

Datastructuren

September 28, 2009

1 Assignments

1. Write functions to
 - a count the number of nodes in a binary tree
 - b count the number of leaves
 - c count the number of right children
 - d find the height of the tree
 - e delete all leaves from a binary tree
2. Recall that *simple graph* G is a pair V_G, E_G , where V_G is a non-empty finite set of elements called *vertices* (or *nodes*, or *points*, Dutch: *knopen*), and E_G is a finite set of *unordered* pairs of *distinct* elements of V_G called *edges* (or *lines*, Dutch: *takken*). Note that (since E_G is a set) there can never be more than one edge joining a pair of vertices. So multiple edges between a pair of vertices are not present. In addition since an edge is built out of distinct vertices, *loops* (that is edges joining a vertex with itself) do not occur either.

If G is a simple, connected graph with n vertices, then the number of edges m satisfies $n - 1 \leq m$. Show that this statement is a true statement.
3. Let T be a graph with n vertices then the following are equivalent:
 - a T is a tree (that is, T has no cycles and is connected)
 - b T contains no cycles, and has $n-1$ edges
 - c T is connected, and has $n-1$ edges
 - d T is connected, and every edge is a bridge
 - e Any two vertices are connected by exactly one path
 - f T contains no cycles, but the addition of any new edge creates exactly one circuit. Recall a circuit is a cycle with no repeated edges).

Show that the equivalence holds. You may use the statement in Assignment 2 and the following proposition: If two distinct circuits in a graph G contain an edge e , then G has a circuit which does not contain e .

4. a Describe carefully the two ways of deleting a node from a binary search tree. One is deletion by merging and the other one is deletion by copying.

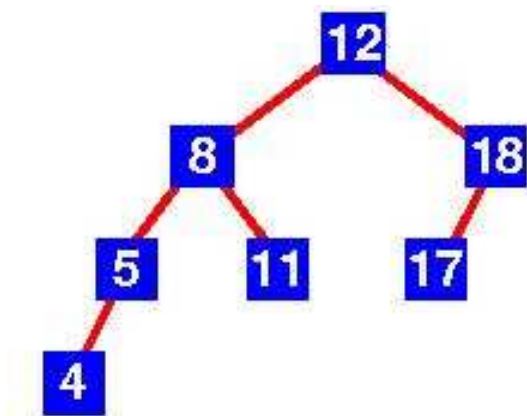


Figure 1: A Binary Search Tree

- b Consider the binary search tree in Fig. 4. For this example, show how the tree would look like after deleting, the root (the node with key 12) for each of the two methods you described in the previous question.