Informed Searching

NO Date

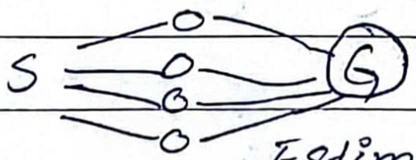
admissible ↑ . Heuristic Search

A* Algorithm → some knowledge about problem

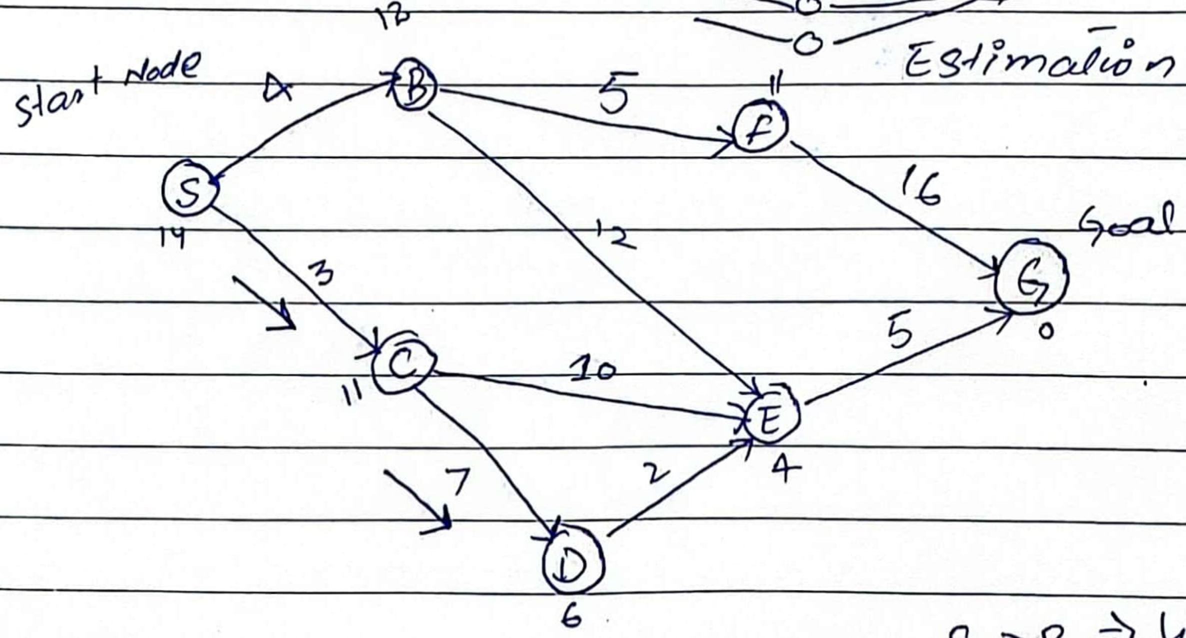
$f(n) = g(N) + h(N)$ → Estimation cost from n to Goal Node

$f(n)$ ↓ Heuristic Function

$g(N)$ → Actual cost from start node to n



Estimation cost



$S \to B \Rightarrow 4 + 12 = 16$

$S \to C \Rightarrow 3 + 11 = 14$ (circled)

$f(S) = 0 + 14$

[$SC \to E \Rightarrow 3 + 10 + 4 = 17$

[$SC \to D \Rightarrow 3 + 7 + 6 = 16$ (circled)

~~$SB \to F \Rightarrow 4 + 5 + 11 = 20$~~

~~$SB \to E \Rightarrow 4 + 12 + 4 = 20$~~

[~~$SCD \to E \Rightarrow 3 + 7 + 2 + 4 = 16$~~ (circled)

