COP5536 Advanced Data Structures

Exam 3

Closed Book

Duration: 60 mins

Prof. Sartaj Sahni

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. For all problems, use only the algorithms discussed in class/text.
2. Write your answers directly on the exam question sheet. You may use scrap paper (supplied by your proctor) for work, but these will not be graded.
3. All answers will be graded on correctness, efficiency, clarity, elegance and other normal criteria that determine quality.
4. You may use only a pen or a pencil. No calculators allowed.

Last name:_____

First name:_____

UFID:_____

Problem 1 [12]

(a) Describe how a priority search tree can be used to determine all intervals $[i, j]$ that contain the interval $[u, v]$. Your explanation must clearly state how intervals are mapped to points and the priority search tree operation to be used along with its parameters and complexity.

(b) Describe, using pseudocode, how to perform the operation $minXinRectangle(x_L, x_R, y_T)$ in a radix priority search tree.

Continue work if necessary

Problem 2 [10] Describe the k-d tree data structure. Your description must include a statement of the type of data stored, whether static or dynamic, the type of search supported and how this is done as well as a derivation of the storage requirements and the time required to construct the tree for n objects.

Continue work if necessary

Problem 3 [10] Given n intervals of the form (l_i, r_i), $l_i \leq r_i$, how would you construct an interval tree so as to report all intervals that intersect/overlap a given interval (l_i, r_i)? What is the time needed to construct the interval tree and that needed to report the intersecting/overlapping intervals?

Continue work if necessary

Problem 4 [12]

(1) Briefly describe how to insert a node into an R-tree.

(2) Describe the Quadratic Method to split a node in an R-tree. Prove that the complexity of this method is $O(M^2)$, where M is the order of the R-tree.

Continue work if necessary

Problem 5 [6] Give an application (and describe how the structure is used to satisfy the application needs in 2-3 sentences each) for: (a) Suffix Tree (b) Quad Tree.

Continue work if necessary