POSSESION OF MOBILES IN EXAM IS UFM PRACTICE.

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END TERM Examination, 2023

B. Tech. EVEN Semester

Course Name : Algorithms and Problem Solving
Course Code : 15B11CI411

Maximum Time : 2 Hr
Maximum Marks : 35

CO1	Analyse the complexity of different algorithms using asymptotic analysis.
CO2	Select appropriate sorting and searching technique for problem solving
CO3	Apply various algorithm design principles for solving a given problem
CO4	Identify, formulate and design an efficient solution to a given problem using appropriate data structure and algorithm design technique.

Q1. [CO1-Marks 3] For the following code write recursive relation and solve using Master Theorem. Let function ProcessAry(ary_start, ary_end) takes O(n) time.

```
DoSomething(ary)
{ary_start = DoSomething (ary[0:n/2]);
 ary_end = DoSomething (ary[n/2:n]);
 return ProcessAry(ary_start, ary_end);}
```

Q2. [CO2- Marks 4] With respect to sorting algorithms answer the followings -

(a) An array of 25 unique elements is to be sorted using the Quicksort. Assume that the pivot element is selected uniformly at random. What would be the probability that the pivot element will get placed in the worst possible location in the first round of partitioning (rounded off to 2 decimal places)?

(b) Consider the following array {89, 19, 50, 17, 12, 15, 2, 5, 7, 11, 6, 9, 100}. What would be the minimum number of swap operations needed to convert it into a max-heap?

(c) Suppose we want to arrange the n numbers stored in an array such that all negative values occur before all positive ones. What would be the minimum number of exchanges required in the worst case?

(d) An unordered list contains n distinct elements. What would be the number of comparisons to find an element in this list that is neither maximum nor minimum?

Q3.[CO3- Marks 4] Given 8 points in a 2D plane with their x and y coordinates, find the closest pair of following points using the closest pair algorithm. Mention each step of the algorithm clearly in the solution.
(2, 3), (12, 30), (40, 50), (5, 1), (12, 10), (3, 4), (20, 25), (30, 35)

Q4.[CO4-Marks 5] Assume you are in charge of a fleet of delivery trucks and have a list of orders that need to be delivered to various locations. Each order includes a delivery address, a weight, and a delivery time window. Each truck has a weight and volume limit, as well as a fixed starting location. Write an efficient algorithm to optimize the delivery route for each truck so that all orders are delivered within their respective time frames while minimizing the overall distance travelled by the trucks.

Q5.[CO3-Marks 6] With respect to string processing algorithms answer the followings-

(a) Compare the running time efficiency of KMP string matching algorithm with Rabin Karp algorithm in worst case.

(b) Perform the string matching process for the following text T for pattern P using Finite Automata Matcher Algorithm. You must process the T and P for all the occurrences of P available in T.

Text(T) = AABAABDABAABD
Pattern(P) = AABD

Q6.[CO4-Marks 7]Suppose you are working as a civil engineer and are tasked with finding the shortest paths between cities in a country with a complex road network. There are n cities and m roads connecting them. The distance between two cities can be calculated using the road network. However, some of the roads are one-way, which means you cannot travel in the opposite direction.

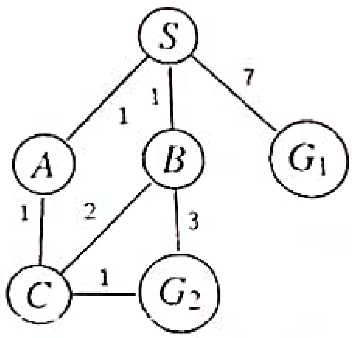
The road network can be represented as an n x n matrix W, where W[i][j] represents the distance from city i to city j. If there is no direct road between city i and city j, then W[i][j] is infinity. Identify the efficient algorithm to solve this problem and provide a step by step solution using identified algorithm for a given the following road network matrix:

W = [[0, 2, 3, inf, 7], [inf, 0, 5, 1, inf], [inf, inf, 0, inf, 4], [inf, inf, 6, 0, inf], [inf, inf, inf, 2, 0]]

where "inf" represents infinity.

Q7. [CO3-Marks 6] With respect to state space search algorithms answer the followings -

(a)Which goal is reached and what is the total cost and time complexity of the solution found for the following state-space graph when using Breadth-First Search and Depth-First Search Search (S is the start state, G1 and G2 are the goal states, arcs are bidirectional, no repeated state checking, break any ties alphabetically)?



(b) Define an evaluation function for a heuristic search problem as:

$f(n) = (w * g(n)) + ((1 - w) * h(n))$ where $g(n)$ is the cost of the best path found from the start state to state n, $h(n)$ is an admissible heuristic function that estimates the cost of a path from n to a goal state, and $0 \leq w \leq 1$.

What search algorithm do you get when: $w = 0$, $w = 0.5$ and $w = 1$