$SCDE \to G \quad 3 + 7 + 2 + 5 + 0 = 17$ (circled) ✓

$TC = O(V + E)$

$O(b^d)$ — d: Depth, b: Branch Factor

کتنے چلڈرن ہیں کسی نوڈ کے

$SC = O(b^d)$

Two-Player Game Playing

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Minimax Algorithm

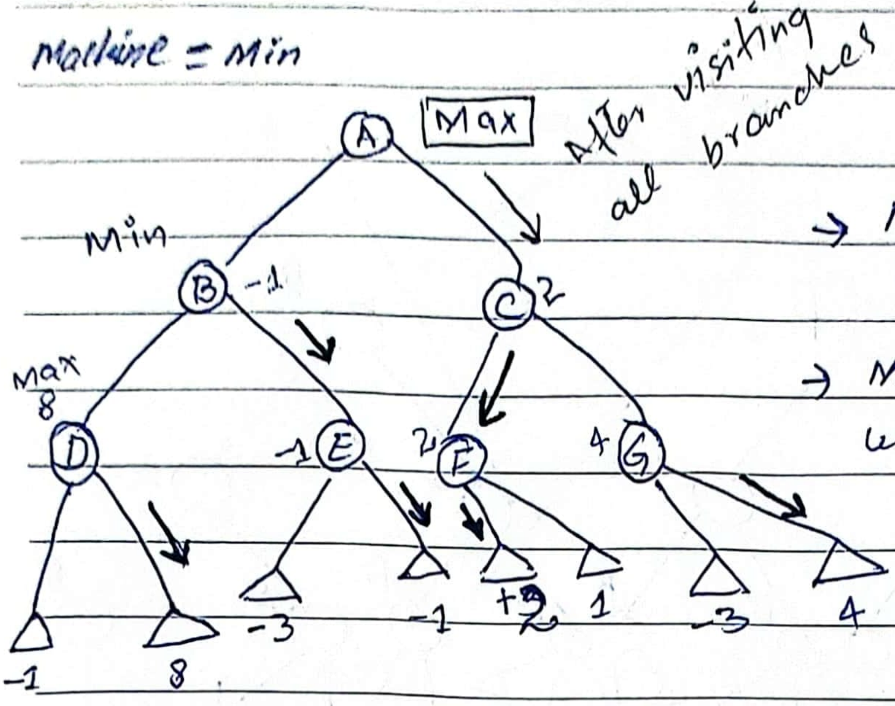
Let's say:

Human = Max

Machine = Min

→ Back tracking algo.

→ Best move strategy used



← Terminals

→ Max will to maximize its utility (Best move)

→ Min will to minimiz utility (worst move) for Max

Game Tree

Utility

Max Reward

Max Profit

$O(b^d)$

2 — depth

$3^2 = 9$

/ branches

35^{100} Game Tree for chess

بہت بڑا ٹری بنے گا۔

Alpha-Beta اس کو کم کرنے کے لیے ہم پروننگ یوز کریں گے۔

Max: A → BC

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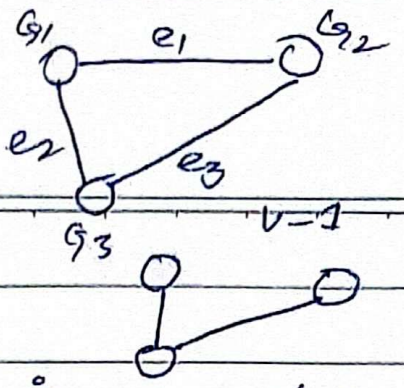

Spanning Tree

A spanning tree is a sub-graph that

→ includes all vertices of the original graph

→ has not cycles (loops)

→ has exactly (V-1) edges (where V is the number of vertices)

→ Is connected, meaning there is path b/w any two vertices.

Key Properties

⇒ A graph with N vertices can have multiple spanning trees. Formula (n^{n-2})

→ The minimum spanning tree is the spanning tree with the smallest total edge weight (used in algorithms like Prim's and Kruskal's)

Example

If you have a road network connecting cities, a spanning tree would be a subset of roads that connect without any redundent roads.

