

CS 212 – DESIGN AND ANALYSIS OF ALGORITHMS

HW 2

George Washington University

Preemptive Clarification

2

- Pseudocode questions should be answered in terms of pseudocode only, i.e., not code but logical steps
- For coding assignment, please follow instructions at the bottom. We can review the code as well.

DILBERT By SCOTT ADAMS



Question 1

3

- Write pseudo code for following operations, considering that heap is an almost complete binary tree implementation using an array
 - ▣ Insert(x)
 - ▣ Extract_min(): This operation finds the minimum, and then removes it.

You can assume that the heap is a min-heap (so smaller numbers are on the top, and smallest number is the root)

Question 2

4

- Write pseudo code for following operations, considering that the binary search tree is an almost complete binary tree implementation using an array
 - ▣ Insert(x)
 - ▣ Delete(x)
 - ▣ Search(x)

- You can assume that binary search tree is a minimum order tree, so from a node, left child is smaller (or equal to) the node value, and right child is greater (or equal to) the node value.

Question 3 – Programming warm-up

5

- Write a program “P1” that reads n 2-dimensional points (x,y) , and outputs the following information:
 - ▣ The northmost, the southmost, the east most and the west most points
 - ▣ The “average” point, which is (x_avg, y_avg)
 - ▣ The pair of closest points. This can be found by simply comparing all pairwise points, in 2 nested loops.
 - ▣ The total time taken for generating this output. This can be noted by noting the system time at the beginning and at the end.
- Write a program “P2” that can generate random input to your program P1, where each x and y coordinates are generated from say -100 to $+100$. Use the program P2 to generate inputs of increasing sizes, say 100 points, 1000 points etc so that you can generate a “time by input size” graph, which shows number of points on the x -axis and the time taken on the y -axis.
- Submit the source code of programs P1 and P2, the output (not the input!) and the time by input size graph.