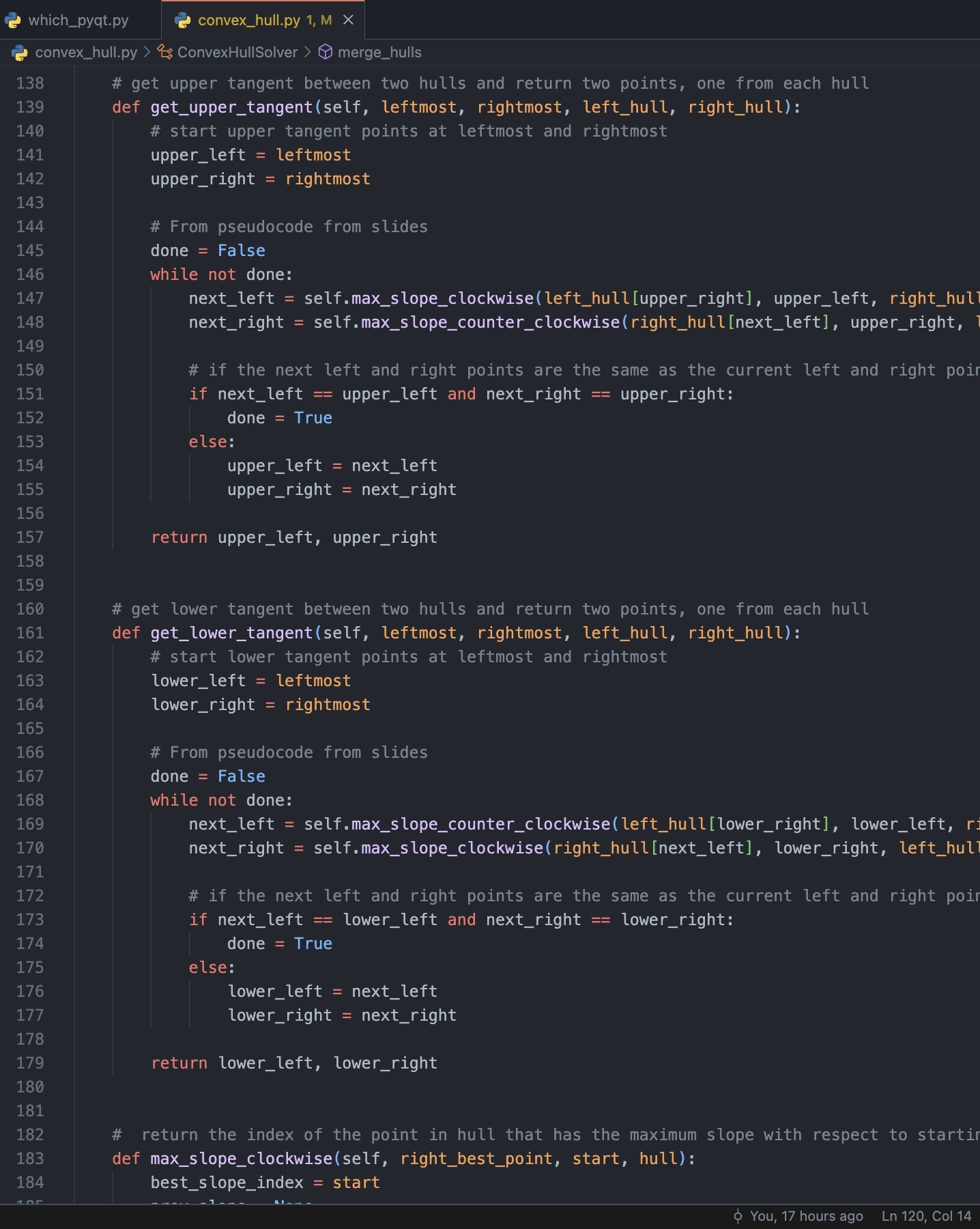
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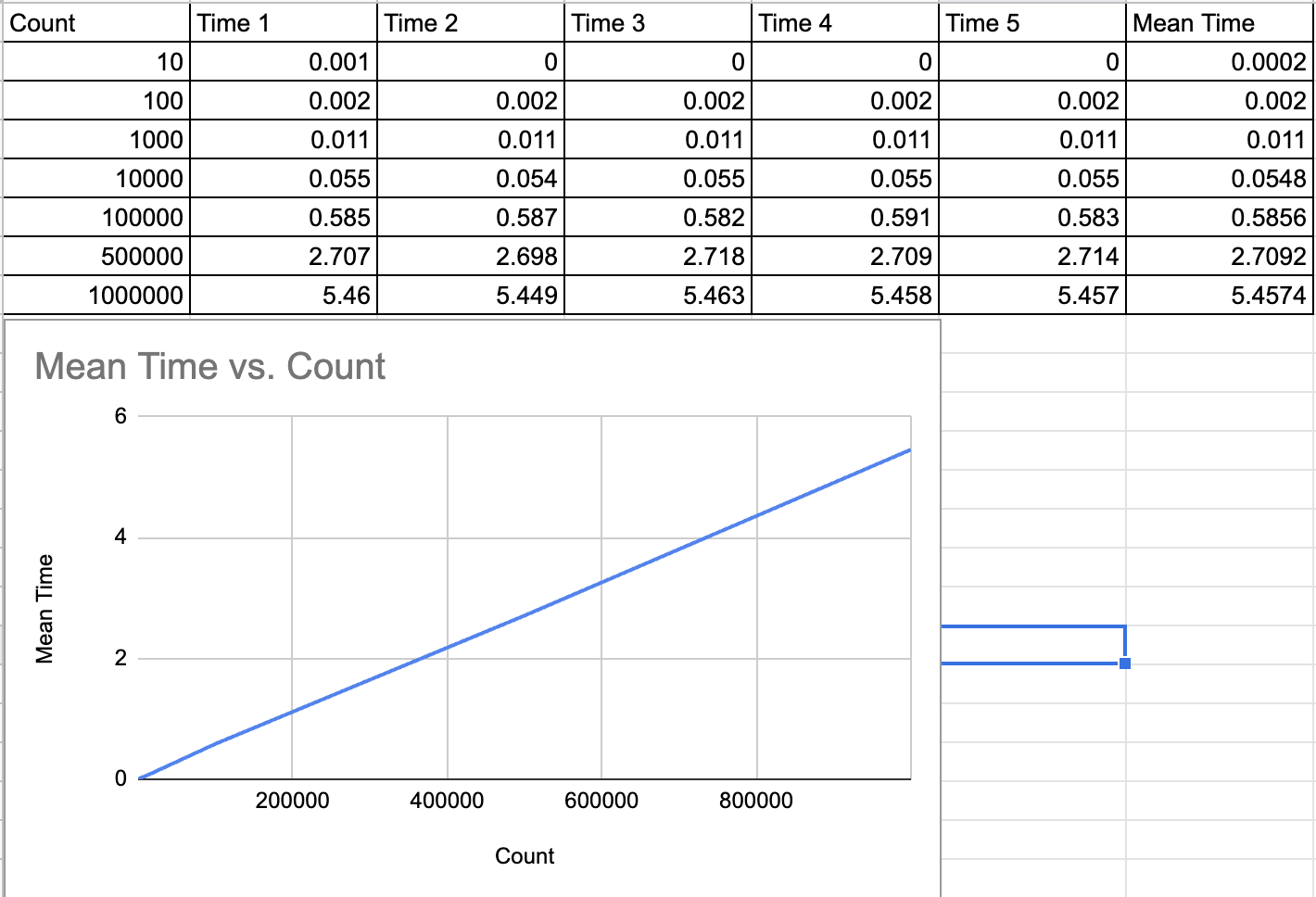
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2. My solution for convex hull can be broken into the following pieces:

