國 立 中 興 大 學

資 訊 工 程 學 系

Term Project

Channel Router

(due Jan. 10, 2024)

Problem Formulation

- **Description**

Grid-based routing is assumed. Let X and Y be two sets of pins, where X and Y locate at the upper and lower boundary of the routing channel, respectively. Each pin is labeled as an integer ranging from 0 to 1000, while a pin with label 0 indicates a location without a terminal. A set of pins with the same label should be connected, while two pins with different labels should not be connected. Two routing layers are available. Pins can only be connected to vertical wires (layer 1), while two vertical wires can be connected using a horizontal wire (layer 2). A layer-1 wire and a layer-2 wire are connected through a via. Doglegs are allowed but out-of-channel wires are not acceptable.

- **Cost**

The cost of a channel rouging CR is

cost(CR) = ($\#T$, WR, $\#v$),

where $\#T$ is the number of tracks used, WR is the overall wire length, and $\#v$ is the number of vias. Wire length of a net is calculated as the overall pitches (both horizontal and vertical) in the net.

Given two channel routings CR_1 and CR_2, cost(CR_1) < cost(CR_2) if (1) $\#T_1<\#T_2$, (2) $\#T_1=\#T_2$ and $WR(CR_1)<WR(CR_2)$, or (3) $\#T_1=\#T_2$, $WR(CR_1)=WR(CR_2)$, and $\#v_1=\#v_2$.

- **Problem**

Given X, Y, write a program to find the channel routing CR with the minimum cost.

Benchmarks

Your program should allow input from a user specified file and report the results. The following shows an example.

- **Input Format**

Column	1	2	3	4
Upper pins	2	0	1	3
Lower pins	1	3	2	1

```
4  3        // #pins in either X or Y; #nets
2  1        // x1=2, y1=1
0  3        // x2=0, y2=3
1  2
3  1
```

- **Output Format**

You may define your output format, but you must provide the following information: (1) number of tracks, (2) overall wire length, (3) number of vias, and (4) detailed information about each net.
Note that it is preferred to provide a graphic output for item (4).

Requirements

Your program must be able to be executed at **UNIX** or **Window** operation system in the following format.

```
% executable_file   input_file
```

The document detailing the features of your approach and complexity reduction strategy is a must. Please send the compressed file of the source code, the executable file and the document to your teaching assistant. (Please specify your **student ID** in the subject line.) Use the above example and the example given in class as your input benchmark circuit.

Grading

Unique source code	20%
100% completion	20%
Minimum number of tracks	20%
Minimum wire length	15%
Minimum number of vias	10%
Complexity reduction strategy	15%