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

October 3, 2023
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Programming Assignment #1

Circuit Partitioning

Due: October 17

1 Problem Description

Let $C = c_1, c_2, c_3, ..., c_n$ be a set of n cells and $N = n_1, n_2, n_3, ..., n_m$ be a set of m nets. Each net n_i connects a subset of the cells in C. The 2-way partitioning problem is to partition the set C of n cells into two *disjoint, balanced* groups, G_1 and G_2 such that the overall cut size is minimized; in other words, no cell replication is allowed. The cut size s is given by the number of nets among G_1 and G_2 (same as the definition in the class slide). For a given *balance factor* r, $0 < r < 1$, the objective of this assignment is to minimize s under the following constraint,

$$\frac{1-r}{2} \times n \leq \#(G_1), \#(G_2) \leq \frac{1+r}{2} \times n.$$

2 Input

The input format and a sample input are given as follows:

Input Format	Sample Input
<Balance Factor>	0.5
NET <Net Name> [<Cell Name>]+;	NET n1 c2 c3 c4 ;
	NET n2 c3 c6 ;
	NET n3 c3 c5 c6 ;
	NET n4 c1 c3 c5 c6 ;
	NET n5 c2 c4 ;
	NET n6 c4 c6 ;
	NET n7 c5 c6 ;

The input file starts with the balance factor r, followed by the description of m nets. The description of each net contains the keyword NET, followed by the net name and a list of the connected cells, and finally the symbol ';'. See the sample input for the format of a circuit with seven nets and six cells.

3 Output

In the program output, you are asked to give the cut size, the sizes of $G1$ and $G2$, and the contents of $G1$ and $G2$. The following table gives the output format and an output to the sample input. (Note that the solution may not be the optimal one.)

Output Format	Sample Output
Cutsize = <Number>	Cutsize = 5
G1 <Size>	G1 3
[<Cell Name>]+;	c1 c2 c3 ;
G2 <Size>	G2 3
[<Cell Name>]+;	c4 c5 c6 ;

4 Language/Platform

1. Language: C or C++ is preferred.
2. Platform: Linux.

5 Command-line Parameter

In order to test your program, you are asked to add the following command-line parameters to your program (e.g., FM input.dat output.dat):

./Lab1 [input file name] [output file name]

Please be noted that the name of your binary executable file must be "Lab1".

6 Submission

You need to submit the following in a "tar" file to E3 (`https://e3.nycu.edu.tw/`) by the deadline. Please put all required files in a folder: (1) source codes, (2) Makefile, (3) a text readme file (readme.txt) stating how to build and use your program. The folder name must be your student ID. Be sure to compress the folder in the linux environment with the following command.

```
tar cvf Student_ID.tar Student_ID
```

7 Grading Policy

This programming assignment will be graded based on (1) the **correctness**, (2) **solution quality**, and (3) **running time**. For each case, the runtime limit is **1 hours**. It will be regarded as "failed" for the case if it takes more than 1 hours.

There will be 25% penalty per day for late submission.