NCKU Programming Contest Training Course
2013/05/18

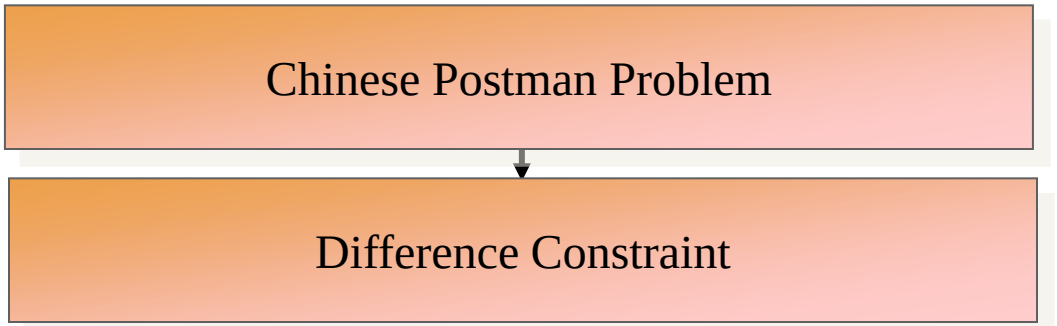
Pinchieh Huang (free999)

Pinchieh.huang@gmail.com

http://myweb.ncku.edu.tw/~p76014143/20130508.rar

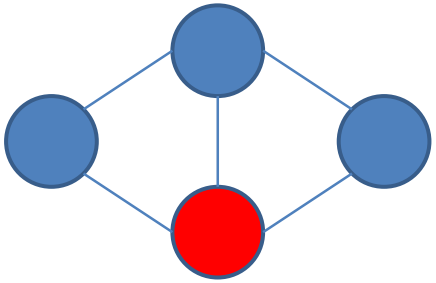
Department of Computer Science and Information Engineering
National Cheng Kung University
Tainan, Taiwan

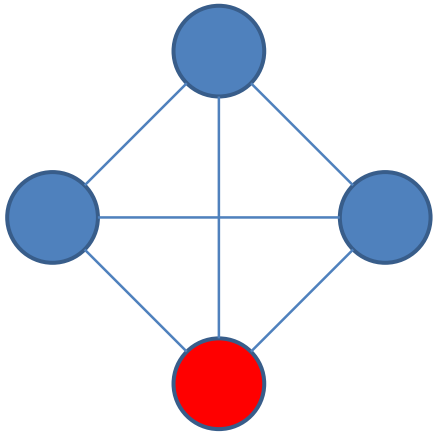
Outline



Chinese Postman Problem

- Problem Definition
  - Given a (weighted) graph G(V, E). Start from a given vertex, finding the shortest route that cover each at least once and back to the origin vertex.



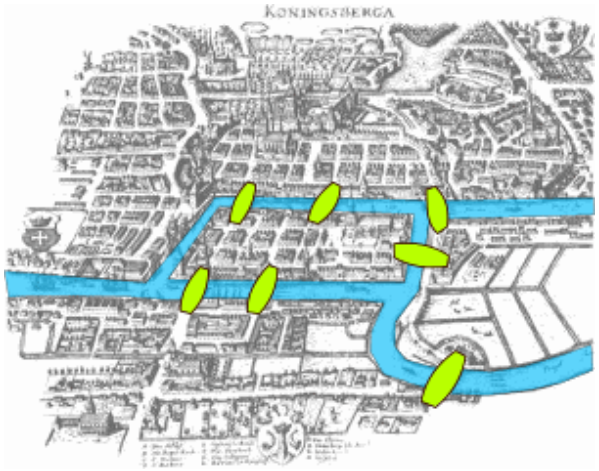


Chinese Postman Problem

- Euler Path (Circuit)
  - **Eulerian trail** (or **Eulerian path**) is a trail in a graph which visits every edge exactly once. Similarly, an **Eulerian circuit** or **Eulerian cycle** is an Eulerian trail which starts and ends on the same vertex.

Chinese Postman Problem

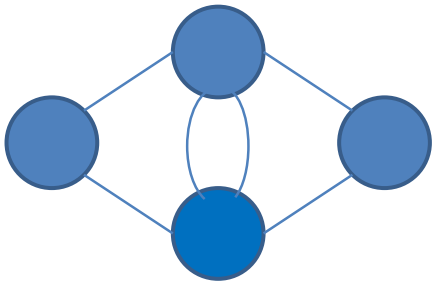
- How to determine whether a Euler Path (Circuit) can be found?



