

(1) Your name and student ID

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(2) How to compile and execute your program and give an execution example.

```
$ ./hw5 *.modified.txt *.result
```

E.g.:

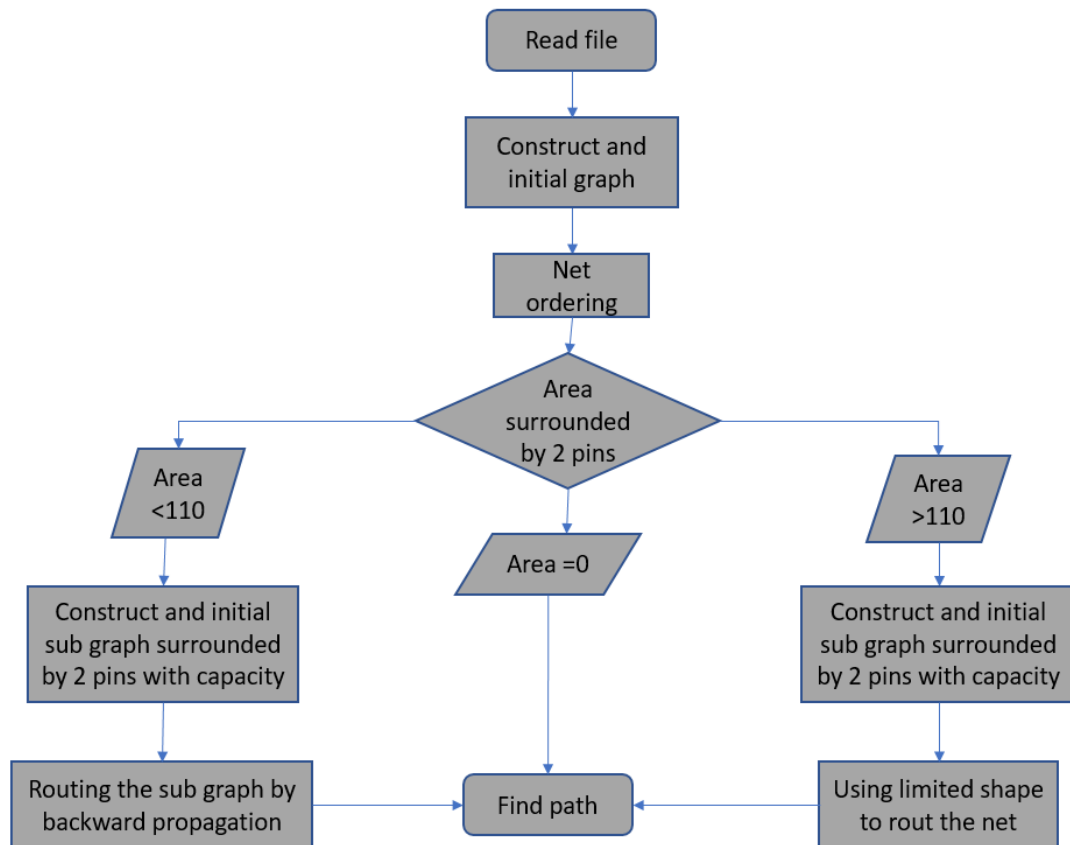
```
$ ./hw5 ../testcase/ibm01.modified.txt ../output/ibm01.result
```

(3) The total overflow, the total wirelength and the runtime of each testcase. Notice that the runtime contains I/O, constructing data structures, computing parts, etc. The more details your experiments have, the more clearly you will know where the runtime bottlenecks are. You can plot your results like the one shown below.

	lbm01	lbm04
Input time	0.09s	0.17s
Output time	0.01s	0.04s
Net ordering time	0.13s	0.28s
Routing time	48.41s	275.69s
Total runtime	48.79s	276.13
Overflow	2168	3273
Wirelength	56773	154228

