

CS 14 - Summer 2003 - Quiz 3

July 22, 2003

1 True/False

Circle *T* or *F* as appropriate. Running-time questions are all in terms of input size n

1. **T F** Insertion into a 2-3 Tree has a running time of $O(n)$ - 2-3 Trees have the same running time as BSTs or better.
2. **T F** Insertion into a heap has running time of $O(n)$ - Heap insertion takes $O(\lg n)$
3. **T F** Heapsort has running time of $O(n \lg n)$ - Insert n objects in $O(n \lg n)$ total time, remove them in the same.
4. **T F** Heaps are most efficiently represented as pointer-based trees. - Arrays work much better for heaps since the heap has to be as complete as possible and fills in left-to-right.
5. **T F** A 2-3 Tree has worse Big-O running time than a regular binary search tree. - 2-3 Trees have slight overhead, but equivalent or better Big-O.
6. **T F** A 2-3 Tree is a type of binary search tree - 2-3 Trees are not binary
7. **T F** A Red-Black Tree is a type of binary search tree - True, with funny rules for insertion, but basically the same structure.
8. **T F** The contents of a heap can be printed in sorted order in $O(n)$ time. - If this were true, Heapsort would be $O(n)$ as well.

2 Short Answer

If you want the option to request a regrade available, your answers to these questions must be made in pen.

1. Describe in English a simple strategy for removing an element from a max-heap.
Swap with the last element in the heap, recursively swap that element with the max of its children until it is in a position where both children are smaller.

2. What is the running time for a method that returns the *size* of a heap and why?
 $O(1)$ because we need to know where to insert the next value anyway, and heaps are implemented in an array. The index of that spot is the size.
3. Draw a heap containing the values 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
See file http://www.cs.ucr.edu/~cs14-p/cs14_03sum/quiz3heap.png
4. Draw the 2-3 Tree resulting from taking the empty tree and inserting the values 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
See file http://www.cs.ucr.edu/~cs14-p/cs14_03sum/quiz3tree.png