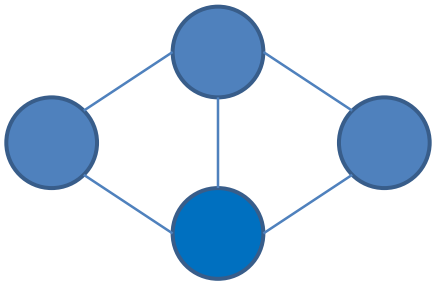
Seven Bridges of Königsberg

Chinese Postman Problem

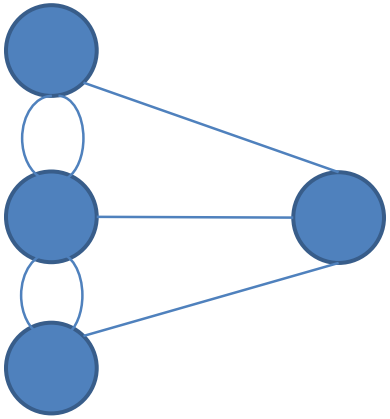
- Lemma
  - A Euler Path can be found in a graph if the number of vertexes with odd degree are less or equal than two. A Euler Circuit can be found in a graph if the number of vertexes with odd degree is equal to 0.



number of V_{odd} =



number of V_{odd} =



number of V_{odd} =

made by free999

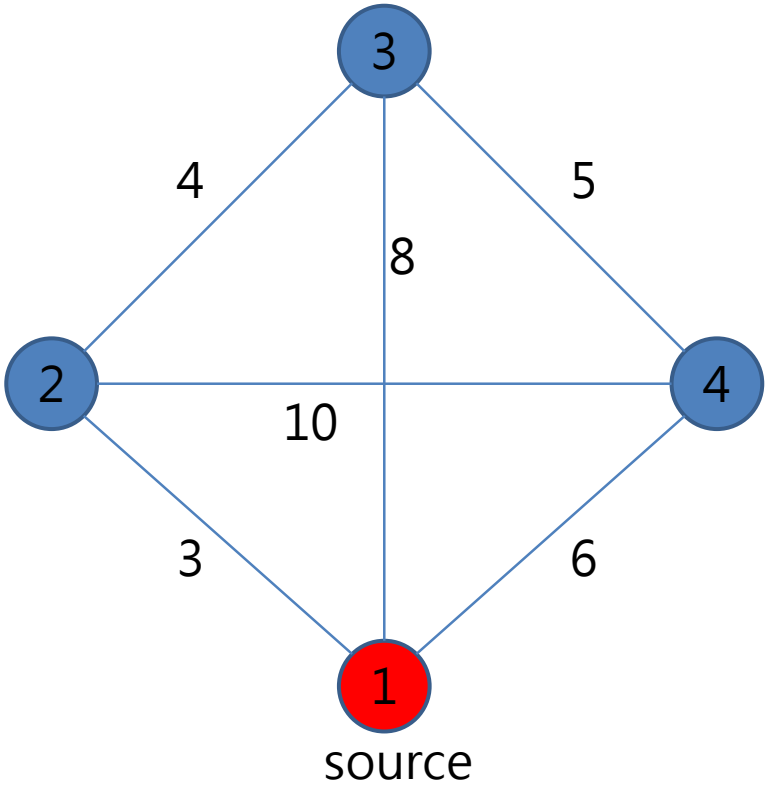
Chinese Postman Problem

- Lets return the original problem..

(1) If we can found an Euler circuit in the given graph, the answer is obvious the summation of all edges' weight.

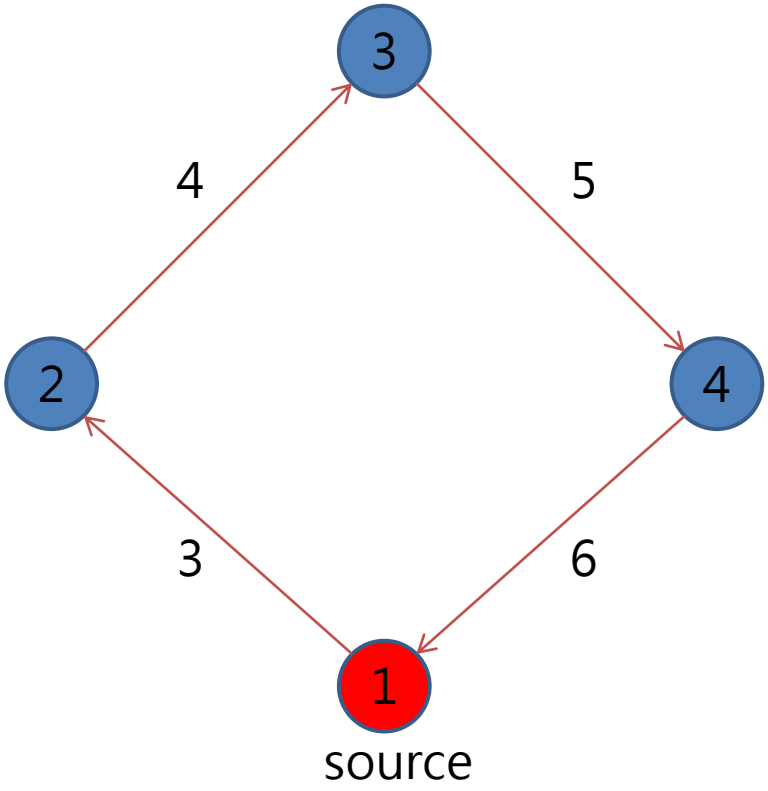
(2) If we can't…. ??

