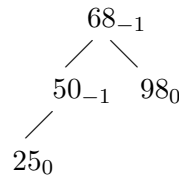


Review of lectures 27 to 29, 33 to 35, 38 to 40

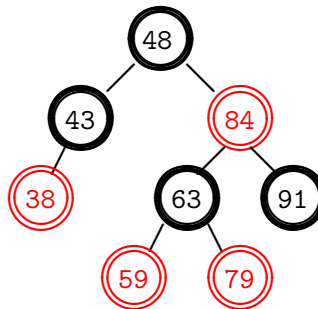
The exam is closed book, calculators or laptop computers are not allowed. Good examples of questions are quizzes and homework assigned at the end of each lecture. Also review the answers to the midterm exams.

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 12 in the textbook.

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.
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:

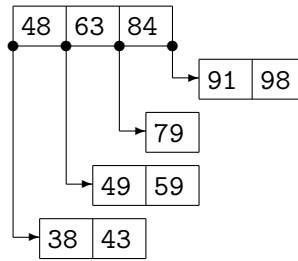


5. Consider the following red-black tree (red nodes have hollow rings):



- (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. Consider the matrix

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

- Draw a graph which has A as adjacency matrix.
- Draw the breadth-first search tree for the graph, starting at vertex 0.
- Draw the depth-first search tree for the graph, starting at vertex 0.

8. Consider the matrix

$$A = \begin{bmatrix} 0.0 & 7.3 & 6.4 & 0.0 & 0.0 & 0.3 \\ 0.0 & 0.0 & 1.4 & 4.5 & 0.0 & 7.4 \\ 0.0 & 0.0 & 1.4 & 3.9 & 2.4 & 0.0 \\ 8.3 & 0.0 & 3.9 & 2.5 & 9.0 & 0.0 \\ 0.0 & 0.0 & 8.9 & 1.4 & 1.4 & 0.0 \\ 0.0 & 2.4 & 2.0 & 0.0 & 0.0 & 1.2 \end{bmatrix}.$$

For the weighted graph defined by the adjacency matrix A , compute all shortest paths starting from the first vertex. Show all steps in the execution of the algorithm.

9. Consider the matrix

$$A = \begin{bmatrix} 8.7 & 1.2 & 0.0 & 0.0 & 7.6 & 2.5 \\ 1.2 & 0.0 & 0.0 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & 5.7 & 3.2 \\ 0.0 & 0.0 & 0.0 & 0.0 & 5.2 & 0.0 \\ 7.6 & 0.0 & 5.7 & 5.2 & 0.0 & 9.6 \\ 2.5 & 0.0 & 3.2 & 0.0 & 9.6 & 3.0 \end{bmatrix}.$$

For the weighted graph defined by the adjacency matrix A , compute the minimum spanning tree, starting from the first vertex. Show all steps in the execution of the algorithm.

The final exam happens on Monday 11 December, from 8AM till 10AM, in 337 BSB.

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.