National Yang Ming Chiao Tung University
電子研究所 / 前瞻半導體研究所
Physical Design Autmation, Fall 2023

December 25, 2023
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Final Exam

1. (10%) You are asked to place a cell i on a chip. The cell i connects to four other pads a, b, c, and d at the coordinates (1, 1), (4, 3), (2, 5), and (6, 2) with the weights 2, 5, 3, and 8, respectively. Find an appropriate position to place the cell i by using the force-directed method.

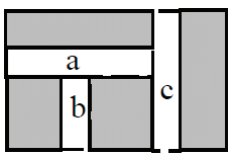
2. (15%) Given a net n with the four pins $p_1 = (2, 5)$, $p_2 = (4, 9)$, $p_3 = (7, 2)$, and $p_4 = (5, 1)$, let the estimated wire lengths by using the half-perimeter approximation, the minimum cost spanning-tree one, and the minimum cost Steiner tree be p, q, and r, respectively. Give p, q, and r.

3. (10%) Compare the pros and cons of quadratic placement and non-quadratic placement.

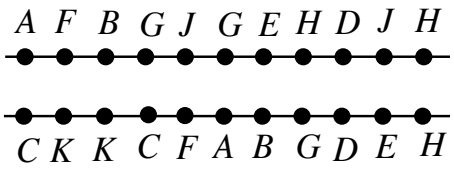
4. (10%) For the Soukup maze router, there is no guarantee that we can find the shortest path if such a path exists. Give an example routing configuration for the situation.

5. (10%) Extend the maze routing algorithm such that it generates a shortest path from source to target with the minimum number of bends.

6. (10%) For the channel configuration in the figure below, we shall first route the channel a, then b, and finally c because a is adjacent to both b and c. Is it correct? Please explain.



7. (25%) Given the instance of the channel routing problem below,



   (a) Draw the HCG and VCG.

   (b) Can the constrained left-edge algorithm apply to this channel routing instance? Route the instance if Figure 1 gives a feasible routing instance; explain why the algorithm does not apply to this instance, otherwise.

   (c) Determine the tight lower bound on the channel height if doglegs are allowed.

8. (10%) Given a netlist N ={[(1, 1), (2, 2)], [(2, 10), (2, 14)], [(6, 2), (10, 10)], [(6, 10), (10, 14)], [(10, 2), (14, 2)]}, where [(p, q), (r, s)] denotes a route from the coordinate (p, q) to (r, s), you are ask to apply a 3-level routing (multilevel routing with three levels) to route the instance N on a 16 $\times$ 16 chip plane. Suppose only straight and L-shaped routes are allowed during the coarsening stage while maze routing is applied during uncoarsening. Also, all wire spacing (including point-to-wire spacing) must be at least 4 units. Show how you obtain the routing solution step by step.

Thank you for your dedicated effort and commitment in taking the "Physical Design Automation" course.
Wish You a Fruitful New Year 2024 !