<Discrete Mathematics>

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작성일_06_11

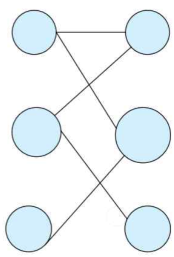
-examples fo reduction-

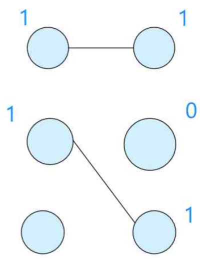
1. 3 CNF -> HP
2. Search version k-clique -> Decision version k-clique
3. Euclide Alg
4. a bipartite graph
5. a matching

-Maximum bipartite graph matching problem-

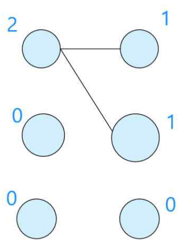
input: a bipartite graph G=(V, E)

output: “a” matching M in G such that the number of elements in M is maximum

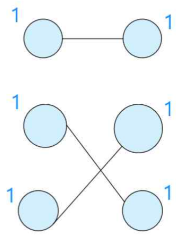

: input graph “G”



: a match



: not a match

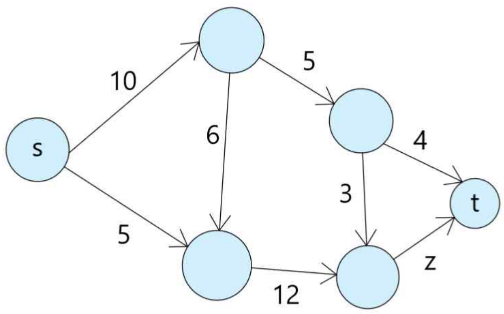


: a max match

-Maximum flow problem-
먼저 두 가지를 이해해야 한다.
1. a flow network
2. a flow

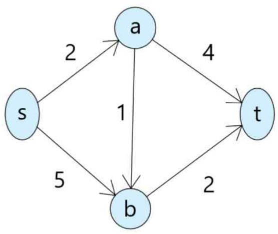
Definition of a flow network
: a flow network is a directed graph G=(V, E) with
1. There exist 2 special nodes in V “s.t” (s: the source, t: the sink(destination))
2. For each edge(<u, v>), a positive real number is assigned.
(that positive number is called “the capacity of the edge”)
3. every node must be on a path from s to t
(4. no self-loop exists -> 이 클래스에서는 안 다룬다.)
(3. says there is no isolated node)

우리가 s를 만들면 t로 보낼 목적을 가지고 있다.
ex)

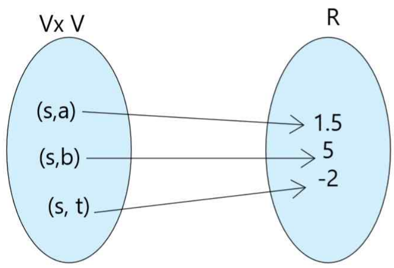


Definition of a flow
: a flow f in a flow network G=(V, E) is a real-valued function
f: VxV -> R
(every pair of vertices) -> (Real number)
subject to
1. flow conservation constraint (don`t lose flow)
2. capacity constraint
-> <s, b> can not be assigned larger than 5.
-> edge보다 더 큰 수를 할당할 수는 없다.
-> 두 node사이에 edge가 없으면 capacity 0로 여기고 음수나 0을 할당한다.
-> self loop이 없는 <x, x>도 역시 capacity 0로 여기고 음수나 0을 할당한다.
3. skew symmetric constraint

R이 real value라서 음수가 될 수도 있다.
ex)

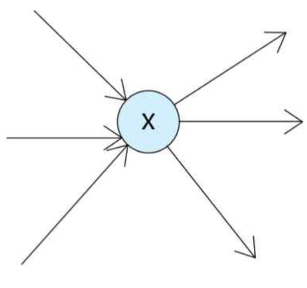


: a graph



: 2. capacity constraint

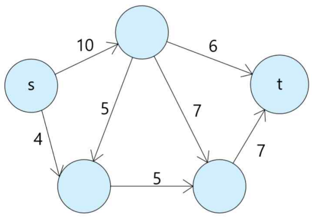
3. skew symmetric constraint
:
f(s, a) = 3이면, f(s, a) = -3이다.
f(b, t) = 1.5이면, f(t, b) = -1.5이다.



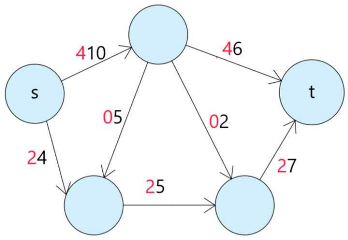
: 1. flow conservation constraint

-Maximum flow problem-
input: a flow network G
output: max|f|

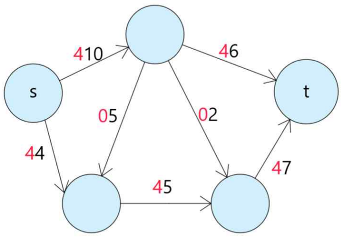
ex)

a graph 

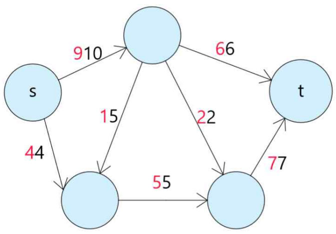
에 대하여



: |f| = 6



: |f| = 8



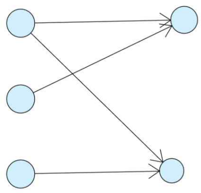
: |f| = 13 (max)

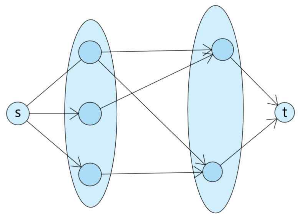
-> 이걸 해결하는 theorem이 있다.
-> max flow minimum cut theorem

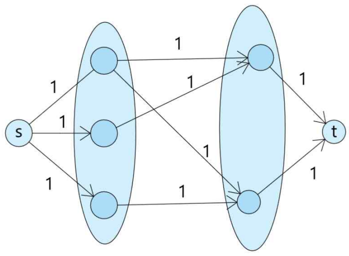
-Maximum flow problem(MFP) &
Maximum bipartite graph matching problem(MBGMP)-
-> relation?

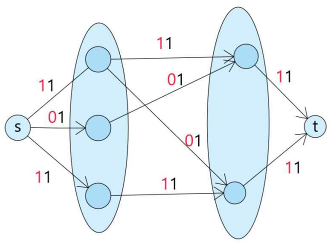
MFP -> MBGMP (reducable? not clear.)
MFP <- MBGMP (reducable)
사실 둘다 solvable하다고 알려져있다.

-MFP -> MBGMP-









MFP를 푸는 alg가 있으면 MBGMP도 풀린다.

MBGMP의 solution의 개수는 신경쓰지 않는다.
아무거나 하나만 보여주면 된다

Chapter 8
equivalence relation

What is a partition?
Given a non empty set A, a partition of A is a union of finite number of non empty subsets of A, A_1, A_2, ... , A_n such that A_1, A_2, ... , A_n are pairwise disjoint
or
a partition of A is the union of infinite number of non empty subsets of A, A_1, A_2, ... , A_n such that A_1, A_2, ... , A_n are pairwise disjoint

set A.

ex) A={1, 2, 3, 4, 5}
A_1 = {1}
A_2 = {2, 3}
A_3 = {4, 5}

Z^+ = {1, 2, 3, 4, 5, ...}