of A. For example:

	1.2 3.4 2.4 3.9 4.0 2.1 Is converted to 7.9 1.6 0.5 1 4 2 4 4 2 8 1 1 b) Describe an efficient algorithm that either rounds A in this fashion, or reports correctly that no such rounding is possible. An nX n grid is an undirected graph with n^2 vertices organized into n rows and n columns. We denote the vertex in the ith row and the jth column by (i, j). Every vertex in the grid have exactly four neighbours, except for the boundary vertices, which are the vertices (i, j) such that i = 1, i = n, j = 1, or j = n. Let (x1, y1), (x2, y2), . . . , (xm, ym) be distinct vertices, called terminals, in the nX n grid. The escape problem is to determine whether there are m vertex-disjoint paths in the grid that connect the terminals to any m distinct boundary vertices. Write an efficient algorithm to solve the escape problem  Sample Input (Showing input nodes in the graph) Sample Output (Showing disjoint paths to the boundary vertices)
7	a) Suppose we need to distribute a message to all the nodes in a rooted tree. Initially, only the root node knows the message. In a single round, any node that knows the message can forward it to at most one of its children. Describe and analyse an efficient algorithm to compute the minimum number of rounds required for the message to be delivered to every node. b) Every year, Prof Gupta assigns the instructors at Thapar to various faculty committees. There are n faculty members and c committees. Each committee member has submitted a list of their prices for serving on each committee; each price could be positive, negative, zero, or even infinite. For example, Professor Jindal might declare that he would serve on the Student Recruiting Committee for 1000 Rs, that he would pay 10000 Rs to serve on the Drug abuse Committee and that he would not serve on the Discipline committee for any price. Conversely, Gupta knows how many instructors are needed for each committee, as well as a list of instructors who would be suitable members for each committee. If Gupta assigns an instructor to a committee, he must pay that instructor's price from the University treasury. Gupta needs to assign instructors to committees so that (1) each committee is full, (3) no instructor is assigned to more than three committees, (2) only suitable and willing instructors are assigned to each committee, and (4) the total cost of the assignment is as small as possible. Write an efficient algorithm that either solves Gupta's problem, or correctly reports that there is no valid assignment whose total cost is finite.