Chinese Postman Problem

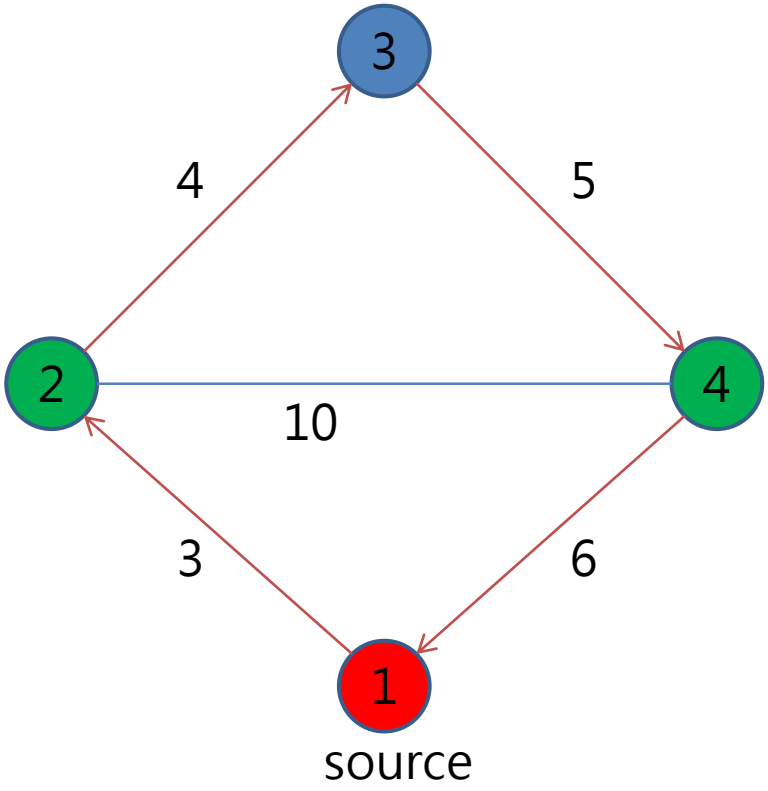


made by free999

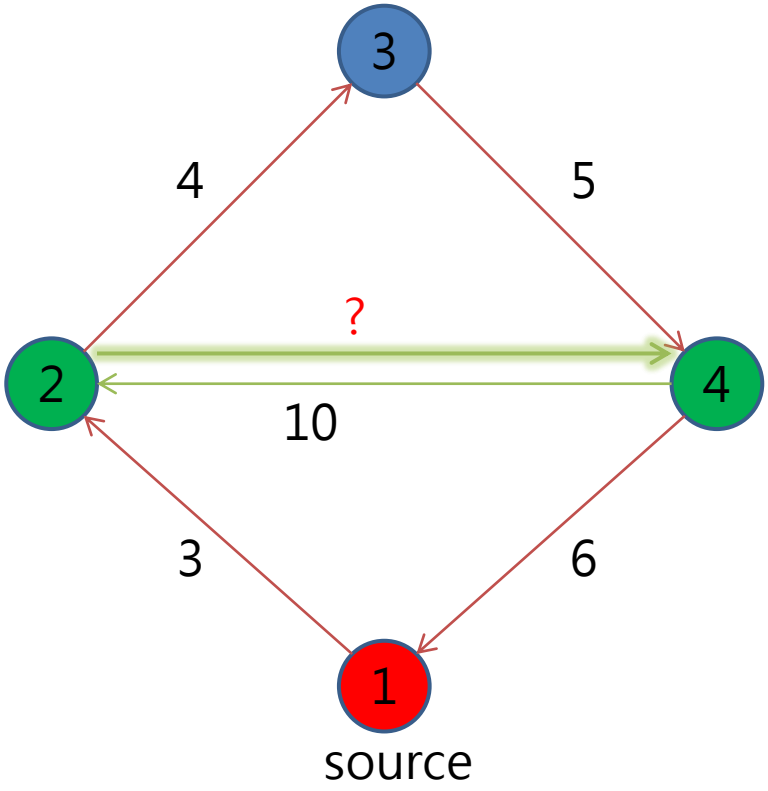
Chinese Postman Problem



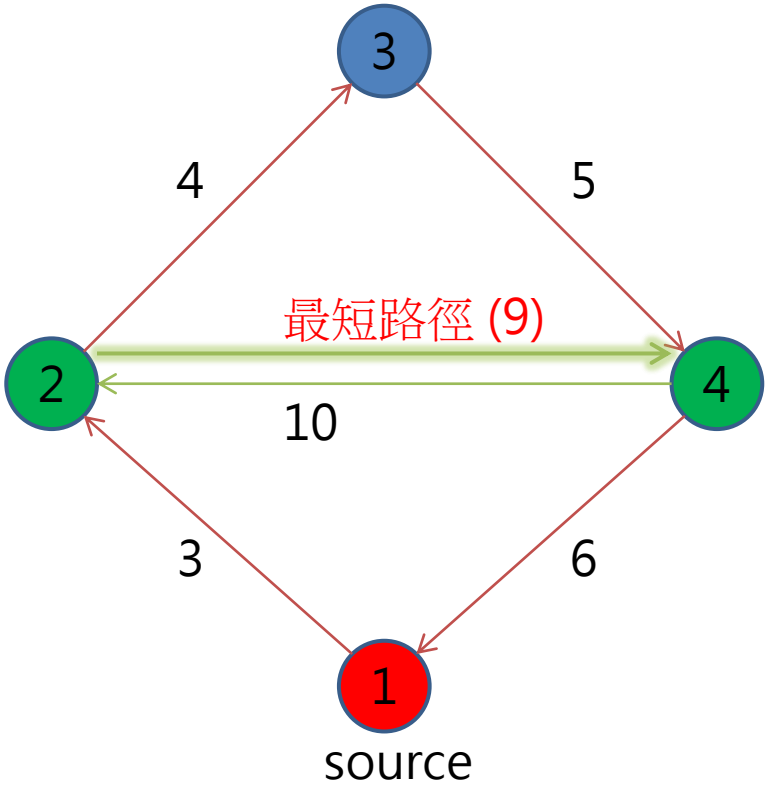
Chinese Postman Problem



