<Discrete Mathematics>

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a closed semiring

5-tuples (S, +, ・, 0, 1)

(1)

+	0	1
0	0	1
1	1	1

(2)

・	0	1
0	0	0
1	0	1

1. monoids-> (S, +, 0), (S, ・, 1)
   a. closed: a + b ∈ S (a ∈ S, b ∈ S)
   b. associative: (a + b) + c = a + (b + c)
   c. identity: a + 0 = 0 + a = a

   a. closed: a ・ b ∈ S (a ∈ S, b ∈ S)
   b. associative: (a ・ b) ・ c = a ・ (b ・ c)
   c. identity: a ・ 1 = 1 ・ a = a

2. + is commutative & idempotent

commutative: x + y = y + x

idempotent: a + a = a

3. distribution: a ・ (b + c) = a ・ b + a ・ c

4. countably infinite: $a_1 + a_2 + \cdots + a_i + \cdots$ exists and unique

-> associative, commutative, idempotent도 잘 적용된다.

5. ・는 infinite한 sum에도 잘 distribute된다.

-> 0+0+0+0+…=0, 1・1・1・…=1

-Warchall algorithm-

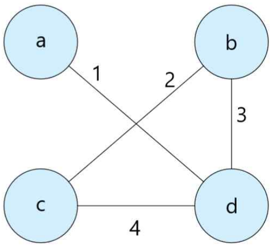
1. Euler cycle problem
2. Hamiltonian cycle problem
3. Traveling salesman problem

-> undirected graph만 다룬다.

Def) a cycle: a finite sequence of nodes such that

1. $x_1 = x_n$
2. $x_2, x_3, \cdots x_{n-1}$ are distinct

-> a finite sequence of sequence로도 정의 가능



b, d, c, b == 3, 4, 2

(1) Euler cycle problem
input: an undirected graph
output:
yes, if the graph has Euler cycle such that every edges of G are used only once
no, otherwise

(2) Hamiltonian cycle problem
input: an undirected problem
output:
yes, if the graph has Euler cycle such that every nodes of G are used only once
except only strating node
no, otherwise

(1)과 (2)중 뭐가 더 harder해 보이는가?
-> (2)가 더 harder해 보인다.
-> (1)은 이것을 해결하는 알고리즘이 있다.
-> edge가 홀수개인 node가 존재하지 않아야 Euler cycle이 존재한다.
-> edge가 홀수개인 node가 존재하지 않거나, 2개 존재해야 Euler path가 존재한다.

(3) Traveling salesman problem
graph에 weight가 있다.
a. 모든 node들을 거쳐야 하고,
b. cost의 합이 최소가 되어야 한다.