

→ Every Action/Move: associated Cost $C > 0$

Repeated Nodes: [✓] Visited List (Already Tested for goal Test)
PQ → Explored List

- ↳ If repeated node's in the visited list (Ignore it) → Test
- ↳ If repeated node is in the exploring list with the higher cost, replace node with lower cost

Visited Nodes: If repeated node has lower cost than the node already visited in the visited list
↳ Remove that node from the visited list and insert (add) to the exploring list

... .. Search Algorithm (Dijkstra Alg) [✓] PQ

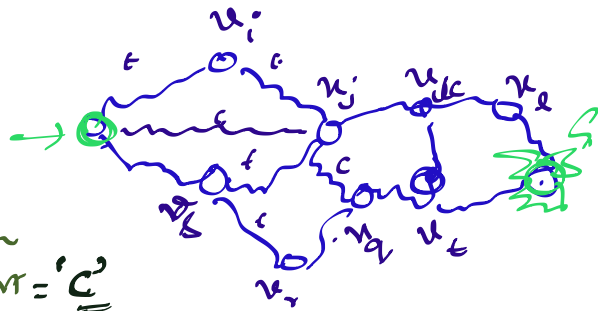
Uniform Cost Search \rightarrow Shortest Path

Breadth First Search edge cost $c > 0$
Algo.

Goal is at depth ' d '.

branching factor: ' b '.

Reach to the goal with
optimal (minimal) cost = ' c '



If every edge/action minimal cost (c). (Uniform)

compute the depth of the goal Node
 optimal path cost is 'c'

$$d \approx \left\lfloor \frac{c}{\epsilon} \right\rfloor + 1$$

epsilon > 0

In general $d \leq \left\lfloor \frac{c}{\epsilon} \right\rfloor + 1$ $\epsilon > 0$

Time : $O(b^{\left\lfloor \frac{c}{\epsilon} \right\rfloor + 1})$ | Optimal: YES ✓
 Space : $O(b^{\left\lfloor \frac{c}{\epsilon} \right\rfloor + 1})$ | Complete: YES ✓

$PQ = \{A_0^{NA}\}$ $visited = \{A_0^{NA}\}$

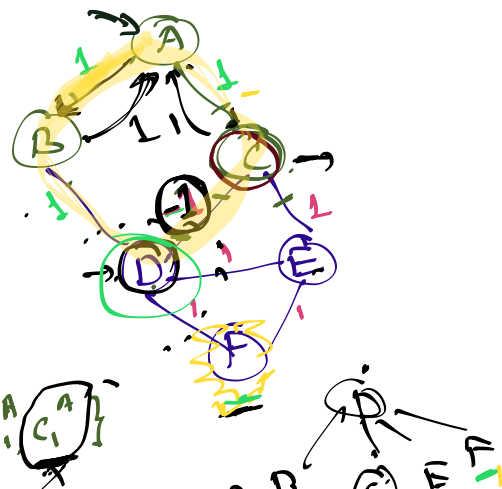
$PQ = \{B_1^A, C_1^A\}$

$g(A) = g(A_0^{NA}) + cost(A \rightarrow B)$

$PQ = \{C_1^A, D_2^B\}$; $V = \{A_0^{NA}, B_1^A\}$

$PQ = g(D_2^B) = g(C_1^A) + cost(C \rightarrow D) = 0$

$PQ = \{D_2^B, E_2^C\}$ $V = \{A_0^{NA}, B_1^A, C_1^A\}$

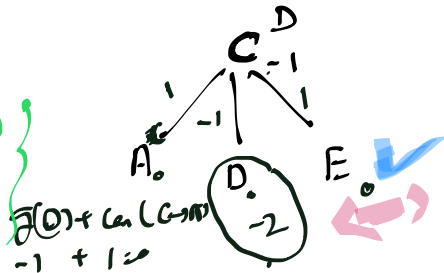


$$PQ = \{ \underline{C_{-1}^D}, \underline{E_1^D}, \dots \} \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark$$

$$PQ = \{ \textcircled{C_{-1}^D}, \textcircled{E_1^D}, \textcircled{F_1^D} \} \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark \quad \checkmark$$

$$V = \{ A_0^A, B_1^A, D_0^A \}$$

$$PQ = \{ \textcircled{D_{-2}^D}, E_0^D, F_1^D \}$$



$$D(D) + C_{-1}(C) = -1 + 1 = 0$$

Negative Cost Edge : OPTIMALITY : NOT \hookrightarrow
Completeness : NOT \hookrightarrow

If the priority order is same as the DFS
Visit order. ✓

Read Heap DS { Binomial heap (min/max), Heap, Binomial heap, Fibonacci Heap }
Core man (Algorithm Book)

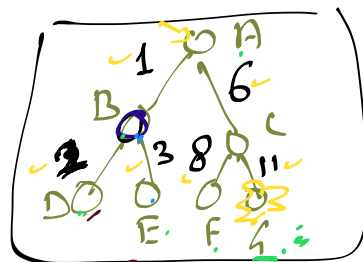
Application }

PQ :- $\{A_0^{NA}\}$

1. $PQ = \{ \overset{A}{B}, \underset{\text{gr. 1}}{C}, \overset{A}{D} \}$

$PQ: \{ \begin{pmatrix} B \\ D \\ 3 \end{pmatrix}, E^B_4, C^A_6 \} : v = \{ A^N_0, B^D_1, D^P_2 \}$