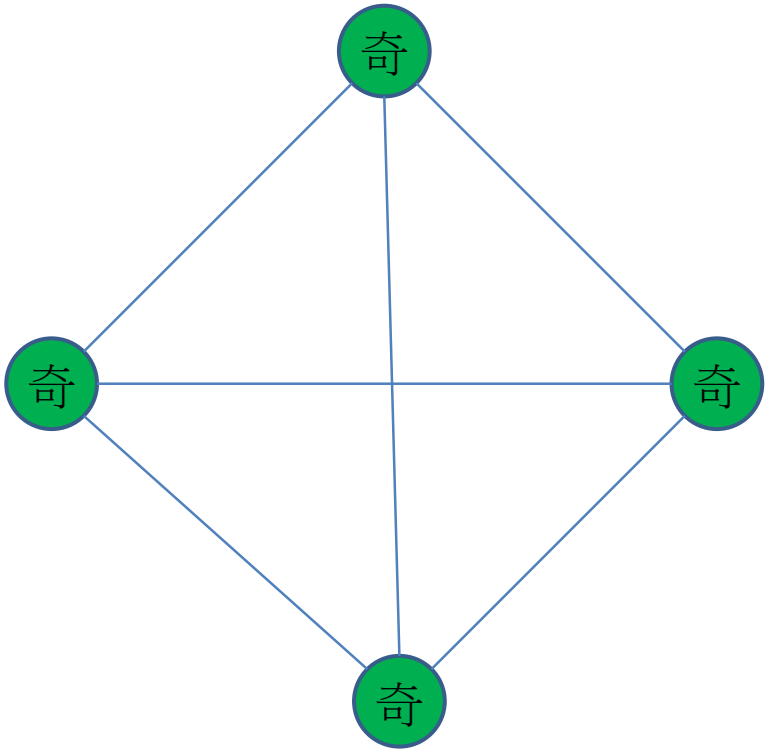
Chinese Postman Problem



Chinese Postman Problem

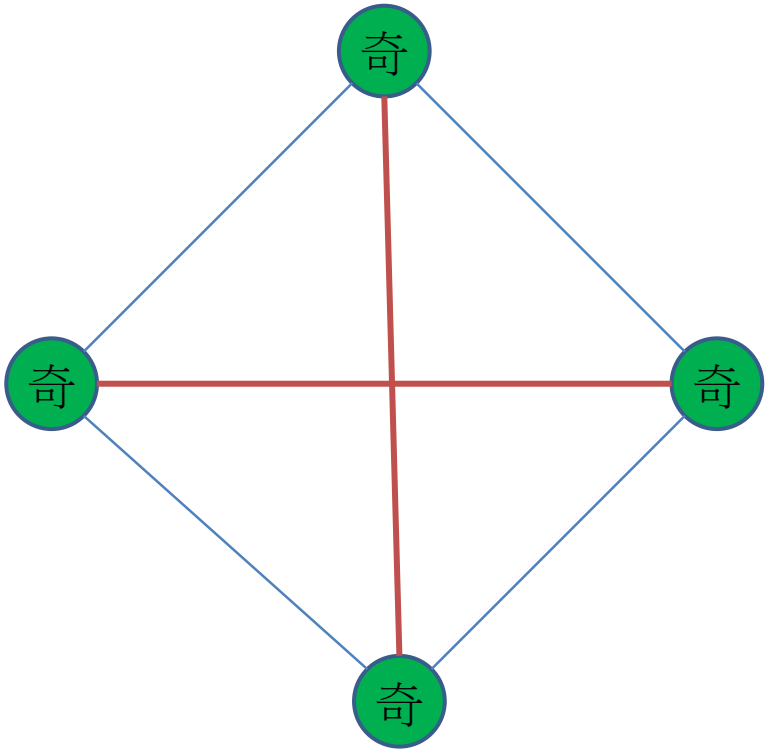


Chinese Postman Problem



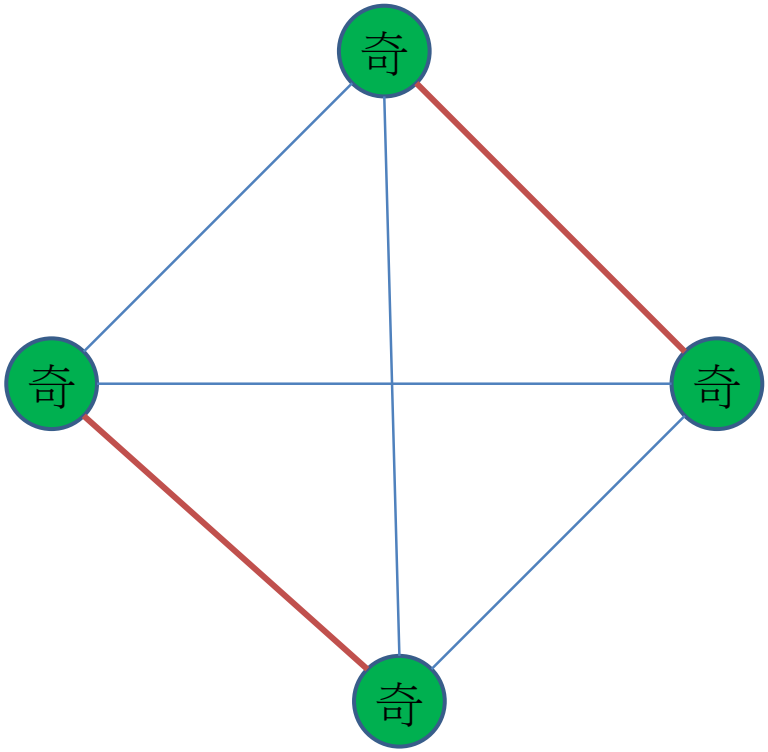
