#EngineeringPlus Online Course Series

ADAMAS SCHOOL OF ENGINEERING AND TECHNOLOGY

Artificial Intelligence

Module: 01
Lecture:

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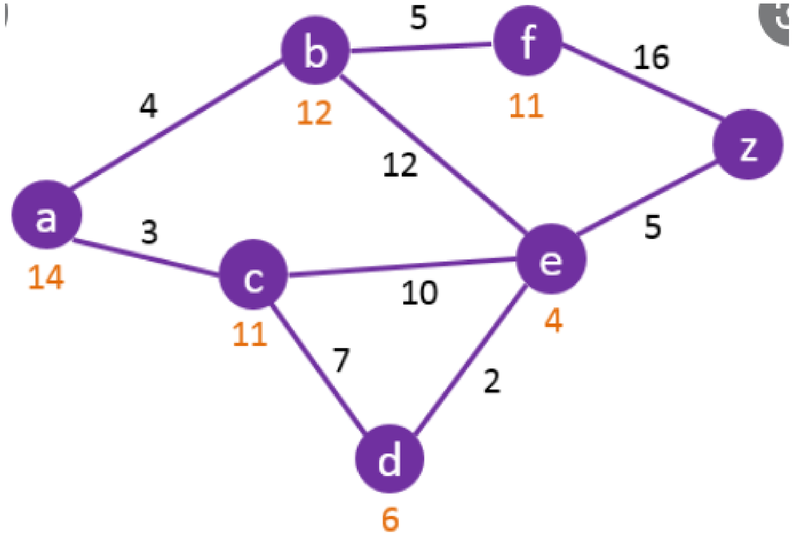
The A* algorithm

- The best - first search is implemented by an algorithm known as A* algorithm.
- The algorithm searches a directed graph in which each node represents a point in the problem space.
- Each node will contain a description of the problem state it represents and it will have links to its parent nodes and successor nodes.
- In addition it will also indicate how best it is for the search process. A* algorithm uses have been generated, heuristic functions applied to them, but successors not generated.
- The list CLOSED contains nodes which have been examined, i.e., their successors generated.

Heuristic function f

- A heuristic function f estimates the merits of each generated node.
- This function f has two components g and h.
- the **function g** gives the cost of getting from the **initial state to the current node.**
- The **function h** is an estimate of the addition cost of getting from **current node to a goal state**.
- The function **f (=g+h)** gives the cost of getting from the initial state to a goal state via the current node.
- Whenever the heuristic function satisfies certain conditions, A* search is both complete and optimal.

Problem



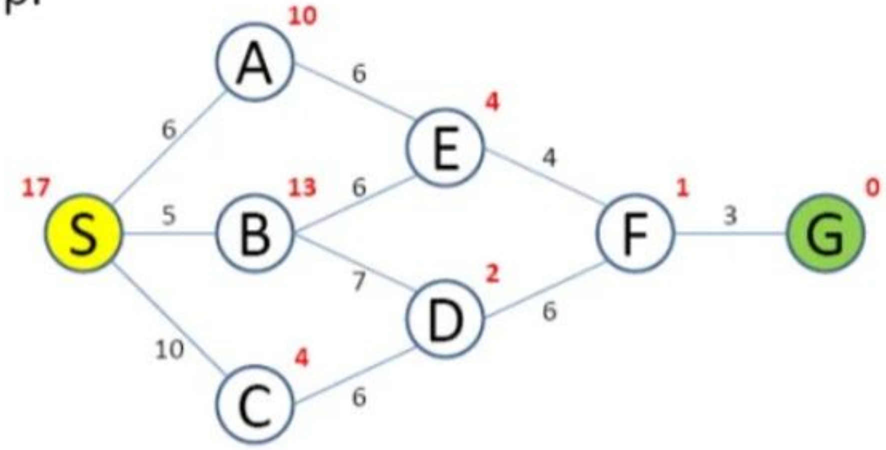
- Use f(N)=g(N)+h(N)
- f(a)=0+14=14
- A->b or a->c
- f(b)=4+12=16 and f(c)=3+11=14
- 14<16
- Expand c, either c->d or c->e
- f(d)=3+7+6=16   and f(e)=3+10+4=17
- 16<17
- Expand either b or d. Let us choose b.
- Either b->e or b->f
- f(e)=4+12+4=20 and f(f)=4+5+11=20
- 20>16
- Expand d, d->e
- f(e)=3+7+2+4=16
- Expand e. e->z
- f(z)=3+7+2+5+0=17
- Path is a-c-d-e-z, cost=17

Admissible A*

- The heuristic function h(N) is called admissible if h(n) is never larger than h*(n), namely h(n) is always less than or equal to true cheapest cost from n to the goal.
- A* is admissible if it uses an admissible heuristic and h(goal)=0
- If the heuristic function **h always underestimates the true cost (h(n) is smaller than h*(n))**, then A* is guaranteed to find an **optimal solution**.

Problem

- Perform the A* Algorithm on the following figure. Explicitly write down the queue at each step.



Hill climbing v/s best first search

	Pros	Cons
Hill Climbing	+ It needs very little memory + It is simple and often gives us a pretty good solution. + In a convex★ search space, it always finds the optimal answer.	- It can get stuck in the local optima. - Plateaus can exist. - Ridges can exist.
Best First Search	+ From the set of possible states, it chooses the best one.	- It requires more memory. - It can get stuck in loops.

References

- Artificial Intelligence, Russell & Norvig, Pearson

Web Resources

https://ai-master.gitbooks.io/heuristic-search/content/properties-of-greedy-best-first-search.html