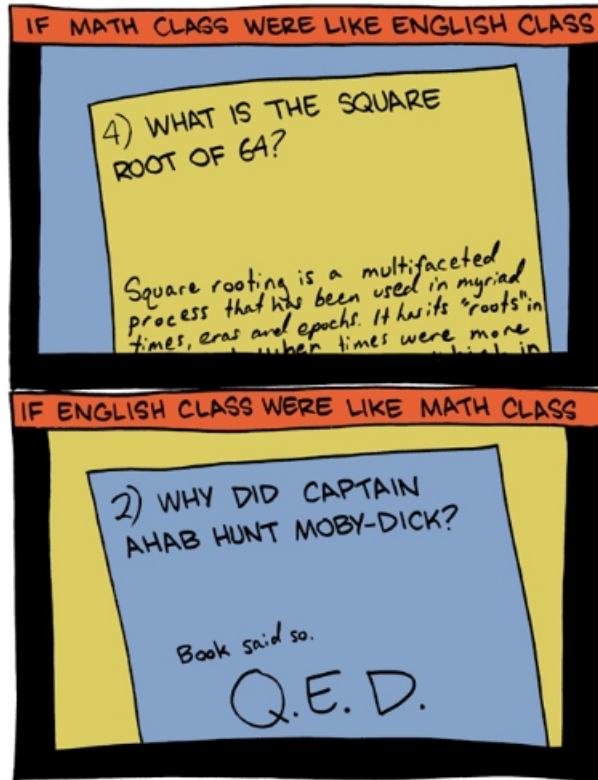


# CS302 - Assignment 9

Due: Thursday, Mar. 14 at the beginning of class  
Hand-in method: paper



<http://www.smbc-comics.com/index.php?db=comics&id=1872>

1. [1 point] What is one thing that you'd like to see reviewed in the class next Tuesday ("nothing" is an acceptable answer)?
2. [12 points] In a binary search tree, we might also keep track of the total number of nodes in that subtree (including the node itself).
  - (a) [5 points] Assuming we store this value (e.g.  $x.size$ ) write pseudocode for a function  $BSTKEYLESTHAN(T, k)$  that takes a tree  $T$  and a number  $k$  and returns the number of values in the tree  $T$  that are less than  $k$ . For example, if the tree had the number 1 through 9 in it, then  $BSTKEYLESTHAN(T, 5)$  should return 4.
  - (b) [2 points] What is the best-case and worst-case running time of your algorithm?

- (c) **[5 points]** Describe an algorithm  $\text{MEDIAN}(T)$  that finds the median element in a binary search tree. You don't have to write pseudocode, but if you don't, make sure that you state your algorithm precisely. *Hint:* you likely will need some sort of helper function. State your run-time with respect to the height of the tree.
3. **[5 points]** Is the operation of deletion “commutative” in that deleting  $x$  and then  $y$  from a binary search tree always leaves the same tree as deleting  $y$  and then  $x$ ? Argue why it is or give a counterexample. *Hint:* There are three different cases for deleting in a binary tree. Make sure you think about all of them.