Notes for Solving Question #3:

Probably the first thing to do is to list the words in alpha order:

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apple
banana
blueberry
mango
mulberry
papaya
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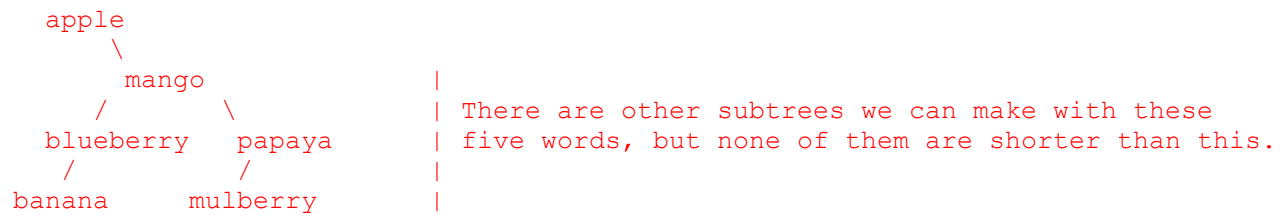
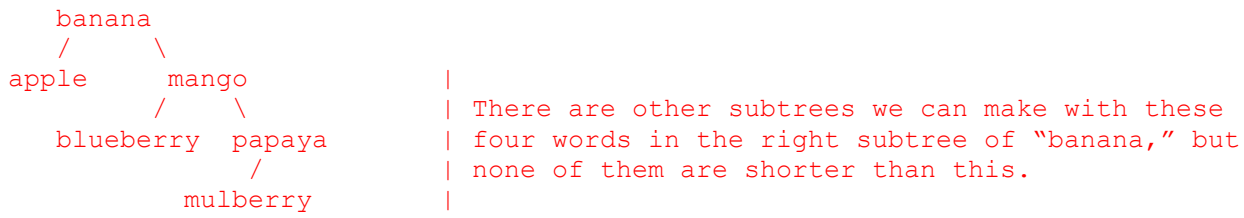
If we try to construct an AVL tree with "apple" at the root, all other words go into its right subtree. The smallest height that right subtree can have is 2, meaning we have an unbalanced root. For example:



Therefore, "apple" cannot be at the root of the AVL tree no matter what order we use to insert these words. Rotations would displace "apple" from the root. A symmetric argument can be used to show that "papaya" cannot ever be the root, since every other word would have to go into the left subtree of "papaya."

Similarly, if we try to place "banana" at the root, its left subtree must contain "apple," and its right subtree must contain all other words. There would be 4 words in its right subtree, with a minimum height of 2. For example:



That means we necessarily have a bad balance factor at "banana" if it's the root, and so it cannot serve as the root of an AVL tree with these words. A symmetric argument can be used to demonstrate that "mulberry" cannot be at the root, since "papaya" would go to the right of "mulberry" and all remaining words would go in its left subtree.

That leaves just "mango" and "blueberry" for us to consider. Either of them can serve as the root. E.g.: