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Homework 4

2. The call to Set<Coord>::insert causes an error because the Coord class doesn’t have its comparison operators defined, so when the insert function tries to use those operators, the program crashes.

3b. If we only had a one-parameter listAll function, you could not create a recursive function that would correctly list the file paths because the function would have no way of adding to the previously written path.

4a. The time complexity for this algorithm is O(N3). There are 3 nested for loops, and each loop contains N operations, so each loop is O(N). Therefore, the overall loop has a total time of O(N3).

4b. The time complexity of this altered algorithm is also O(N3). When measuring big-O, we measure the worst case scenario, and the worst case scenario is the case where i = N. In this case, the loop is the same as the loop in 4a., so the time complexity is also the same.

5a. The worst case time complexity for this function is O(N2). In the worst case, the for loop at the end of the function runs 2N times. The get() function for Set has a runtime of O(N), and the insert() function has a runtime of O(N). This means that the total time for the loop is O(2N\*2N), which is O(N2) when simplified.

5b. The time complexity for this modified function is O(N logN). Copying all the items from the two sets to vector V takes O(2N) time. Then, sorting this vector uses an O(N logN) algorithm. Then, deleting all the result nodes takes O(N) time. Finally, copying the items unique items from V into the result takes O(2N) time. This gives a total time of O(5N+N logN), which can be simplified to O(N logN).

5c. The time complexity is O(N). In the worst case, the while loop runs N times, and each time it runs, 1 operation occurs (insertBefore function), giving the loop O(N). Then, the for loop at the end runs at most N times. Therefore the complexity, O(2N), is simplified down to O(N).