Lec 1. Single source shortest-paths problem.

n = number of nodes in the network
m = number of edges in the network
→ we will analysis performance of Algorithms with those 2 parameters.

(n, m) → Corresponding to size of input.

$w(u,v)$ we use a weight than distance because there is a negative distance. Thus we use a more general term.

So Consequently, Single Source path
= finding the path of smallest total weights.
↳ Source to all other Vertices.

- Point to point Solved by Single-Source Shortest path algorithm

we can have Multiple shortest path
but only one shortest path weight.

X) Lec 1, Base example

$\delta(s,v) = 14$, $\delta(s,y) = +\infty$ ← shortest path doesn't exist

Base 4)

1) A subpath of a shortest path is a shortest path.

2) For each edge $(u,v) \in E$: $\delta(s,v) \leq \delta(s,u) + w(u,v)$

↳ always $\leq$ cuz it is the shortest path.

Base 6)

~~Shortes~~

- Single Source shortest path Problem

- all pair shortest paths problem.
  ↳ Table.

- distance (weight) can be Non negative or Negative
  find the shortest path in Negative distance.
  use appropriate Algorithm in some case
  → if there is no cycle that's very fast algorithm.

If we have additional informations like geographical coordinates then we can set more faster algorithms.

Pose 7), Pose 8)

Negative distance.

exchange-rates Networks	shortest path problem	Differences
1) Multiplying weights 2) Maximum paths	adding weights minimum paths	

So how can we solve this problem?

→ To use ~~rede~~ reducing way. (reduction)

do not change the nodes just weights

As using reduction way there are negative weights
so we can't use dijkstra algorithm

Page 9) Flow Networks.

We are underlying our network scenario

Nodes : represents computers

edges : Always non-negative, And this is Capacity of Connection.

We can use this

·) In computer networks : the bandwidth of the link.
(The maximum data transfer rate)

·) In transportation networks : the maximum number of vehicles can enter the road during a one-hour period.

·) In financial analysis : the maximum funds which can be transfered from one site to another.

What kind of Question may ask in here?

·) Maximum flow Question

$s \rightarrow t$
Source to destination ⇒ finding a maximum flow.

* 한 edge의 최대 capacity를 찾는것! 흐름량과 상관.

Algorithm that optimal way of sending flow from one site to another site in the network.

Case 11) Minimum cost flow.

·) bit more complecated than maximum flow because we have more than 1 sources.

nodes = number of production (+, supply)
number of demand (−, demanding)

edge = (x, y) x = capacity of link
y = cost of sending one unit.

Some distribution problem can be ~~used~~ solved by this.

Case 12) Multicommodity flow.

·) 1 Common Network
number of commodities using network.

여러 노드들이 각자의 도착지점에 하나의 네트워크를 통해서 자원을 보내는 문제.

goal : Minimise the maximum congestion on an edge.

May ask organizing flow in the network in the exam.

Lec 1)

page 13) NP-hard problems, ~~both~~ metaheuristics.

V to W : fast algorithms exist
V to W : visits all sites No fast algorithm is known.

branch and bound method. (base)
⇒ find optimal solution (Not for big input, medium size may work)
if it is not working reduce input.

⇒ approximation algorithms : they don't ~~guarantee~~ guarantee the best path, but guarantee 상당히 이상적 수.
↳ we don't talk about it in this lec.

⇒ heuristics ⇒ they don't guarantee the ~~best~~ optimal how good solution is
just examine and test whither this algorithm may good or not.

↳ problem specific heuristics
metaheuristics
simulated annealing
genetic programming