

Homework 6: Written Component

Due Monday, July 21, at 9 AM (GMT-7)

CSc 345 – Summer 2014

Instructor: Qiyam Tung

Instructions

1. This is an individual assignment. You must do your own work.
2. If you are having difficulty and need to ask a question you can:
 - (a) Ask questions in class.
 - (b) Stop by my office hours (or make an appointment).
 - (c) Post a question on Piazza.
 - (d) Post a private question on Piazza if the question is too specific.
3. Show all work. Incomplete solutions will **not** receive full credit
4. You may write your solutions by hand, or you may type them using any appropriate program such as Microsoft Word, OpenOffice Writer, L^AT_EX, etc. . . .
However, the final copy should be in PDF form and formatted so that it is legible.
5. If the listed problem is only a number, refer to the online book for the description of the problem (starting at page 46).

1 Problems (99 points possible (54 written, 45 from program))

1. (20 points) Heaps

- (a) (5) Construct a **max**-heap from the sequence of data values 21, 14, 35, 43, 9, 2, 8, 12, 28, 24. Show the resulting heap, as well as your intermediate heaps after each of the values 43 and 12 have been inserted.
- (b) (10) Sort the following values using Heap Sort. Show the heap representation and the state of the array when the heap is created from the list, and after each value is removed.

10, 7, 8, 4, 9, 12

- (c) (5) In heap sort, we first build a max heap using `bubble-down()`. Another way to do this is to do n separate insertions, each cost $\log_2 i$ for i -th insertion. Thus, the total cost is $\sum_{i=1}^n \log_2 i$. Prove that this sum is $\Omega(n \log_2 n)$.

2. (25 points) AVL and Splay Trees

- (a) (10) Build an AVL tree by inserting the following keys, in the order given, into the tree, and show the resulting tree:

11, 20, 25, 22, 23, 21, 10

- (b) (5) Delete value 20 from AVL tree from question 2a, then show the resulting tree.
- (c) (10) Assume that your final tree from question 2a is a splay tree. Search for 21, and show the resulting tree after splaying. Then, search for 24 in that resulting tree, and again show the resulting tree after splaying.

3. (9) Given the following 2-3 tree

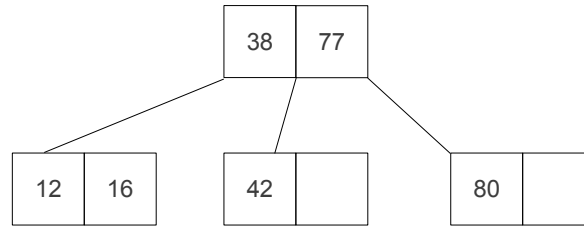


Figure 1: 2-3 Tree

- (a) (3) Using the original tree, show the final tree resulting from adding 66 and then 55.
 - (b) (3) Using the original tree, show the final tree after deleting 38.
 - (c) (3) Using the original tree, show the final tree after deleting 77.
4. (6) Find the optimal BST for the given info. Draw the optimal BST, and give the AST. You must **show all your work** to receive full credit.

$$K = \langle 6, 15, 40 \rangle, P = \langle .25, .25, .1 \rangle, Q = \langle .15, .05, .08, .12 \rangle$$

5. (45) Splay Tree program (see on separate handout).