

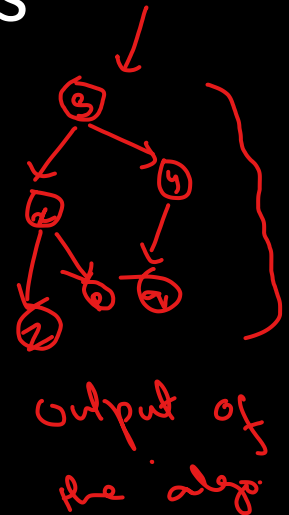
Date: 26/05/21

# Black Board

## Design and Analysis of Algorithms

Topics:

- Single Source Shortest Paths  
(Source means starting point)

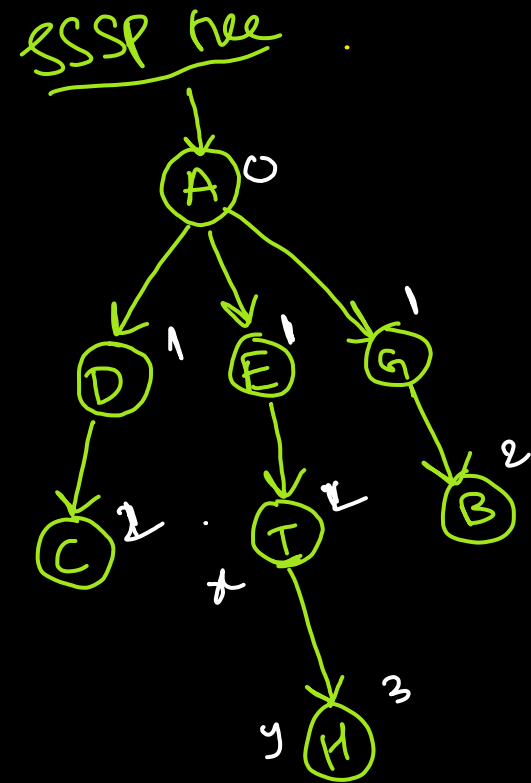
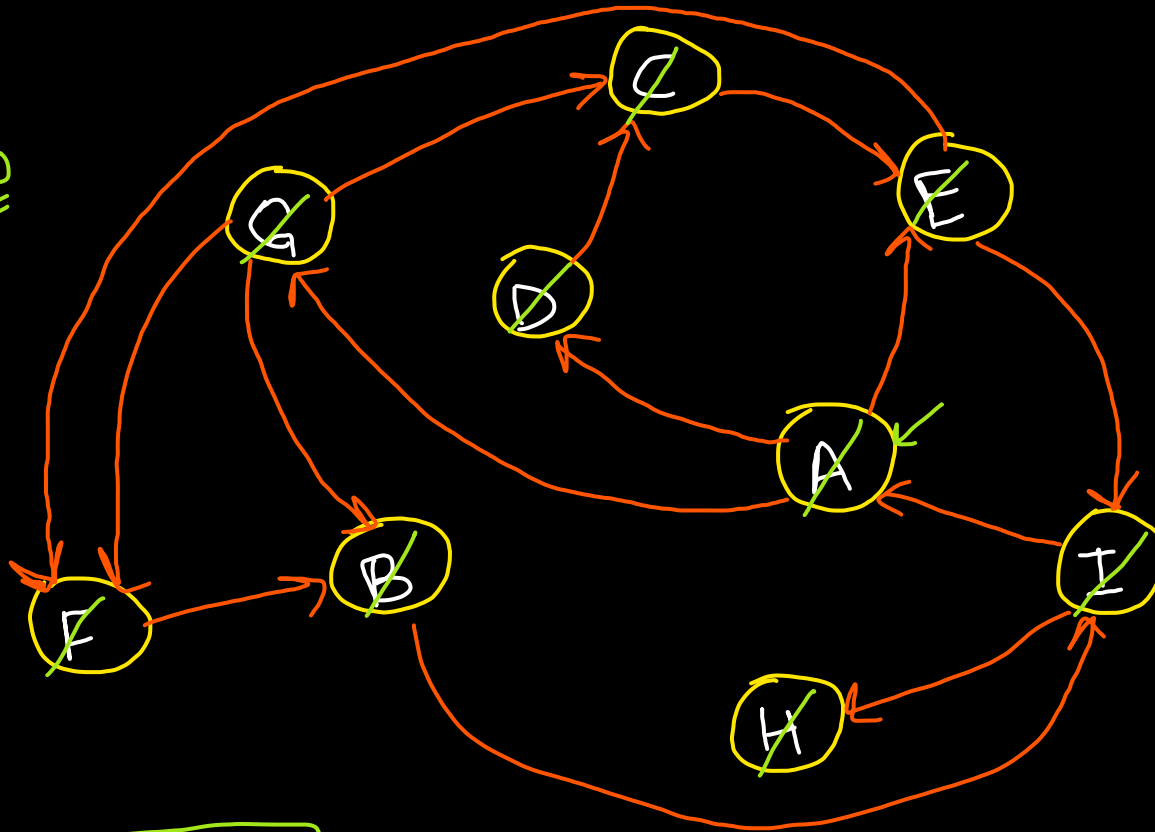


# Single Source Shortest Paths for various types of graphs

SSSP algo

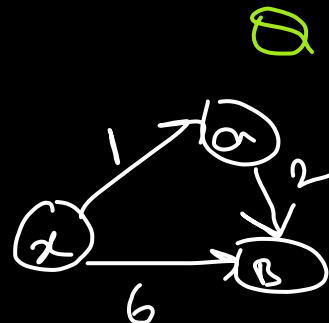
<u>Directed or Undirected Un-weighted Graph</u>	<b>BFS</b>	$O( V + E )$ <i>linear</i>
<b>Directed Acyclic Graph</b> (Weighted) ✓	<b>DP based on Topological Sort</b>	$O( V + E )$ <i>linear</i>
<b>Directed or Undirected Weighted Graph</b> (+ve weights)	<b>Greedy Algorithm</b> ( <u>Dijkstra's Algorithm</u> )	$O(( V + E )\lg V )$
<b>Directed or Undirected Weighted Graph</b> (+ve or -ve weights)	<b>DP Algorithm</b> ( <u>Bellman-Ford Algorithm</u> )	$O( V  E )$

# BFS: Breadth First Search



Handwritten notes in a box:

- $Par[D] = A$
- $Par[E] = A, Par[G] = A \dots$



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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SSSPBFS( $G=(V,E)$ ,  $s$ )

// setup

$\left[ \begin{array}{l} \text{Par}[] \leftarrow \text{nil} \\ \text{dist}[] \leftarrow \infty \\ \text{dist}[s] \leftarrow 0 \\ \hline \text{Create } Q \end{array} \right]$

$Q.\text{enqueue}(s)$

WHILE  $!Q.\text{empty}()$

$x \leftarrow Q.\text{dequeue}()$

For each  $(x,y) \in E$ :

IF  $\text{dist}[y] == \infty$ :

$\left[ \begin{array}{l} \text{dist}[y] = \text{dist}[x] + 1 \\ \text{par}[y] = x \\ Q.\text{enqueue}(y) \end{array} \right]$

# Using BFS as a shortest path algorithm (Un-weighted Graphs)



# Shortest Paths in DAGs

