COS 226 Fall 2012 Quiz 2 30 pts.; 30 minutes; 4 questions; 6 pages. 2012-10-30 2:00 p.m.
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Name: __________________________

1. (1 pt.)
   • Read all material carefully.
   • You may refer to your books, papers, and notes during this test.
   • No computer or network access of any kind is allowed (or needed).
   • Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
   • Use the conventions used in class and the textbook for notation, algorithmic options, etc.

Write your name in the space provided above.

2. (12 pts.) Depict the action of in-place heapsort on the following array. Depict both the state of the array (in linear form) and the max-heap it encodes (in tree form), using a format similar to Figures 21.25–21.27 (pp. 824–825) in the textbook1:

   • after each percDown operation in the first (buildHeap) phase and
   • after each deleteMax operation in the second phase.

array a[i]: 84 27 13 90 46 99 51 31 73 26
indices i: 0 1 2 3 4 5 6 7 8 9

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[additional space for answering the earlier question]
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3. (10 pts.) Depict the transformations to the following *top-down splay tree* in response to the access pattern 1, 2, 3, 4, 5, 6, 7, 8. For each access:

- Adorn the node being accessed with an asterisk *. 
- Clearly label each splay operation noting its type, and depict the tree before and after the operation.

![Diagram of a top-down splay tree with nodes labeled 1, 2, 3, 4, 5, 6, 7, 8. Nodes 4, 5, and 8 are marked with an asterisk.](image-url)
[additional space for answering the earlier question]
4. (7 pts.)

(a) Depict all AA-trees containing the four keys: 1, 2, 3, 4.
(b) Repeat the above for AA-trees with five keys: 1, 2, 3, 4, 5.
(c) Briefly explain why the trees you depict are the only possibilities.