CS504 PhD qualifying exam

1. What is the average number of Voronoi vertices in the Voronoi diagram of n points in the plane? Justify your answer.
2. The Delaunay triangulation of a set of points in the plane optimizes some geometric, measurable attribute over all possible triangulations of the point set. What is the thing that the Delaunay triangulation optimizes? Formulate your answer precisely.
3. What is the worst-case running time of the algorithm for performing a 3-dimensional range query on a kd-tree storing n points in 3D? Justify your answer.
4. (a) Show that the set of edges of a Delaunay triangulation of a set P of points in the plane contains the Euclidean minimum spanning tree (EMST) of P.

(b) Use this result to give an efficient algorithm to compute an EMST of P. Analyze the running time of your algorithm.