7-6-2022 "Artificial Intelligence"

finale

- AI : The ability to learn or understand things or to deal with new or difficult situations.

"The laws of thought initiated the field called logic."

⇒ Agent : Perceives its environment through sensors and acts upon that environment through actuators.
→ made of :- (agent = architecture + program)

- Task environments :
  ① Performance measures.
  ② Environment.
  ③ Actuators.
  ④ Sensors.

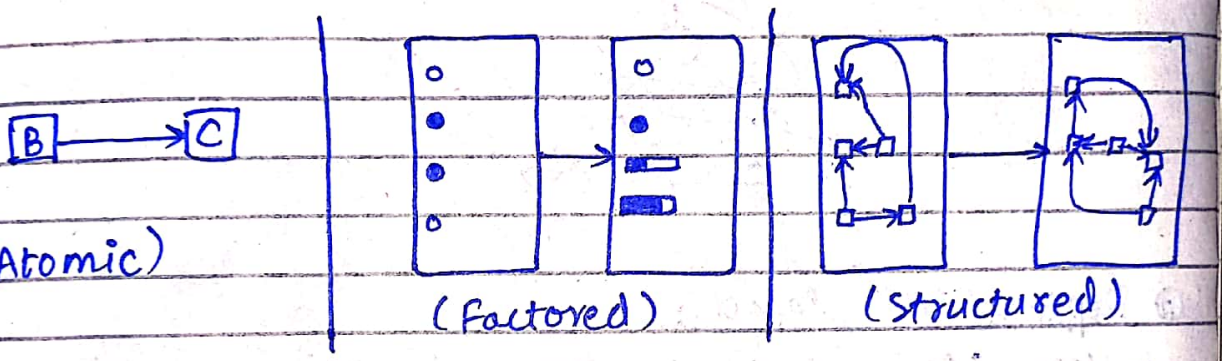
- Environment Types:
  - Fully observable vs partially observable.
  - Deterministic vs stochastic.
  - Episodic vs sequential.
  - Static vs dynamic.
  - Discrete vs continuous.
  - Single agent vs multi-agent.

- Agent Types :

① Simple Reflex agent.
② Model-based agent.
③ Goal-based agent.
④ Utility-based agent.

⇒ Learning agent:
- learning element.
- Performance element.
- Critic.
- Problem generator.

⇒ State representations:



"Tree"	"Graph"
• made of nodes & links • has root node. • No loop.	• made of nodes & links. • directed or undirected. • Loops are allowded.

⇒ Problem definition:
- Initial states.
- Actions.
- Transition Model.
- Goal test.
- Path cost.

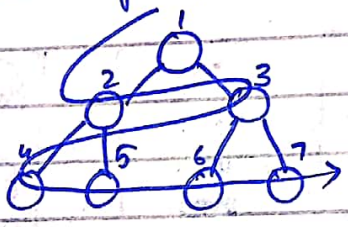
⇒ Terminologies:
- Visited or Open list.
- Expanded or close list.

⇒ Uninformed Searches:

- also called "blind searches".

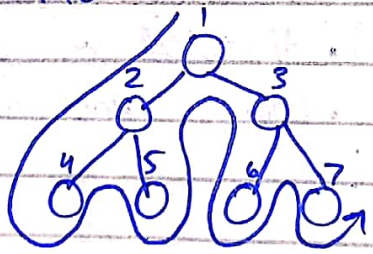
① Breadth - First Search:

> Uses Queue data structure. (FIFO)
> Complete? Yes, if b is finite.
> Optimal? Yes, if path cost = 1 per step.



② Depth - First Search:

> Uses Stack data structure. (LIFO)
> Complete? No
> Optimal? No



③ Depth - Limited Search:

> $l < b$.

④ Iterative deepining Search:

> $l = 1, l = 2 \ldots\ldots l = n$
> Complete? Yes, if b is finite.
> Optimal? Yes, if path cost = 1 per step.

⑤ Uniform-Cost Search:
- > Uses Queue order.
- > Complete ? Yes.
- > Optimal ? Yes.
- > Uses path cost to achieve goal.

⑥ Bidirectional Search:
- > Run two simultaneous searches.
- > forward from initial state, backward from goal.
- > Complete ? Yes.
- > Optional ? Yes.

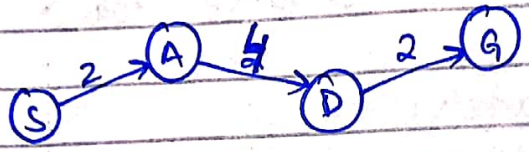
⇒ Informed (Heuristic) Searches:
- Uses 'problem-specific knowledge'.

① Best-First Search:
- > evaluation function : $(f(n) = h(n))$
- > Uses node-heuristic values to goal.
- > Complete ? Only when graph-search tree is finite, otherwise never.
- > Optimal ? No.

② A* Search:
- > evaluation function: $(f(n) = g(n) + h(n))$
- > Uses path cost plus node-heuristic values to achieve goal.
- > Complete ? Yes.
- > Optimal ? Yes.

⇒ Admissible heuristic :

- Heuristic value of the node must be less than path cost to goal.



> heuristic values :
S = 10 , A = 2 , D = 4 , G = 0

- A : 2 <= 6 , OK.
- D : 4 <= 2 , NOT OK.
- S : 10 <= 8 , NOT OK , but the value of S doesn't effect.

- Manhattan Distance :

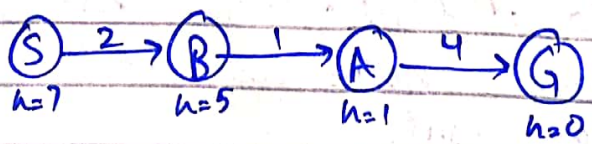
$$= |x_1 - x_2| + |y_1 - y_2|$$

- Euclidean Distance :

$$= \sqrt{|x_1 - x_2|^2 + |y_1 - y_2|^2}$$

⇒ Consistency :

→ $h(n) - h(n') \leq c(n, a, n')$



> S → B : 7 - 5 ≤ 2 , consistent
> B → A : 5 - 1 ≤ 1 , not consistent
> A → G : 1 - 0 ≤ 4 , consistent.