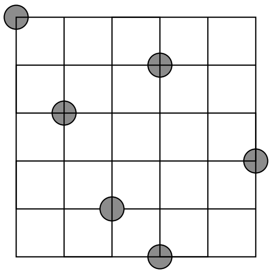
CS294-3: Algorithms in the real world — Assignment 5 (VLSI and Pattern Matching)

Due: Friday Nov 21, 1997

Please feel free to send me email if there are any ambiguous questions.

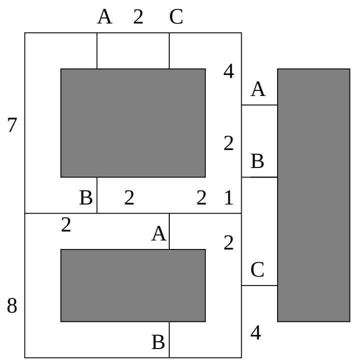
**Problem 1:** Consider the following graph.



**A.** Find a minimum cost Rectilinear Steiner Tree (RST) for the following set of points (the shaded points are the demand points).

**B.** Is this an S-RST? If not show the minimum cost S-RST.

**Problem 2:** For the following routing problem the three nets $A, B$ and $C$ need to be connected. The numbers on the edges represent their lengths, and assume that the capacity of every edge is 2.




**A.** Specify an integer (0-1) program for which the solution gives the minimum total wire length.

**B.** Solve the program (you do not need to show your work).

**Problem 3:** Describe an $O(nm)$ time $O(n+m)$ space algorithm for finding a minimum cost alignment assuming an affine gap cost model. Pseudocode with comments would be the best way to describe it.

**Problem 4:** (**Extra Credit.**) Describe an $O(nm\log(m+n))$ time algorithms for finding a minimum cost alignment assuming the gap cost function $x(k)$ (where $k$ is the length of the gap) is concave downward (*i.e.* the second derivative is always negative).