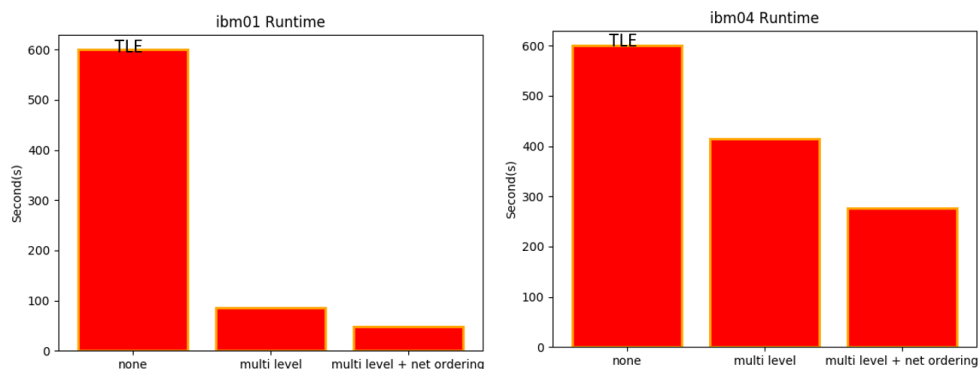
(4) The details of your implementation. You have to use flow chart(s) to help elaborate your algorithm, and please follow the symbols usually used in flow charts. (If you are not familiar with the symbols, please refer to this reference: <https://www.programiz.com/article/flowchart-programming>) If your method is similar to some previous works/papers, please cite the papers and reveal the difference(s).

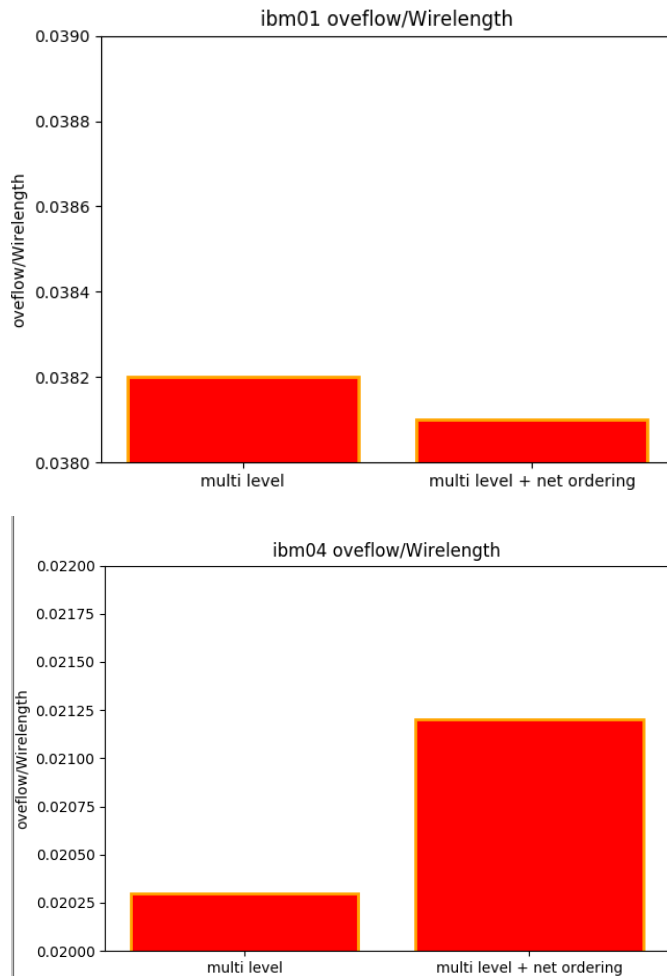
我的方法是從 hadlock 的方法得到的靈感的，我在一開始建立 2 pin net 的 routing graph 時候在 weight 部分加入了 capacity，讓 backward propagation 的時候會考慮到 edge capacity。然而如果一開始建立的 routing sub graph 太大的話會導致 backward propagation 會花太多時間，因此太大的 sub graph 會使用 L shape 找哪條 path 佔的 capacity 最少。



(5) What tricks did you do to speed up your program or to enhance your solution quality? Also plot the effects of those different settings like the ones shown below.

利用類似 multi level 的方式把不同大小的 sub graph 用不同方式去 routing，我把太大的 sub graph 使用 L shape 找哪條 path 佔的 capacity 最少。還有加入 net ordering 改善 solution quality。





(6) What have you learned from this homework? What problem(s) have you encountered in this homework?

這次作業整體來說沒有很大的困難，主要是在設計演算法上需要思考如何在有 capacity 的情況下去優化整個演算法讓 overflow 越小越好，我有參考 hadlock 的概念加入 capacity 的 weight 讓 backward propagation 有更多的參考依據，不過這個方法沒辦法使用在太大的 sub graph 上，因此未來可能要使用 multi level 的方法讓 sub graph 變成更小的圖來解這個問題。