* convex\_hull\_helper: recursive function call to compute hull
  + Constant time, runs log(n) times
    - Calls merge\_hulls
  + O(Log(n)) time complexity
* merge\_hulls
  + Calls get\_upper\_tangent & get\_lower\_tangent
  + Worst case, iterates over n points in left & right hulls to add to convex hull
  + O(n) time complexity
* get\_upper\_tangent and get\_lower\_tangent
  + iterates over points in left and right hull and finds upper/lower tangent respectively
  + calls max\_slope
    - gets max/best slope from given starting point for the tangent line
  + Worst case, iterates over N points in left or right hull and calls max\_slope each iteration
  + Runs O(n) times and calls max\_slope which at worst case has a time complexity of O(n)
  + Thus, get\_upper\_tangent and get\_lower\_tangent run in O(n^2) worst case (very very rare).
* Max\_slope (clockwise and counter clockwise)
  + Iterates over points in given hull and finds best slope (highest or lowest) for respective tangent using a given point
  + Absolute worst case, runs in O(N) time complexity if it iterated over every single point in the hull.

Overall, using the D&C algorithm, we get O(nlog(n)), however, using the smaller numbers we are using (7 digits and less), we can expect nearly linear times.

3.



I did not use a logarithmic graph, but if I did then it would make the linear relationship look like a logarithmic relationship. However, the best relationship is linear. This can be seen by inspection, and also calculated the ratio from 500,000 -> 100,000 = 2.7s -> 5.4s (both growth 2x).

4. As mentioned above, there are some discrepancies from the theoretical and empirical analysis. Theoretically, it should be O(nlog(n)), however, in practice, with numbers 7 digits and less, it is essentially linear.

5. (Green dots cause it’s a lot easier to see than blue LOL)