

Assignment No. 1

Course Code: ECAP538

Registration Number: 322201297

Instructions:

- Attempt all questions given below in your own handwriting. Assignment in typed format will not be considered for evaluation.
- The student has to complete the assignment in the allocated pages only. Any other page in case utilized shall not be considered.

Q1. Solve single source shortest paths.

[10 Marks] [CO2, L3]

The single-source shortest path (SSSP) problem consists of finding the shortest paths between a given vertex v and all other vertices in the graph. Algorithm such as Dijkstra solve this problem. This problem

Dijkstra's Algorithm

Dijkstra's algorithm is a greedy algorithm for the SSSP problem.

- ~~1. Mark all nodes unvisited. Create a set if to zero for our initial node and to infinity for all other nodes. Set the initial node as current~~
- ~~2. Mark all nodes unvisited. Create a set of all the unvisited nodes called the unvisited set.~~
2. Assign to every node a tentative distance value: Set it to zero for our initial node and to infinity for other nodes. Set the initial node as current.
3. For the current node, consider all of its unvis neighbors and calculate their tentative distance through the current node. Compare the newly calculated tentative distance to the current assigned value and assign the smaller one. For example, if the current node A is marked with a distance of 6, and the edge connecting it with a neighbor B has length 2, then the distance to B through A will be $6+2=8$. If B was previously marked with a distance greater than 8 then change it to 8. Otherwise, the current value will be kept.
4. When we are done considering all of the unvisited neighbors of the current node, mark the current node as visited and remove it from the unvisited set. A visited node will never be checked again.
5. If the destination node has been marked visited or if the smallest tentative distance among the nodes in the unvisited set is infinity then stop.
6. Otherwise, select the unvisited node that is marked with the smallest tentative distance set it as the new "Current node", and go back to step 3.

Signature of the Student

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Note:-

CO: is the Course Outcome as per your course syllabus.

L1-L6: Learning level objectives as per Revised Bloom Taxonomy (RBT).

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Q2. Differentiate between divide and conquer and greedy method.

[10 Marks] [CO1, L2]

Divide and Conquer	Greedy Algorithm
<ul style="list-style-type: none"> It is used to obtain a solution to the given problem, it does not aim for the optimal solution. In this technique, the problem is divided into small subproblems and solved independently. Finally all the solutions to subproblems are collected together to get the solution to the given problem. Divide and conquer is less efficient and slower because it is recursive in nature. Divide and conquer may generate duplicate solutions. Divide and conquer algorithms mostly run in polynomial time. Examples: Merge sort, Quick sort, Strassen's matrix multiplication. 	<ul style="list-style-type: none"> It is used to obtain an optimal solution to the given problem. In greedy method, a set of feasible solutions are generated and pick up one feasible solution is the optimal solution. A greedy method is comparatively efficient and faster as it is iterative in nature. Optimal solution is generated without sorting previously generated solutions, thus it avoids the recomputation. It also runs in polynomial time but takes less time than divide and conquer. Examples: Fractional knapsack problem, Activity selection problem, Job sequencing problem.

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