

CSE 312 Midterm

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I. QUESTION

- a) Is $4^{1536} - 9^{4824}$ divisible by 35?
- b) If p is prime, how many elements of $\{0, 1, \dots, p^n - 1\}$ have an inverse modulo p^n ?

II. QUESTION

- a) Write a pseudocode for a divide-and-conquer algorithm for finding a position of the largest element in an array of n numbers.
- b) Set up and solve a recurrence relation for the number of key comparisons made by your algorithm.

III. QUESTION

How can one use binary search for range searching, i.e., for finding all the elements in a sorted array whose values fall between two given values L and U (inclusively)?

IV. QUESTION

Write a function that, for a given graph G , outputs vertices of each connected component.

V. QUESTION

In the topological sorting, one needs a starting vertex (source) to initiate sorting.

- a) How would you find a source (or determine that such a vertex does not exist) in a directed graph represented by its adjacency matrix? What is the time complexity of this algorithm?
- b) How would you find a source (or determine that such a vertex does not exist) in a directed graph represented by its adjacency list? What is the time complexity of this algorithm?