



Figure 1: Illustration of a binary tree where the nodes have a reference back to their parent nodes.

**CS311, Spring 2009, Ali Erkan**  
**Problem Set**  
**Due Date/Time: Feb 16, 2009 (Monday), 2:00PM**

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- **Use neat handwriting.** If I cannot read what you write, then I have to assume that your answer is incorrect. You will win a special place in my heart if you submit typed solutions. If you want to try this out, consider Mathematica or LaTeX (with some help from Ali).
  - **Our lateness policy is simple:** 1% off for the first hour and 100% off thereafter.
  - **As of the beginning of the semester, you have three late days.** If you choose to use a late day, then your effective deadline is the due time of the following day. Two or three days of lateness cannot be used at once.
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Please submit your solutions to the following questions from the book:

- 4.1.d, 4.1.e.
- 4.8.
- 4.9.
- 4.18.
- 4.22.
- 4.27.
- 4.28.
- Assume that each node of a tree has a reference to its parent (of course, this reference is 'null' for the root); an example is shown in figure 1. Now, suppose that someone gives you a reference to any one of these nodes and asks "if you were traversing this tree according to the preorder traversal logic, what would be the next node you process?". For example, if we were given a reference to the node 'E' in figure 1, the next node to visit according to the preorder logic would be 'B'. But, if the reference was to node 'F', then the next node would be 'R'. As you answer this question, keep in mind that if your solution does not have a loop, then you don't have the right answer.
- Suppose we **insert()** a node to an AVL tree. As we go up the path to the root, we may encounter an imbalance at which point we stop and rotate things. Once we are done with the rotations, do we need to continue on our way to the root? Or are we done? If the former, then you need to provide a justification. If the latter, then you need to come up with an example where fixing an imbalance at one point is not enough and we actually have to further up, looking for other imbalances to fix.