made by free999

Chinese Postman Problem



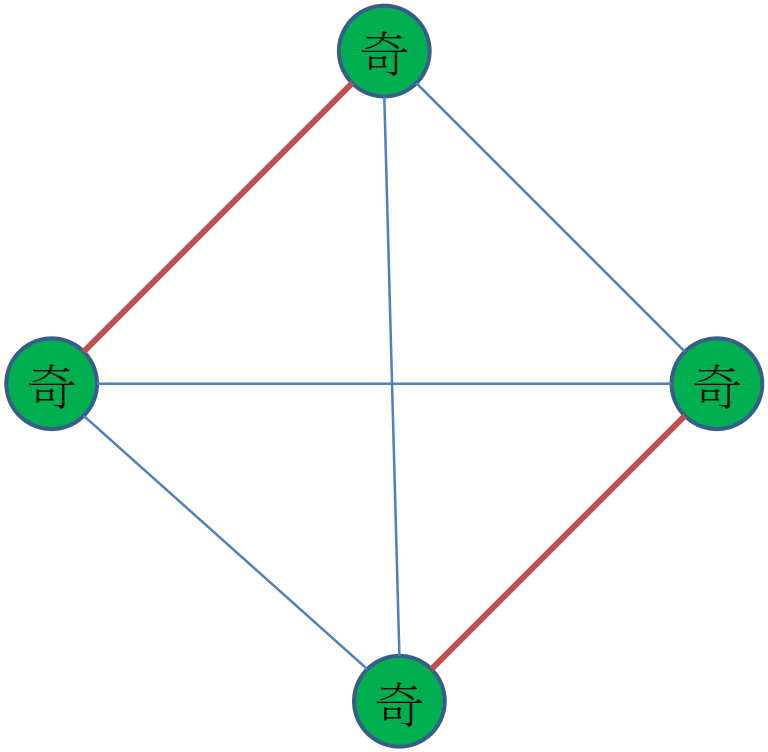
made by free999

Chinese Postman Problem



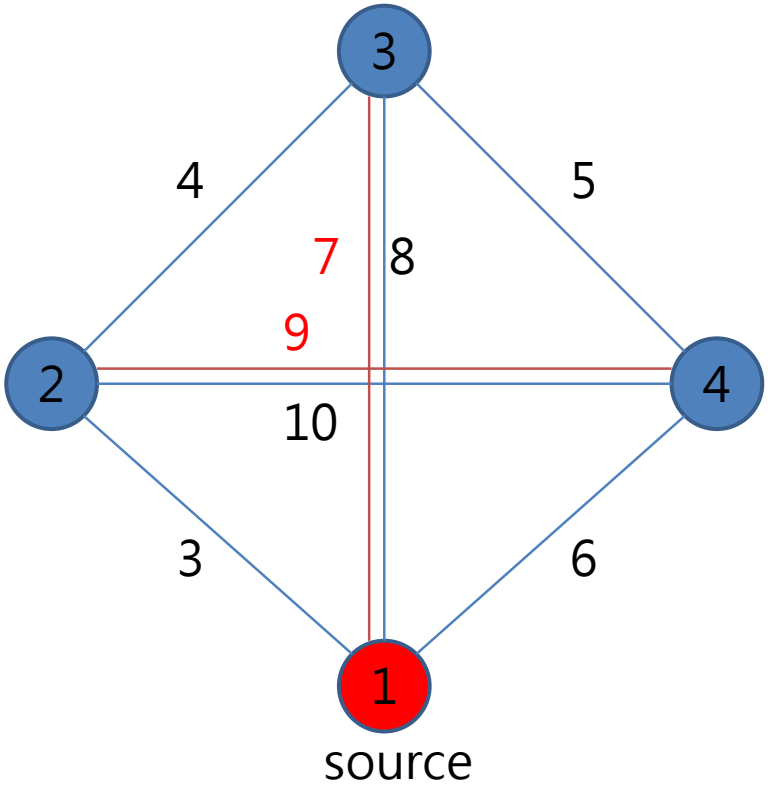
made by free999

Chinese Postman Problem

