National Taiwan University
Graduate Institute of Electronics Engineering
Physical Design for Nanometer ICs, Spring 2017

Handout #3
March 8, 2017
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Programming Assignment #1: 2-Way F-M Circuit Partitioning; Due: 5pm on-line, April 1st, 2017 (Saturday)

Modified from Problem #3 of the 2001 IC/CAD Contest (Source: Faraday Technology Corp.)

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 constraint

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

by the Fiduccia-Mattheyses heuristic introduced in class.

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**

   (a) Language: C, C++, or Java.

   (b) Platform: Linux. **For fair evaluation of the submitted program, you should apply an account to access the machines in the EDA Union Lab in the Ming-Dar Building and develop your programs on the servers in the lab. Submitted programs that fail to be executed on these servers by the TA will incur significant penalty.**

   Please visit the following website for the information on the account application:
   http://edaunion.ee.ntu.edu.tw/.

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):

   [executable file name] [input file name] [output file name]

6. **Submission**

   You need to submit the following materials in a .tar or a .zip file (e.g., r04901001-p1.zip) at the course website by the deadline: (1) source codes, (2) executable binary, (3) a text readme file (readme.txt) stating how to build and use your programs, (4) a report (report.doc) on the data structures used in your program.

7. **Grading Policy**

   This programming assignment will be graded based on (1) **correctness**, (2) **solution quality**, (3) **running time**, (4) **readme.txt**, and (5) **report.doc**. Please check these items before your submission.

8. **Online Resources**

   Sample input files (input.dat), readme.txt, and report.doc can be found at the course website through the submission link:

   http://eda.ee.ntu.edu.tw/~yslu/pd17/pa1_submission/index.php

   A checker to verify your program results is available for download at:

   http://eda.ee.ntu.edu.tw/~yslu/pd17/pa1_submission/checker.tgz