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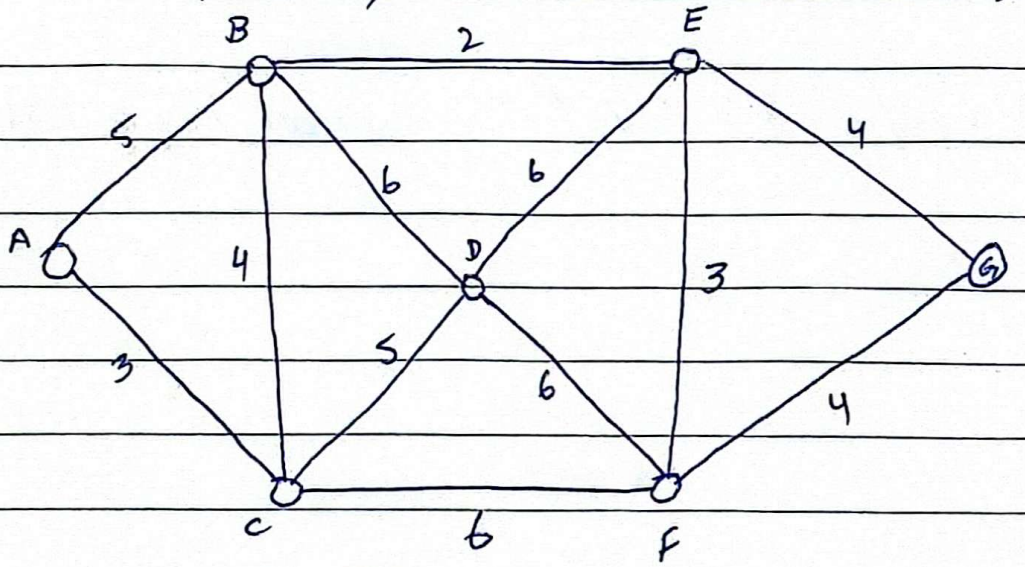
Kruskal Algorithm

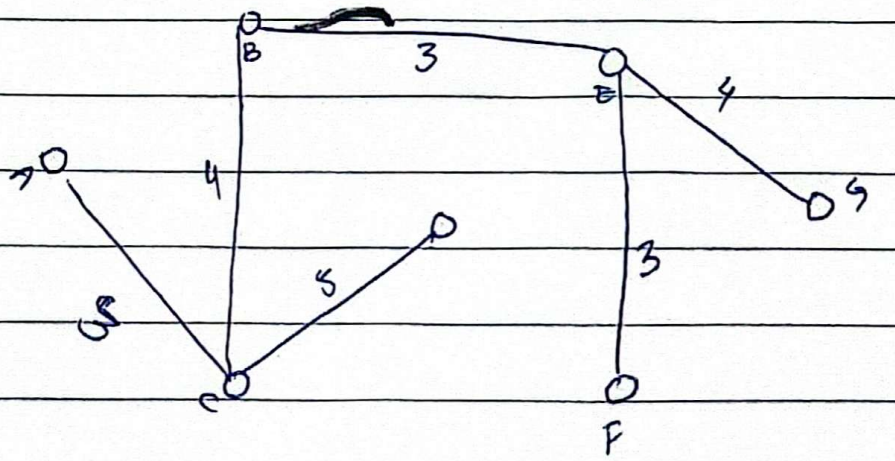
→ It is a greedy algorithm used to find minimum spanning tree of a weighted, connected, and undirected graph.

→ No. of vertices same while edges should be n-1.

→ It constructs Min Heap with e edges

→ Take one by one edge and add it in spanning tree (without loops)





Minimum cost = 21

Minimization Problem

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Prim's Algorithm

→ It is used to find minimum cost spaning tree (MST)
↓ acyclic

MST ⇒ vertices = V
Edges = V-1

→ It works on weighted, connected and undirected graph.

→ It follows the "Greedy Approach".

→ You can start from any vertex