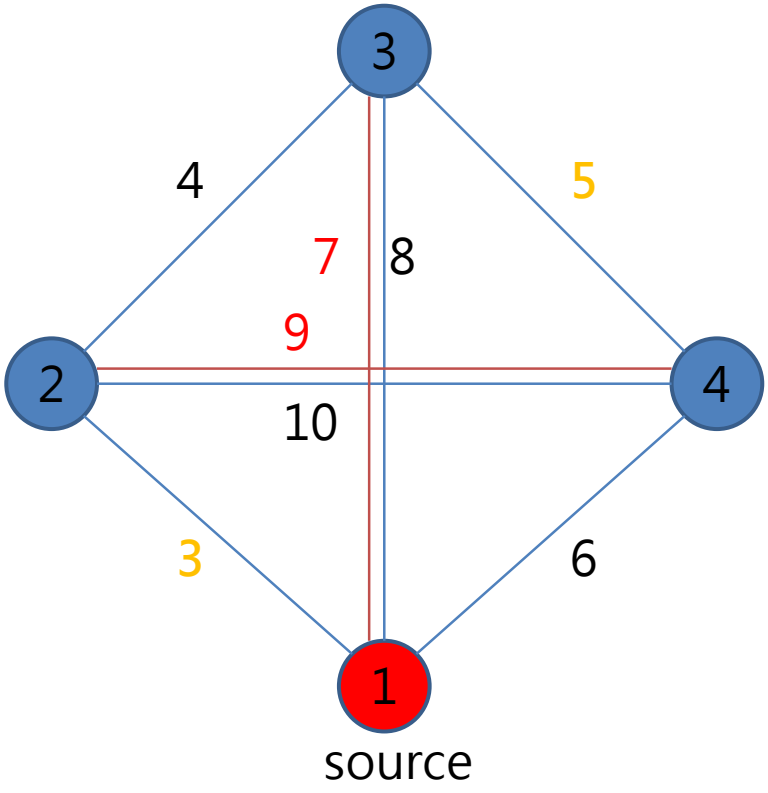


made by free999

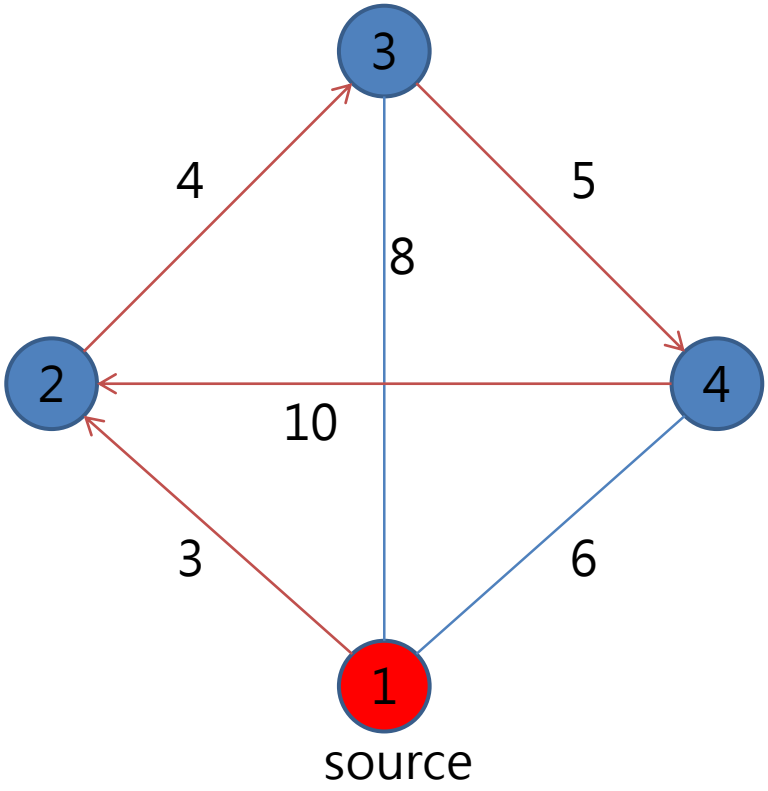
Chinese Postman Problem



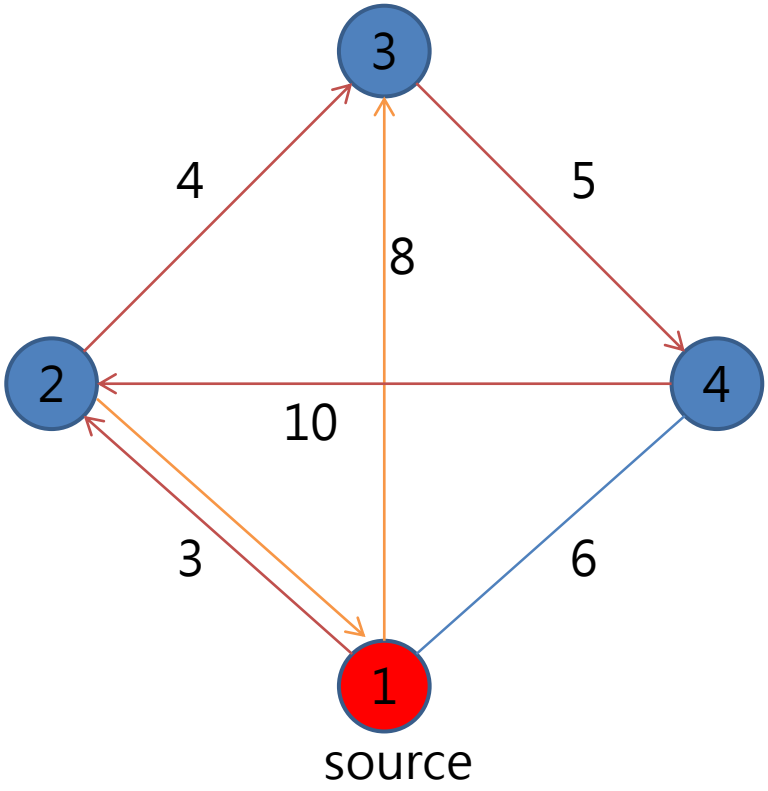
Chinese Postman Problem



