

Programming assignment #4

規劃修課時間表

Objective

1. To understand how to design an algorithm.
2. To exercise the concept of recursion.
3. To learn how to use topological sort.

Problem

Adar 老師希望同學們在大學時能修完 n 門課程，但某些課程必須通過一些先修課程才能繼續選修，題目中會給定課程總數以及某些課程的先修條件，請同學們根據條件規劃好修課順序並完成修課時間表。

Input

輸入格式如下所示：

課程總數 n
先修條件列表
<欲修課程> <先修課程>
...

在 input file 中，第一行表示有 n 門課程，課程代號由 0 到 $n-1$ ，先修條件列表中<欲修課程>和<先修課程>皆由課程代號表示，修<欲修課程>之前必須完成<先修課程>才行。

Input file example: (“//” is comment and will not appear in input file)

```
4          // 總共有 4 門課，課程代號分別為 0、1、2、3
1 0        // 修課程 1 之前必須先修課程 0
2 0
3 1
3 2
```

Output

給定課程總數以及先決條件後，輸出為了修完所有課程所規劃出來的課程時間表，答案可能會有許多種，只要不違反條件皆可，先修條件**不會有互相衝突的情況發生**（**必會有解**）。

Output file example: (“//” is comment and will not appear in output file)

```
0 1 2 3      // 總共 4 門課，課程 1、2 皆需先修過課程 0，課程 3 又必須
              // 先修過課程 1、2，因此共有兩種順序 {0, 1, 2, 3}, {0, 2, 1, 3}
              // 兩種答案皆可
```

Compile & Execute

Compile command: **\$ g++ <hw4.cpp> -O3**

Execute command: **\$./<execute file> <input file> <output file>**

(Ex : \$./a.out input1.txt output1.txt)

Note that input and output file should be the arguments of program. Please make sure your code can be compiled and executed “**on server**”.

Program Submission

1. Please use **C++** language and your program **must be written in only one source file**.
2. Your source file must be named as “**Student_ID_number_hw4.cpp**” and please make sure that all characters of the filename are in **lower case**. For example, if your student number is 0710100, the name of your program file should be “**0710100_hw4.cpp**”.
3. **Do not print** any words on terminal.
4. Upload your **report** and **program** to the new E3 by deadline. (**不要壓縮**)
未按照繳交格式繳交作業的人會被扣分！！

Report

1. No more than 3 pages.
2. Your report must contain:
 - a. The flow chart or the pseudo code of your program.
 - b. The experimental results and analysis. (Time complexity)
3. The report file name must be “**Student_ID_number_hw4.pdf**” and please make sure that all characters of the filename are in **lower case**. For example, if your student number is 0710100, the name of your program file should be “**0710100_hw4.pdf**”.

Bonus

無法修完所有課程的原因是因為有條件相互衝突，意即在 directed graph 中將先修條件以 arc 表示後會產生 cycle 而無法進行 topological sort，若同學能發現在老師給予的條件下無法修完所有課程即可得到 bonus point。

Bonus input file example: (“//” is comment and will not appear in input file)

```
4
1 3      //
3 0      // 此 3 條件互相衝突
0 1      //
2 1
```

在 Bonus 中，若發現條件會產生衝突，則輸出“Conflict”即可。

Bonus output file example:

```
Conflict
```

Grading

You need to submit both your source code and report. Remember the submission rules mentioned above, or **you will get zero point!!!!**

- Small case (×6) 60%
* **Time limit: 1 minute for above cases**
- Big case (×1) 20%
 - Correct answer 10%
 - Timing performance (If the answer is correct) 10%
* **Time limit: 5 minute for big case**
- Report 20%
- Bonus (×2) 20%

Due Date

- **Due Date : 2021/1/15 23:55:00**
- **Plagiarism is forbidden.**
- **遲交，第一、二天分數打 9 折，第三、四天打 8 折，第五、六天打 7 折，之後則不予繳交**