Northwestern University
Electrical Engineering and Computer Science
EECS357 Introduction to VLSI CAD
Prof. Hai Zhou

Feb 20, 2014
Handout #7
Due: Feb 27

Homework 4

You may discuss the assignments with your classmates but need to write down your solutions independently. Be careful with your handwriting. Unclear solutions will be assumed to be wrong.

1. (20 points) Exercise 4.3 on page 221.
2. (20 points) Exercise 4.7 on page 223.
3. (20 points) Exercise 4.9 on page 223.
4. (20 points) Professor Toole proposes a new divide-and-conquer algorithm for computing minimum spanning trees, which goes as follows. Given a graph $G = (V, E)$, partition the set V of vertices into two sets V_1 and V_2 such that $|V_1|$ and $|V_2|$ differ by at most 1. Let E_1 be the set of edges that are incident only on vertices in V_1, and let E_2 be the set of edges that are incident only on vertices in V_2. Recursively solve a minimum-spanning-tree problem on each of the two subgraphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$. Finally, select the minimum-weight edge in E that crosses the cut (V_1, V_2), and use this edge to unite the resulting two minimum spanning trees into a single spanning tree.
   Either argue that the algorithm correctly computes a minimum spanning tree of G, or provide an example for which the algorithm fails.
5. (20 points) Use Zhou's rectilinear spanning graph algorithm (Zhou et al. Information Processing Letters 02) to find the nearest neighbors in $R1$ and $R2$ for the following points:
   $$(0, 0), (10, 15), (4, 5), (3, 4), (5, 4), (8, 7), (9, 12), (14, 12).$$
   In each step, you should list which point is scanned, points in active sets, and connections made.