Prob- $\{E_4^B, L_6^A\}$

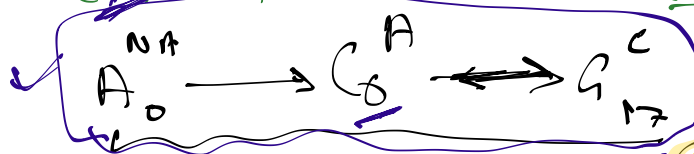
$$PQ = 1 \text{ C. A2} \Rightarrow PQ = \sqrt{E^C} \quad \text{C} \quad 2 \quad \text{A} = S^{\text{an}} \text{ A} \text{ B}$$


סג

$\{ \underline{6} \}$ $\{ \underline{14}, 17 \}$ $\{ 10, 15, 17, 3, \underline{E^B}, \underline{C^A} \}$

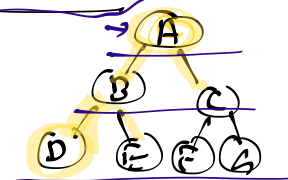
$PQ = \{ \underline{G_{17}^C} \}$ $V = \{ A_0^{NA}, B_1^A, D_3^B, E_4^B, \underline{C_6^A}, F_{14}^C \}$

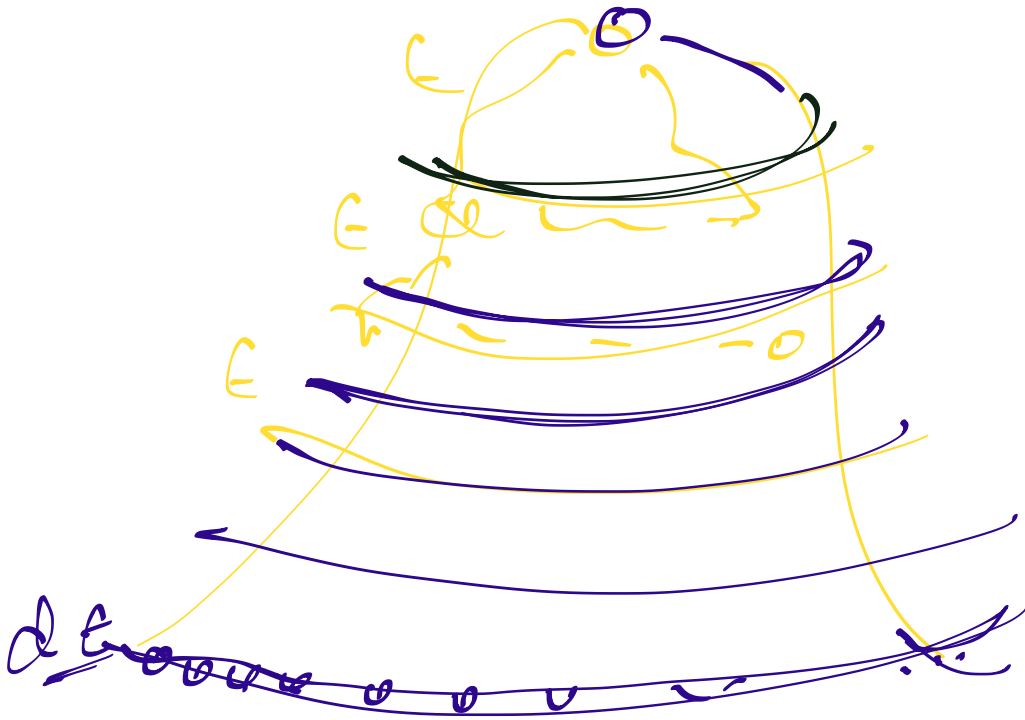
\Rightarrow Goal Test (G) is passed Algo will stop.



DFS
 $A \rightarrow B \rightarrow D \rightarrow E \rightarrow C \rightarrow F \rightarrow G$

BFS: $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow F \rightarrow G$





→ Heuristic Values (Guss / Common Sense)
Experienced Values)

rough
let we have estimate of the path cost from start
node to the other nodes including Goal Node.

heuristic

	A	B	C	D	E	F	G
Start (A) →	A→A	B→A	C→A	D→A	E→A	F→A	G→A
	15	13	12	16	11	9	0

$h(A) = A \rightarrow A$
Cost of the goal node from any node

Let edge cnt is uniform on root edge
cnts

Build the PO DS on heapish

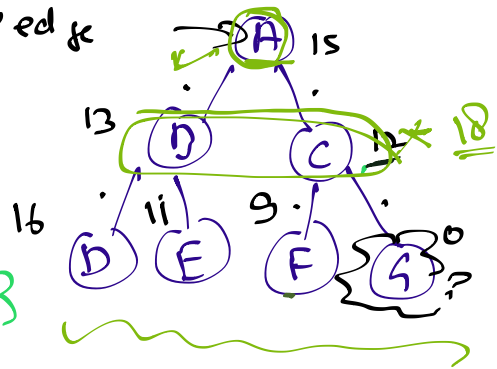
Value:

$$p_a = \{ n_{15}^{na} \} \quad v = \{ n_{15}^{nr} \}$$

$$P_k = \{c_{12}^A, b_{13}^A\}$$

$$V = \{ A_{15}^{NT}, C_{12}^A \}$$

$$P_Q = \{ F_9^c, G_0^c, B_{12}^A \} = n'' \quad A \rightarrow C \rightarrow G$$



$$\hookrightarrow g(u_i) + h(u_i)$$

A* search

$$\left(\text{start} \rightarrow u_i + \underbrace{u_i \rightarrow \text{goal}}_h \right) \Rightarrow$$

Optimal

Admissible
heuristic