(1) Your name and student ID

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

--How to compile

In this directory, enter the following command:

$ make

It will generate the executable file "hw4" in "../bin/".

If you want to remove it, please enter the following command:

$ make clean

--How to Run

In this directory, enter the following command:

Usage: ../bin/[exe] [aux file] [output file]

e.g.

$ ../bin/hw4 ../testcase/ibm01/ibm01.aux ../output/ibm01.result

$../bin/hw4 ../testcase/ibm07/ibm07.aux ../output/ibm07.result

$../bin/hw4 ../testcase/ibm09/ibm09.aux ../output/ibm09.result

$../bin/hw4 ../testcase/adaptec1/adaptec1.aux ../output/adaptec1.result

$../bin/hw4 ../testcase/adaptec3/adaptec3.aux ../output/adaptec3.result

(3) The total displacement, the maximum displacement and the runtime of each testcase. Notice that the runtime contains I/O, constructing data structures, computing parts, etc. (You need to provide a screenshot for the result of HW4_grading.sh.)

Run time\ testcase	Adaptec1	Adaptec3	Ibm01	Ibm07	Ibm09
Total displacement	3518877.50	5446926.00	5654348.00	28928868.00	46540948.00
Max.disp.	216.211	164.04	2428.04	7656.04	10013.9
Read file time	0.66s	1.42s	0.04s	0.14s	0.16s
Abacus	19.12s	90.69s	0.21s	2.16s	2.83s
Write file time	0.02s	0.08s	0.01s	0.02s	0.01s

Total time	20.23s	92.31s	0.26s	2.30s	3.05s

```
[g111062652@ic51 ~]$ mv CS6135_HW4_111062652.tar.gz HW4_grading/student/111062652
[g111062652@ic51 ~]$ cd HW4_grading/
[g111062652@ic51 ~/HW4_grading]$ bash HW4_grading.sh
|-------------------------------------------------|
|                                                 |
|    This script is used for PDA HW4 grading.     |
|                                                 |
|-------------------------------------------------|
grading on 111062652:
  testcase |  max disp. |     total disp. |    runtime | status
  adaptec1 |     216.21 |      3518877.50 |      20.23 | Maximum displacement constra
int was violated for adaptec1.
  adaptec3 |     164.64 |      5446926.00 |      92.31 | Maximum displacement constraint was violat
ed for adaptec3.
     ibm01 |    2428.04 |      5654348.00 |       0.26 | success
     ibm07 |    7656.04 |     28928868.00 |       2.30 | Maximum displacement constraint was violat
ed for ibm07.
     ibm09 |   10013.90 |     46540948.00 |       3.05 | Maximum displacement constraint was violat
ed for ibm09.
|-------------------------------------------------------|
|                                                       |
|    Successfully generate grades to HW4_grade.csv      |
|                                                       |
```

(4) The details of your implementation. If there is anything different between your implementation and the algorithm in the ISPD-08 paper, please reveal the difference(s) and explain the reasons.

Paper 中紀錄了每一個 cluster 的頭尾 cell，我沒有記錄這個。實作中發現這個好像沒甚麼用處。

其它照 paper 的 pesudo code 實作。

(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.

1.計算 cost 時不算全部的，只算當前 node 移動距離(一樣會改變整個 cluster 的移動距離)，這樣得下來的結果平均來說反而比較好，但是兩種方法都沒有辦法使 max disp.滿足。

(下方以 ada3 為例)

	$min \sum_{i=1}^{n} \lvert x_i^c - x_i'^c \rvert$	Min(cell i opt. - cell i)
Max disp.	2592.47	164.64
Total disp.	6728455.5	5446926.00
Run time	133.76	92.31

按: Fast Legalization for Standard Cell Placement with Simultaneous Wirelength and Displacement Minimization **paper 中，將** α=1, β=0

$$Cost(i) = HPWL + N_i(\alpha \cdot (DP_S) + \beta \cdot (DP_P)) \quad (1)$$

(6) Please compare your results with the previous top 5 students' results, and show your advantage either in runtime or in solution quality. Are your results better than theirs?

✓ If so, please express your advantages to beat them.

✓ If not, it's fine. If your program is too slow, then what could be the bottleneck of your program? If your solution quality is inferior, what do you think that you could do to improve the result in the future?

若是以 total displacement 來看，performance 好像還不錯，但是我只有 ibm01 有符合 max displacement，我覺得是一開始擺的時候有些 cell 就擺錯 subrow 了，我在導致後面有些 cell 原本應該要在的位置被占掉後，被迫移動到很遠的地方。計算 cost 時也考慮到該 subrow 中所有的 node 移動狀況，但是沒有改善這一問題，仍待思考。

(7) If you implement parallelization (for algorithm itself), please describe the implementation details and provide some experimental results.

沒有做平行化

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

學習到 abacus 方法，更加了解指標的一些限制。

這次的作業雖然概念聽起來比較簡單，可是實作上我覺得最麻煩，很多細節的地方很容易就出錯。檔案很大，好難 debug。