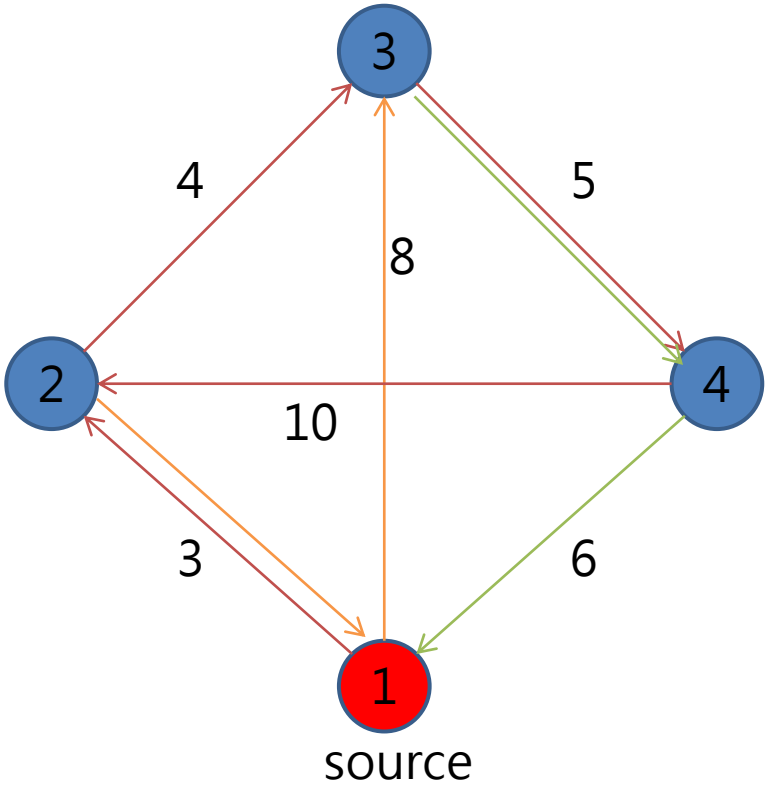
Chinese Postman Problem



Chinese Postman Problem



Chinese Postman Problem

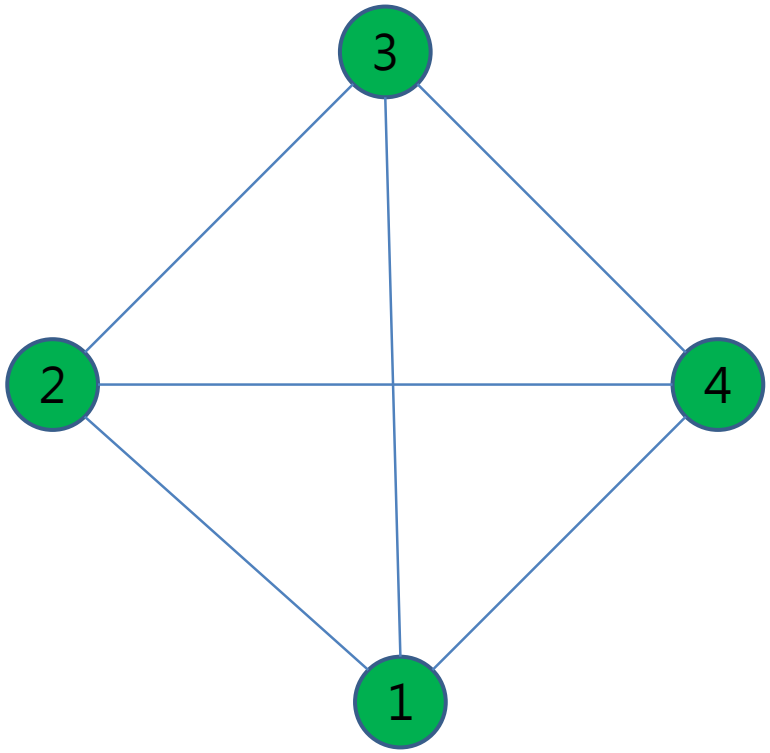


match

dp[bit] = 走過 bit 上的點的最短距離

求 dp[(1<<N) -1]

