quiz4 : today

lab3 : Posted, due friday

New Problem in graph Theory:

Single Source Shortest Paths (SSSP)

Defn

Given $x, y \in V(G)$, the distance from x to y is

$$\delta(x,y) = \begin{cases} \text{min length of an } x\text{-}y \text{ Path in } G, \text{ if } y \text{ is reachable from } x. \\ \infty \text{ if } y \text{ not reachable from } x \end{cases}$$

SSSP Problem:

Given $s \in V(G)$, determine $\delta(s,x)$ for all $x \in V(G)$. Further, if $\delta(s,x) < \infty$ (i.e. x is reachable from s) determine a shortest s-x path in G.

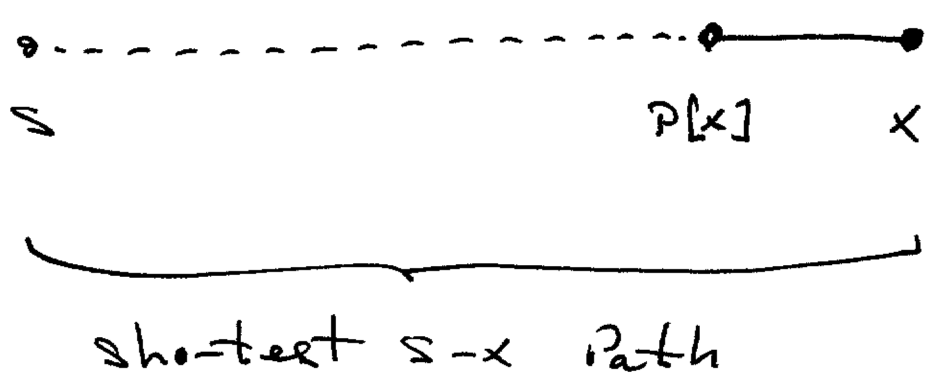
Solution: Breadth First Search (BFS).

BFS is basically reachable() all over again.

Add 2 new attributes.

- A dictionary : distance
  distance[x] gives $\delta(s,x)$, the length of a shortest s-x Path.

- A dictionary : Predecessor
  predecessor[x] gives the Predecessor vertex of x along a shortest s-x Path.

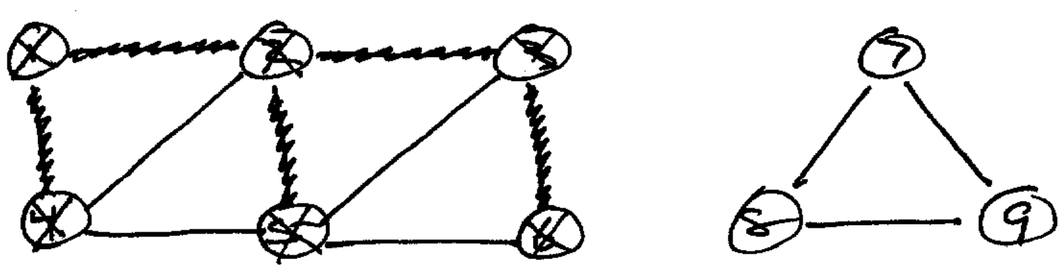


when a new vertex y is discovered, we set Predecessor[y] to be the vertex x from which y was discovered, i.e. as a member of adj[x].

we also set distance[y] to be one more than distance[x].

$$\text{distance}[y] = \text{distance}[x] + 1$$

Ex. (same)



source = 1

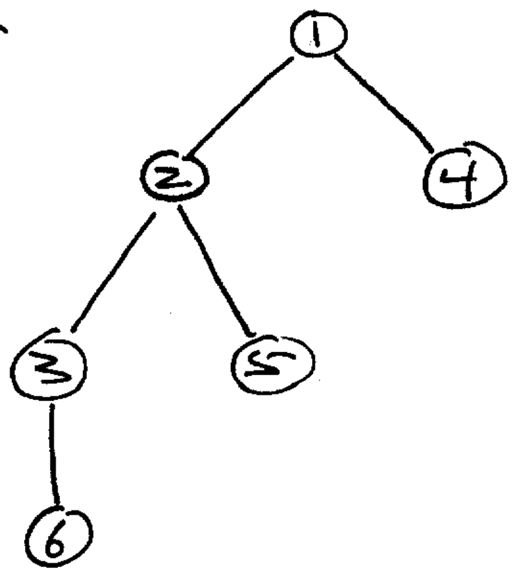
discovered queue:

~~1~~ ~~2~~ ~~4~~ ~~3~~ ~~5~~ ~~6~~

dist:

Predessor subgraph:

also called a shortest path tree



0

1

2

3

shortest 1-6 path is

$\boxed{1, 2, 3, 6}$

see Recursive function getPath()

Exercises.

- run on same graph, different sources.
- run on different graphs.

Next time!

- Graph coloring
- PaG