

EE3980 Algorithms

Homework 7. Grouping Friends

Due: May 1, 2021

A social scientist is studying a group of N people. It is known that some of these N people are good friends with constant communications among them. However, the contents of the communications are not available to the scientist. All the scientist has is a list of the sender-receiver information. Your assignment is to help this scientist analyzing the list to divide the people into friend subgroups. The definition of a friend subgroup is the following: Given any two persons belong to a friend subgroup if

1. They have sent and received messages directly between them.
2. They have sent and received messages through one or more friends between them.

For example, four persons, A , B , C , and D , belong to a friend subgroup if the following communication records were found.

$A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$, and $D \rightarrow A$.

If, however, one of the people has sent messages to others but not receiving any, then apparently he is not a friend to any one. And, thus, he is a friend subgroup by himself.

On the other extreme, a friend subgroup can contain a single person who received messages but not sending out any.

Ten communication lists are available for your analysis. They are `c1.dat` – `c10.dat`. The first line of each file consists of two integers: the total number of people being studied, and the number of communication records. It then followed by the names of all the people, and the communication records. The content of file `c1.dat` is attached at the end.

And your program should generate output as the following:

```
$ a.out < c1.dat
N = 10 M = 25 Subgroup = 3 CPU time = 3.09944e-06
Number of subgroups: 3
Subgroup 1: 谷慎林 左優一 鄭談佶
Subgroup 2: 張殊煊 王遐科 李政女
Subgroup 3: 廖絮筱 陳因萱 周慶讚 韓竟浩
```

Your program should read in the data file, generate the subgroups and then print out the results. For this homework, the CPU time measures only the subgroup generation, i.e., read in the data and write out the results need not be counted in the CPU time reported. And, no repetition is needed to take the average CPU time.

As before, please write a C program to process these communication records and generate necessary outputs. In addition, please analyze the complexities of your program and turn in your report.

Notes.

1. One executable and error-free **C** source file should be turned in. This source file should be named as **hw07.c**.
2. A report file in **pdf** format is also needed. This file should be named as **hw07a.pdf**.
3. Submit your **hw07.c** and **hw07a.pdf** on EE workstations using the following command:

```
~ee3980/bin/submit hw07 hw07.c hw07a.pdf
```

where **hw07** indicates homework 7.

4. Your report should be clearly written such that I can understand it. The writing, including English grammar, is part of the grading criteria.
5. The CPU time per iteration of the second algorithm, if any, may be used to determined part of the grades of this homework.



The content of the file `c1.dat` is shown below.

10 25

谷慎林

鄭談佶

左優一

張殊嫻

李政女

王遐科

廖絜筱

韓竟浩

周慶讚

陳因萱

王遐科 -> 張殊嫻

李政女 -> 王遐科

張殊嫻 -> 王遐科

左優一 -> 陳因萱

張殊嫻 -> 李政女

陳因萱 -> 廖絜筱

谷慎林 -> 陳因萱

左優一 -> 谷慎林

左優一 -> 廖絜筱

韓竟浩 -> 周慶讚

張殊嫻 -> 廖絜筱

李政女 -> 周慶讚

王遐科 -> 陳因萱

鄭談佶 -> 左優一

谷慎林 -> 韓竟浩

谷慎林 -> 張殊嫻

谷慎林 -> 鄭談佶

王遐科 -> 韓竟浩

左優一 -> 張殊嫻

廖絜筱 -> 周慶讚

王遐科 -> 廖絜筱

鄭談佶 -> 周慶讚

鄭談佶 -> 王遐科

廖絜筱 -> 韓竟浩

周慶讚 -> 陳因萱

