Informed Search

→ It is a search which tries to reduce amount of search that must be done by making intelligent choices for the nodes that are selected for expansion.

→ It consist of information about goal state.

→ Better than uninformed search

→ finds optimal solution to reach Goal state using Heuristic function.

→ Eg :- * Hill climbing
　　　　 * Best fit Search algo
　　　　 * A* Search algo , AO*
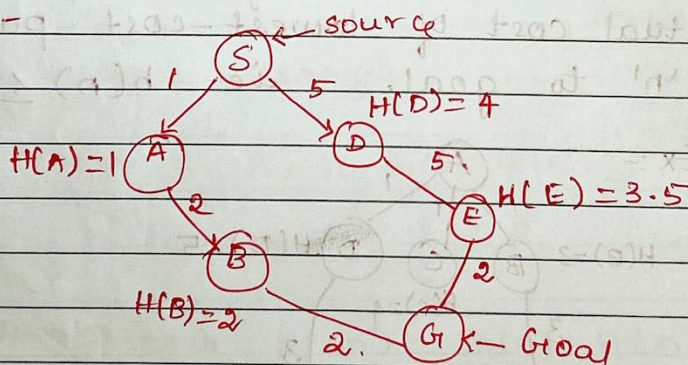
Formula :-

$$f(n) = G(n) + H(n)$$

where.

　　　 f(n) : Overall cost
　　　 G(n) : path cost
　　　 H(n) : Heuristic value

Ex :-

source

$H(D) = 4$
$H(A) = 1$
$H(E) = 3.5$
$H(B) = 2$

G ← Goal

S to G.

$$S \nearrow A \quad [f(n) = G(n) + H(n)]$$
$$= 1 + 1 = 2.$$

$$\searrow^{5} D \quad [f(n) = G(n) + H(n)]$$
$$= 5 + 4 = 9$$

$2 < 9$.
So choose path A.

$S \to A$

$S \xrightarrow{1} A \xrightarrow{2} B \quad = f(n) = G(n) + H(n)$
$$3 + 2 = 5$$

→ heuristic value for Goal is 0.

$S \xrightarrow{1} A \xrightarrow{2} B \xrightarrow{2} G = f(n) + G(n) + H(n)$
$$5 + 0 = 5 \quad \to \text{total cost.}$$

Heuristic search:-

Simple searching technique tries to Solve problem in optimize way using heuristic function.

↓

minimum steps/cost

Heuristic function:-

It is a function $f(n)$ that gives an estimation on the cost of getting from node 'n' to the Goal state.

↳ Helps in Selecting optimal node for expansion

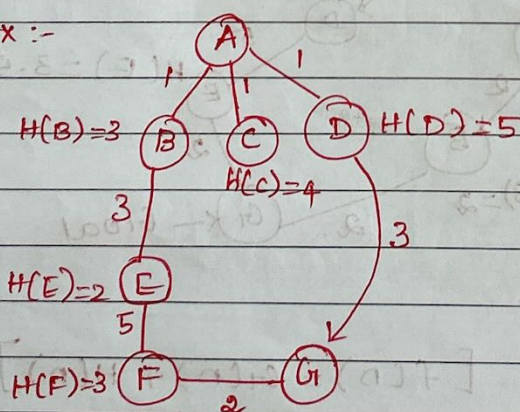## Types of Heuristic :-

① Admissible
② Non-Admissible

(1) Admissible :-

→ In this Heuristic function, never over estimates the cost of reaching the Goal.

→ $h(n)$ is always less than or equal to actual cost of lowest-cost path from node 'n' to goal.   ie $h(n) \leq h'(n)$

↳ Goal state

Ex :-

$$A \to B \implies f(n) = G(n) + H(n) = 1 + 3 = 4$$
$$\quad\quad C \implies f(n) = G(n) + H(n) = 1 + 4 = 5$$
$$\quad\quad D \implies f(n) = G(n) + H(n) = 1 + 5 = 6$$

It is less cost. so choose B.

$$A \xrightarrow{1} B \xrightarrow{3} E \implies f(n) = G(n) + H(n)$$
$$H(E)=2 \quad\quad = 4 + 2 = 5$$

$$A \xrightarrow{1} B \xrightarrow{3} E \xrightarrow{5} f \implies f(n) = G(n) + H(n)$$
$$H(f)=3 \quad\quad\quad 9 + 3 = 12$$

$$A \xrightarrow{1} B \xrightarrow{3} E \xrightarrow{5} F \xrightarrow{2} G =$$

$$f(n) = G(n) + H(n)$$
$$= 11 + 0$$
$$= 11.$$

Cost :-

$$A \to B \to E \to F \to G = 11$$

In admissible

$$H(n) \leq H'(n)$$

Goal state cost.

$$H(B) \Rightarrow 3$$

$$3 \leq 11. \quad so \quad admissible$$

$$H(E) = 2. \quad 2 \leq 11 \quad '' \quad ''$$

$$H(F) = 3 \quad 3 \leq 11 \quad '' \quad ''$$

*A, *UA.

(ii) Non - Admissible :-

In this heuristic function overestimate the cost of reaching goal.

i.e $H(n) \geq H'(n)$
↳ Goal state cost. to reach

from above example :-

$$A \to D = f(n) = G(n) + H(n)$$
$$= 1 + 5$$
$$= 6.$$

$$A \xrightarrow{1} D \xrightarrow{3} G \quad f(n) = G(n) + H(n)$$
$$= 4 + 0$$
$$= 4.$$

$$H(n) \geq H'(n)$$
$$H(D) = 5$$
$$5 \geq 4 \quad (overall \ cost \ to \ reach \ G)$$

So this is non-admissible heuristic search.

Difference between Blind and Heuristic Search.

Blind Search.	Heuristic Search.
→ Also known as unknown/ uninformed search.	It is a method of solving problems more easily and fast.
→ There is no information about the searching.	→ also known as informed search.
→ No knowledge of where the Goal.	They have knowledge of where goal or finish of the graph.
→ Eg: DFS, BFS	Eg:- Hill climbing, A*, AO*, Best first search
→ Efficiency is low.	→ High efficient ↳ less time ↳ less cost.
→ Slower than Heuristic Large.	→ finds solution quickly.
→ Less memory is used	→ No large memory is required
→ No special function is used	→ Heuristic function is used.