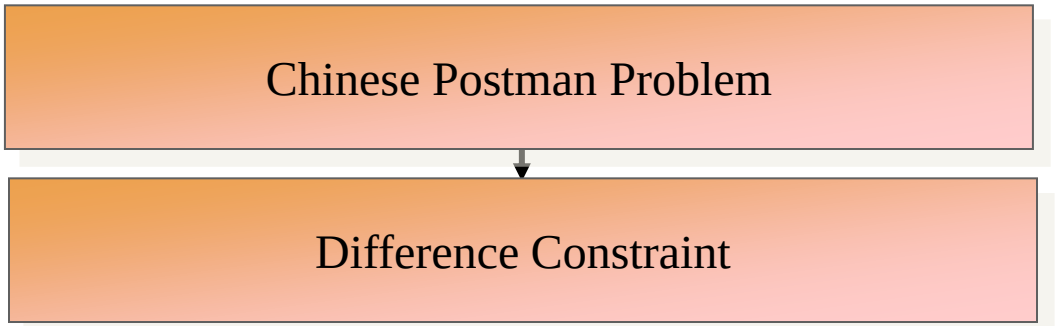
枚舉任兩個拜訪過的點



Example

- UVa 10296

Outline



Difference Constraint

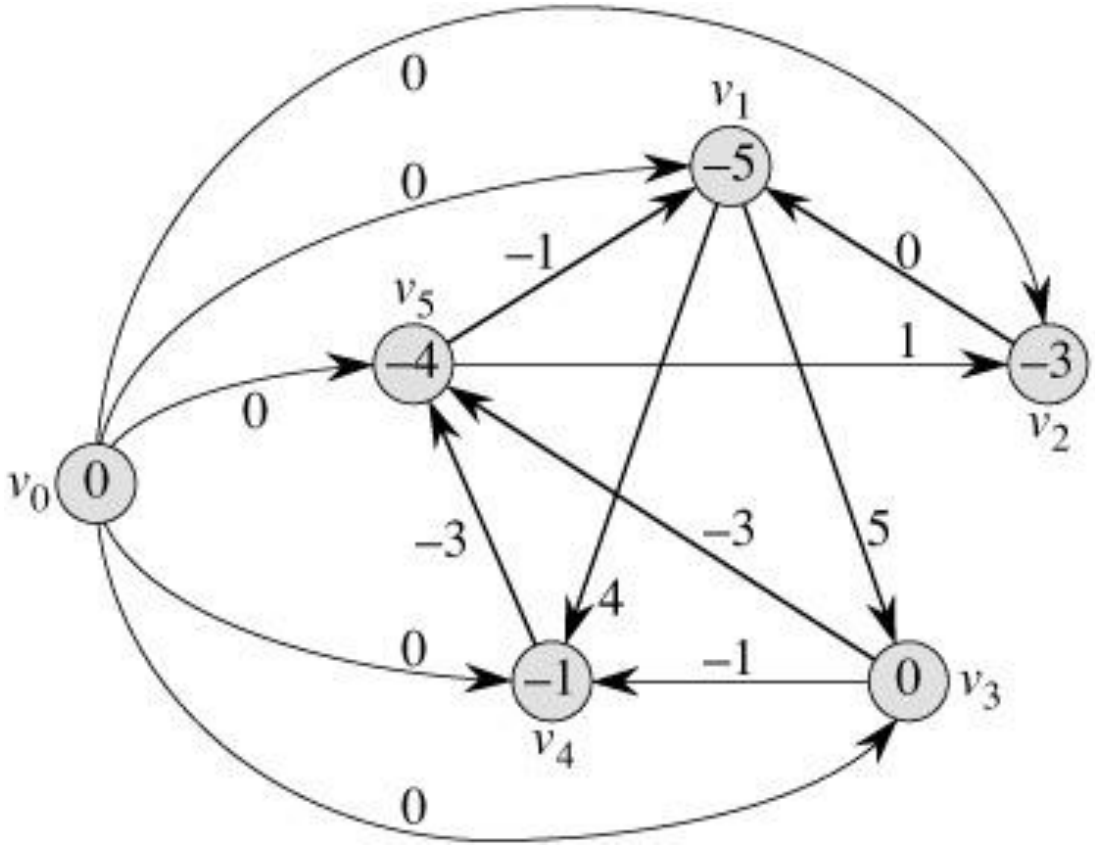
Given :

X1 - X2 <= 0
X1 - X5 <= -1
X2 - X5 <= 1
X3 - X1 <= 5
X4 - X1 <= 4
X4 - X3 <= -1
X5 - X3 <= -3
X5 - X4 <= -3

Find :

A feasible solution of X1, X2, …,X5

Difference Constraint



made by free999

example

Uva 515

made by free999

K-shortest Path

made by free999

Homework

Uva

515,

POJ

1201, 2983, 1364, 1275

made by free999