CSc 437
Homework 4 (100 pts.)
Due: 11/7/11

Instructions. All assignments are to be completed on separate paper. Use only one side of the paper. Assignments will be due at the beginning of class, or via email. To receive full credit, you must show all of your work.

All questions are taken from the textbook (second edition)

1. 6.8

2. **10 points bonus** 6.9. In particular 1) prove what is the complexity of the planar map (as a function of n and A). 2) Explain which modifications are needed (both algorithmic and data structures) to the algortihm studied in class so it can handle intersecting segments, 3) Argue that the expected path length in the graph is $O(\log n)$, and 4) What is the total time needed to insert all segments.

3. 6.10

4. 6.16

5. Let p be a point in the plane, and let $s_i = NN_S(p)$. Prove directly, without using bisections, that any point x on the segment s_ip satisfies $s_i = NN_S(x)$. Prove this fact to bound the number of cells in $VD(S)$. Use this fact to bound the complexity of $VD(S)$.

6. Let $S = \{s_1 \ldots s_n\}$, be a set of sites, and let $\{w_1 \ldots w_n\}$ be a set of real numbers. We define the distance of a point x from $d_i(x, s_i)$, the *weighted distance* from from x to s_i to be $d_i(x) = w_i + ||x - s_i||$ where $||x - s_i||$ is the Euclidian distance between x and s_i. Repeat the previous question in this case. Which family of curves represent the bisectors between sites ? What is the answer to this question if all $w_i = 1$ for every i.

7. Prove that a point $s_i \in S$ is a vertex of $CH(S)$ iff the cell of s_i in $VD(S)$ is unbounded.

8. Prove that if not all the sites of S lie on a line, then the edges of $VD(S)$ form a connected graph

9. Assume $VD(S)$ is given to you, and let s' be a site note in S. Suggest an $O(n)$ time algorithm for commuting $VD(S \cup s')$.

10. Given S as above, suggest an $O(n \log n)$ algorithm to determine if you can continuously translate a unit disk from a starting position when it centers is on site s_i to a position where its center is a different site s_j, so that at any intermediate stage the disk is disjoint to all sites of S.

11. 7.3
12. 7.11
13. 9.2
14. 9.13