

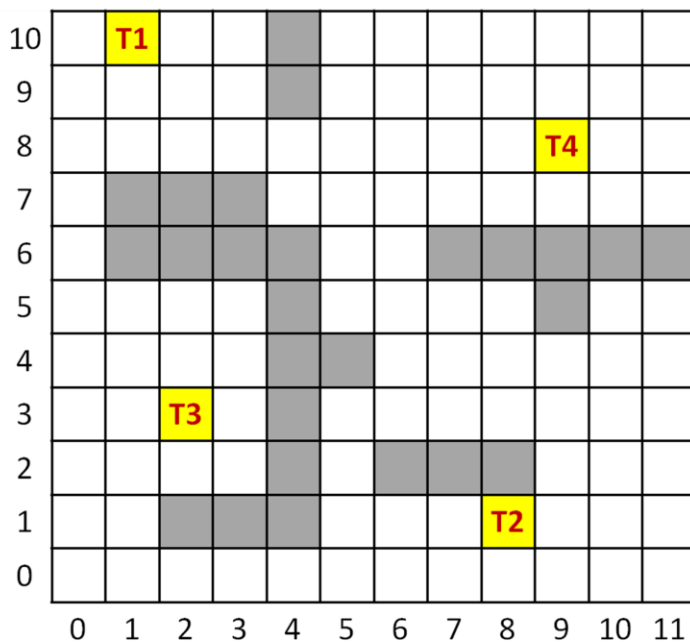
# CS518A: Parallel EDA

## Homework #2: An Obstacle-Avoiding Router

Given a set of pins (or terminals) and a set of obstacles in a rectangular routing area, you are requested to write a parallel computer program which solves the obstacle-avoiding routing problem by connecting all the pins. Your program must be written in C/C++ with OpenMP.

The format of the input file is defined as follows:

- **.chip**: The dimension of the routing area is defined by two sets of  $(x\ y)$  coordinates; the first set of coordinates defines the position of the lower-left corner while the second set of coordinates defines the position of the upper-right corner.
- **.pin**: The syntax defines the number and the positions of pins which are to be connected.
- **.obs**: This type of syntax defines the rectangular obstacles which reside in the routing area. For the example shown in Figure 1, there are eight obstacles; each obstacle is defined by the coordinates of its lower-left corner and its upper-right corner.



### Input File:

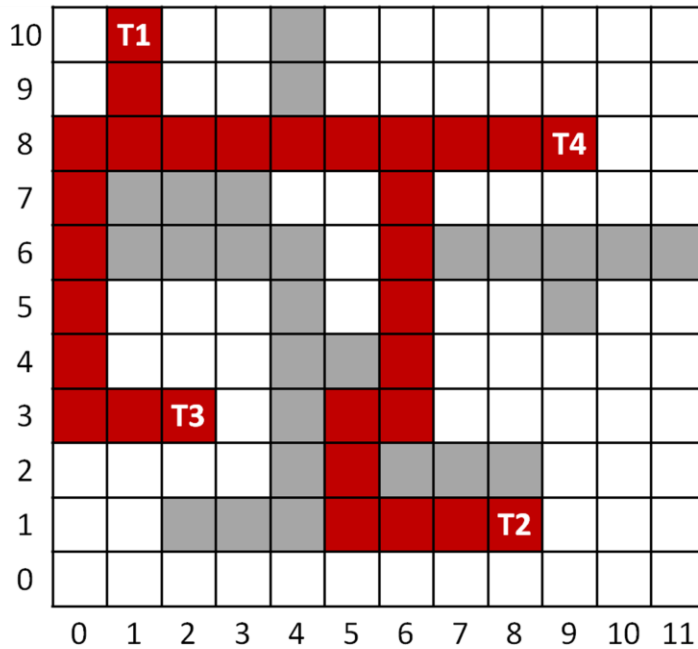
```
.chip (0 0) (11 10)
.pin 4
1 (1 10)
2 (8 1)
3 (2 3)
4 (9 8)
.obs 8
(4 9) (4 10)
(1 6) (3 7)
(4 2) (4 6)
(5 4) (5 4)
(2 1) (4 1)
(7 6) (11 6)
(9 5) (9 5)
(6 2) (8 2)
```

Figure 1. Example of the input file format

The format of the output file is defined as follows:

- **.net**: Your computer program should generate a net which connects all the pins defined in the input file. In order to write to the output file, the generated net must be decomposed into horizontal and vertical wire segments.

- **.total\_wire\_length**: Your program should calculate the total wire length.
- **.num\_of\_vias**: Your program should calculate the total number of vias for the routing result. It is assumed that the routing problem requires the use of two routing layers; one layer for horizontal net segments and the other for vertical net segments. It is also assumed that the pins (or terminals) do not need any *via* in order to connect to the net.



### A Sample Output File:

```
.net
(1 10) (1 8)
(0 8) (9 8)
(0 8) (0 3)
(0 3) (2 3)
(6 8) (6 3)
(5 3) (6 3)
(5 3) (5 1)
(8 1) (5 1)
.total_wire_length
30
.num_of_vias
7
```

**Figure 2.** Example of the output file format

**Requirements:** Please write a report containing 2~5 pages to describe your algorithm, the source code, how to run the program, and experimental results. Please email your source code, makefile, executable file, and the report to [iltseng@saturn.yzu.edu.tw](mailto:iltseng@saturn.yzu.edu.tw) by the deadline.

**Deadline:** Tuesday, November 24<sup>th</sup>, 2009

### References:

- Takumi Watanabe, Hitoshi Kitazawa, and Yoshi Sugiyama, "A Parallel Adaptable Routing Algorithm and its Implementation on a Two-Dimensional Array Processor," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, Vol. CAD-6, No. 2, March 1987, pp. 241-250.
- Liang Li and Evangeline F. Y. Young, "Obstacle-Avoiding Rectilinear Steiner Tree Construction," *Proceedings of International Conference on Computer-Aided Design*, 2008, pp. 523-528.