National Taiwan University
Graduate Institute of Electronic Engineering
VLSI Physical Design, Fall 2020

Guidelines for Programming Assignment #2
(due on-line at 23:00, Oct. 28, 2020)

***Submission*: email to Prof. Chen, csj@ntu.edu.tw**

Problem

You are asked to write a **Kernighan & Lin circuit partitioner** that partitions circuit cells into two sets. (modified from Problem #3 of the 2001 IC/CAD Contest, Source: Faraday Technology Crop.)

Let C = c1, c2, c3, ..., cn be a set of n cells and N = n1, n2, n3, ..., nm be a set of m nets. Each net ni 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, G1 and G2 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 G1 and G2 (same as the definition in the class slide). Implement the Kernighan & Lin (K-L) algorithm to solve this partitioning problem. Please produce the initial solution for K-L yourself. **You can try to improve your quality of result by any other methods besides K-L**.

Note: There will be a large hidden case besides the sample cases. You can create some simple test cases to check the correctness of your implementation.

Input

.dat file describes the netlist of the circuit. 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 ';'. The input format is as follows:

```
NET <Net Name> [<Cell Name>]+;
```

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.)

```
Cutsize = <Number>
G1 <Size>
[<Cell Name>]+;
G2 <Size>
[<Cell Name>]+;
```

Example

Sample input

```
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 ;
```

Sample output

```
Cutsize = 5
G1 3
c1 c2 c3 ;
G2 3
c4 c5 c6 ;
```

Required Files

You need to submit the following materials in a .tar.gz or .zip file:

(1) Source codes and Makefile (you can divide the two algorithms into two different programs or integrate them into one program with command-line parameters)

(2) Executable binary

(3) A text readme file describing how to compile and run your programs

(4) A report (**report.doc**) includes:

1. The CPU time and cut size of each test case

Test case	Time (Sec)	Cut size
design_0		
design_2		
hidden case		

2. Special method or data structure for better runtime or solution quality you use in your program.

Language/Platform

Language: C or C++. It is better that your program is executable on the EDA union Lab machine.

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

File-name Rule

The submission filename should be <student_id1>-<p2>.tar.gz or <student_id1>-<p2>.zip (e.g. **r02943000-p2.zip**). If you have a modified version, please add _v[version_number] as a postfix to the filename and resubmit it to the submission website (e.g. . **r02943180-p2-v1.zip**).

Command-line Parameter

You have to add command-line parameters in your program to specify the input and output file name as the format (e.g., `KL input.dat output.dat`):

```
[executable_file_name] [input_file_name] [output_file_name]
```

Evaluation

(1) correctness

(2) quality(run time and cut size)

(2) output file format

(3) report.doc

(4) **demo in class**

Demo

1. Run hidden case

2. <u>10 ~ 15 min presentation</u>

The content of the presentation is pretty free. You can share what you discovered in the PA2 with the class. In case you do not know what to present, the following are some suggestion

(1) Share your methods and data structures that improve the quality of the results

(2) Show your experimental results and compare the result of different methods

(3) Analyze the advantages and disadvantages of different methods.

If there is any question, please mail to csj@ntu.edu.tw