

CSE 312 Midterm 2

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I. QUESTION (DIVIDE AND CONQUER) (15 POINTS)

Find the square root of a number N using divide and conquer technique which run in $\mathcal{O}(\log N)$ time.

II. QUESTION (DIVIDE AND CONQUER) (20 POINTS)

For the one dimensional version of closest-pair problem, for the problem of finding two closest numbers among a given set of N integers, design an algorithm based on divide and conquer technique which run in $\mathcal{O}(N \log N)$ time.

III. QUESTION (DIVIDE AND CONQUER) (15 POINTS)

Design an algorithm to rearrange elements of a given array of N integers so that all its negative elements precede all its positive elements. Your algorithm should run in $\mathcal{O}(N)$ time and must not use any external storage more than $\mathcal{O}(1)$.

IV. QUESTION (GRAPH ALGORITHMS) (20 POINTS)

A node in a graph is said to be an *island* if there are no incoming edges to it and no outgoing edges from it. Given the adjacency list representation of unweighted graph G , write a function that calculates the number of islands in that graph.

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int islands()
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V. QUESTION (GRAPH ALGORITHMS) (15 POINTS)

Modify breadth first search algorithm such that it will calculate the shortest path from the source node to all nodes in an unweighted graph.

VI. QUESTION (GRAPH ALGORITHMS) (15 POINTS)

Modify depth first search algorithm such that it will determine if the undirected graph can be colored with just two colors so that no two adjacent vertices are in the same color.