National Taiwan University
Department of Electrical Engineering
Algorithms, Fall 2018

Handout #14
November 6, 2018
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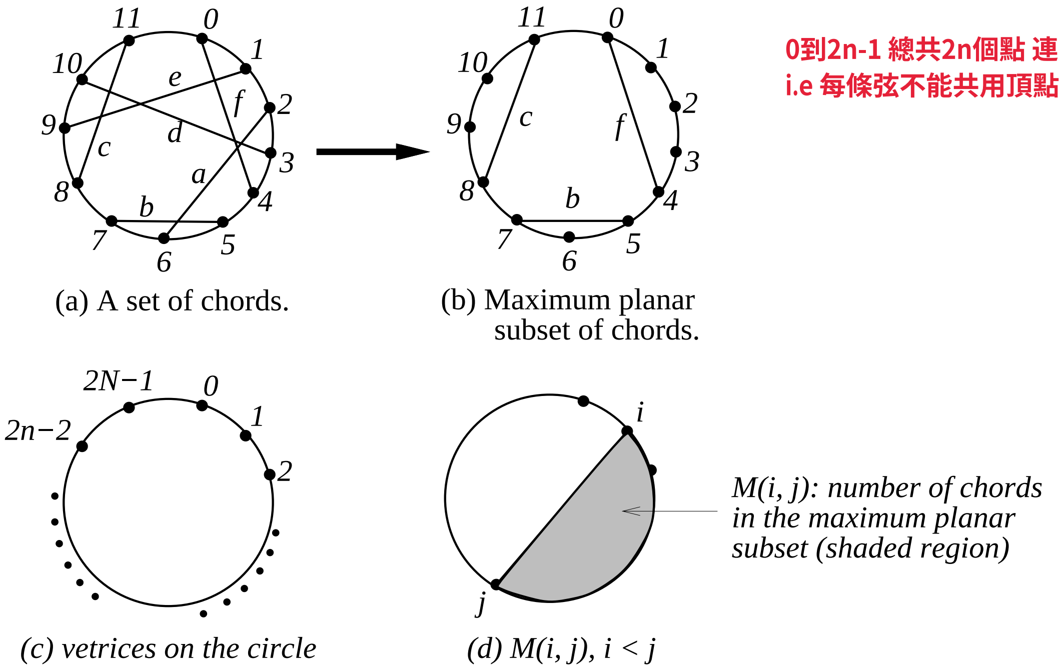
Programming Assignment #2 (due on-line at 6pm, November 25, 2018)

Submission URL & Online Resources (three input test cases provided; more hidden test cases will be used for the final test):
https://cool.ntu.edu.tw/courses/155/assignments/974

Problem: Maximum Planar Subset

Given is a set C of n chords of a circle (see Figure 2 (a)). We assume that no two chords of C share an endpoint. Number the endpoints of these chords from 0 to $2n-1$, clockwise around the circle (see Figure 2 (c)). Let $M(i,j), i \leq j$, denote the number of chords in the maximum *planar subset* (*i.e.*, no two chords overlap each other in the subset) in the region formed by the chord $\overline{ij}$ and the arc between the endpoints i and j (see Figure 2 (d)). As the example shown in Figure 2 (a), $M(2,7) = 1$, M(3, 3) = 0, and $M(0,11) = 3$. You are asked to write a program that computes the number of chords in the maximum planar subset in a circle of n chords, *i.e.*, compute $M(0,2n-1)$, and reports the details of each chords, as shown in Figure 2 (b).



(a) A set of chords.

(b) Maximum planar subset of chords.

(c) vetrices on the circle

(d) M(i, j), i < j

0到2n-1 總共2n個點 連成n條弦
i.e 每條弦不能共用頂點

Figure 1: Maximum planar subset.

Input

The input consists of an integer $2n$, $1 \leq n \leq 90,000$, denoting the number of vertices on a circle, followed by n lines, each containing two integers a and b ($0 \leq a, b \leq 2n - 1$), denoting two endpoints of a chord. A single "0" (zero) in the input line signifies the end of input.

Output

The output file reports the number of chords in the maximum planar subset in the input circle of n chords, followed by a list of the two endpoints for each resulting chord in the maximum planar subset (sorted by the first endpoint in the increasing order).

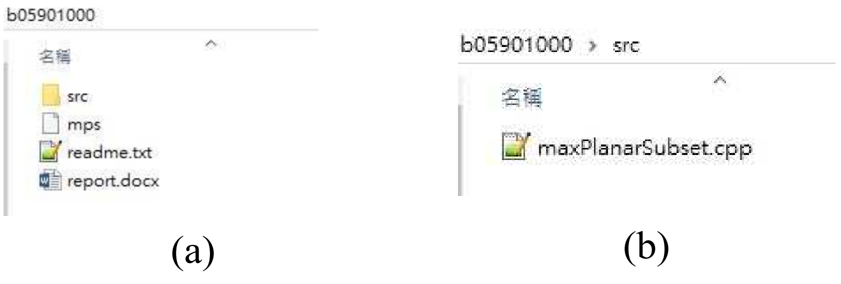
Here is an input/output example (see Figure 2):

Sample Input	**Sample Output**
`12`	`3`
`0 4`	`0 4`
`1 9`	`5 7`
`2 6`	`8 11`
`3 10`	
`5 7`	
`8 11`	
`0`	

Required Files:
You need to submit the following materials in a *.zip* file:

- Source codes **in src/ directory**(*e.g.* maxPlanarSubset.cpp), only *.h, *.hpp, *.c, *.cpp are allowed in **src/**, NO directories are allowed;
- Executable binary **named mps**;
- A text readme file **named readme.txt** describing how to compile and run your programs;
- A report **named report.doc or report.docx** of algorithm, data structure, and discussion.

The following images give a sample submission format:



b05901000
名稱
src
mps
readme.txt
report.docx

(a)

b05901000 › src
名稱
maxPlanarSubset.cpp

(b)

Figure 2: Submission files example.

The submission filename should be <student_id>_p2_v[version_number].zip (e.g. b05901000_p2_v1.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.* b05901000_p2_v1.zip, b05901000_p2_v2.zip, etc.).

Language/Platform:

1. Language: C or C++.
2. Platform: Unix/Linux or Windows

Evaluation:
The individual score per test case is determined by the correctness of the output result as well as the file format. Bonus will be given to most efficient programs. (Note that there are more hidden test cases to evaluate your program.)

For any questions, please email Yu-Sheng Lu at yslu@eda.ee.ntu.edu.tw or Jun-Jie Wang at jjwang@eda.ee.ntu.edu.tw.