

Review of lectures 27 to 29, 33 to 35, 38 to 40

Like the midterm exams, the final exam is open book, but calculators or laptop computers are not allowed. Good examples of questions are quizzes and homework assigned at the end of each lecture. Also review the answers to the midterm exams.

This sheet contains some preliminary examples of questions about the rest of the second part of the course, on the material tested by the second midterm exam, chapters 9 and 11 in the textbook; and the last three lectures on solving recurrences.

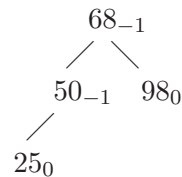
1. Give C++ code to read in the name of a text file and to build a frequency table of all vowels (letters a, e, i, o, and u) that occur in the file.
2. Consider a hash table of size 5. Suppose we want to place the keys 21, 22, and 1 in this table using open addressing.

Draw the evolution of the state of the hash table as we insert 21, 22, and 1.

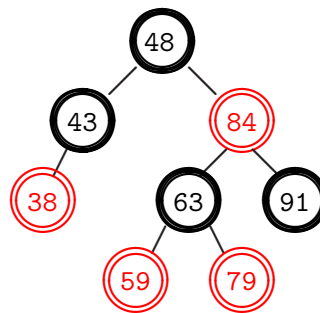
3. Consider a hash table of size 5. Suppose we want to place the keys 21, 22, and 1 in this table using chaining (also called bucket hashing).

Draw the evolution of the state of the hash table as we insert 21, 22, and 1.

4. Insert 15 into the AVL tree drawn below:

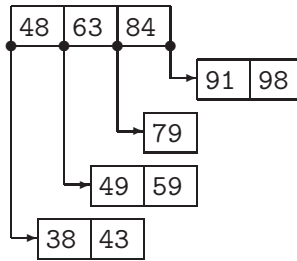


5. Consider the following red-black tree (red nodes have hollow rings):



- (a) Insert 49 in the tree. Draw all intermediate stages.
- (b) Draw the 2-3-4 tree equivalent to the red-black tree above.

6. Insert the numbers 50, 51, 52, 53, 54, and 55 in the 2-3-4 tree drawn below:



7. Show that the cost of merge sort on a sequence of n elements is $O(n \log_2(n))$.
8. Apply the substitution method to show that the solution of $T(n) = T(n-1) + n$ is $O(n^2)$.
9. Consider $T(n) = 3T(n/2) + n$. Use a recursion tree to derive a guess for an asymptotic upper bound for $T(n)$ and verify the guess with the substitution method.
10. Use the master method to solve the recurrence for binary search $T(n) = T(n/2) + O(1)$.

The final exam will happen on Tuesday 7 December, from 8AM till 10AM, in TH 216.

In case of a scheduling conflict with another final exam, please let me know as soon as possible so we can schedule a make up.

Observe the university rules concerning incompletes. An incomplete can only be granted if all of the following conditions are satisfied:

1. The student is in good standing and needs only a final exam to complete the course. In particular, this means that no midterms are skipped, attendance to the discussion sessions was documented by quiz scores, and all projects received a satisfactory grade.
2. Some event (for which adequate documentation can be provided) prevented the student from making a makeup final exam.

Note that these rules are from the university, the administration needs to approve incompletes.