

2001 IC/CAD Contest

Problem 3: *K*-Way Netlist Partitioning

Source: Faraday Technology Inc.

December 20, 2000

Revised on March 20, 2001

(Revised on the format of input data and the definition of balance conditions.)

1. Introduction and Problem Description

Let $C = \{C_1, C_2, C_3, \dots, C_n\}$ be a set of n cells and $N = \{N_1, N_2, \dots, N_m\}$ be a set of m nets. Each net $N_i, i = 1, 2 \dots m$, connects a subset of the cells in C . The K -way partitioning problem is to partition the set C of n cells into K disjoint, balanced groups $G_1, G_2, G_3, \dots, G_K$ so that the overall cut size is minimized; in other words, no cell replication is allowed. The cut size with respect to a net i, S_i , is given by the number of groups to which the net connects minus one. For example, if a net crosses four groups, then the cut size of this net is 3. The objective of the K -way partitioning problem is to minimize $\sum_{i=1}^m S_i$, under the constraint that the number of cells in group G_i , denoted by $\#(G_i)$, satisfy the size constraints $0.9n/K \leq \#(G_i) \leq 1.1 n/K$, for all $i = 1, 2, \dots, K$.

2. Input

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

Input Format	Sample Input
<K>	3
NET <NetName> [<CellName>]+;	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 first line of an input file starts with the number K , denoting the number of partitions, followed by the description of m nets. The description of each net contains the key word NET, followed by the name of the net and a list of the cells to which the net connects, and finally ended with the symbol “;”. See the

sample input for the format of seven nets and six cells.

3. Output

Your results will be verified by an automatic test program. Therefore, it is very important to conform to the output format. 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
Cutsizes = <Number>	Cutsizes = 6
P1 = [<CellName>]+ ;	P1 = c1 c2 c3 ;
P2 = [<CellName>]+ ;	P2 = c4 ;
.....	P3 = c5 c6 ;

4. Language/Platform

1. Language: C or C++.
2. Platform: SUN OS/Solaris.

5. Evaluation

Final cut size, CPU time, and memory requirement.

6. Questions

Please report any question regarding this problem to cad@cis.nctu.edu.tw with the email subject "CAD Contest: Problem 3." Your question(s) will be answered in two weeks, and the Q&A's will be posted at the contest web site.

References

- [1] C. M. Fiduccia, and R. M. Mattheyses, "A Linear-Time Heuristics for Improving Network Partitions," *Proceedings of the 19th Design Automation Conference*, pp. 175-181, 1982.
- [2] N. Sherwani, *Algorithms for VLSI Physical Design Automation*, Kluwer Academic Publishers.