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BTECH 3RD YEAR

AI/ML
Tutorial 3

Ans 1, Problem solving is one of the parts of Artificial Intelligence which encompasses a number of techniques such as algorithms, heuristics to solve a problem.

Ans 2, State Space search is a process used in the field of computer science, including artificial intelligence (AI), in which successive configurations or state of an instance are considered with the intention of finding a goal state with a desired property.

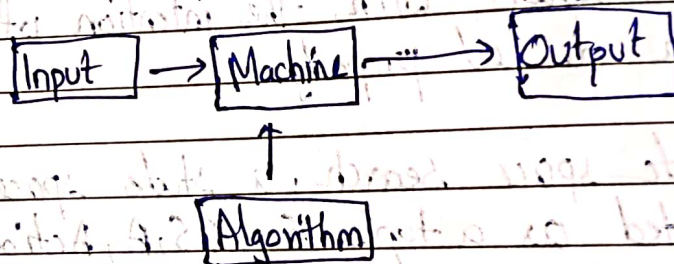
In state space search, a state space is formally represented as a tuple $S: (S, A, \text{Action}(s), \text{Result}(s, a), \text{Cost}(s, a))$, in which:-

- S is the set of all possible states
- A is the set of possible action, not related to a particular state but regarding all the state space.
- $\text{Action}(s)$ is the function that establish which action is possible to perform in a certain state.
- $\text{Result}(s, a)$ is the function that return the state reached performing action a in state s .
- $\text{Cost}(s, a)$ is the cost of performing an action a in state s , In many state spaces is a constant, but this is not true in general.

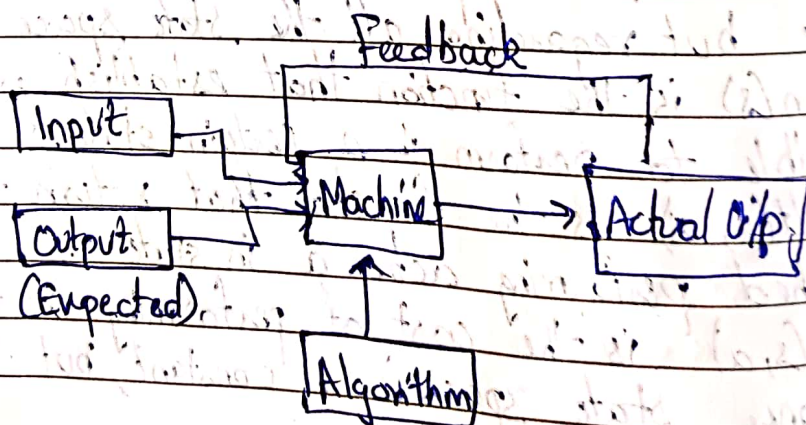
Ans 3: The approach of conventional problems is that they can be solved by particular algorithms that are well defined for a given scenario.

AI based problems offer an undefined but observable environment for which the machine is fed data and it needs to come up with a solution based on that data.

Basically, the below diagram shows clear distinction between the above two concepts:-



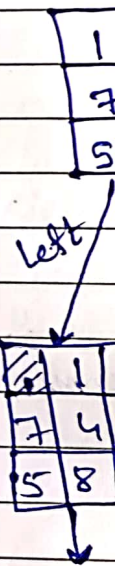
Conventional problem



AI problem.

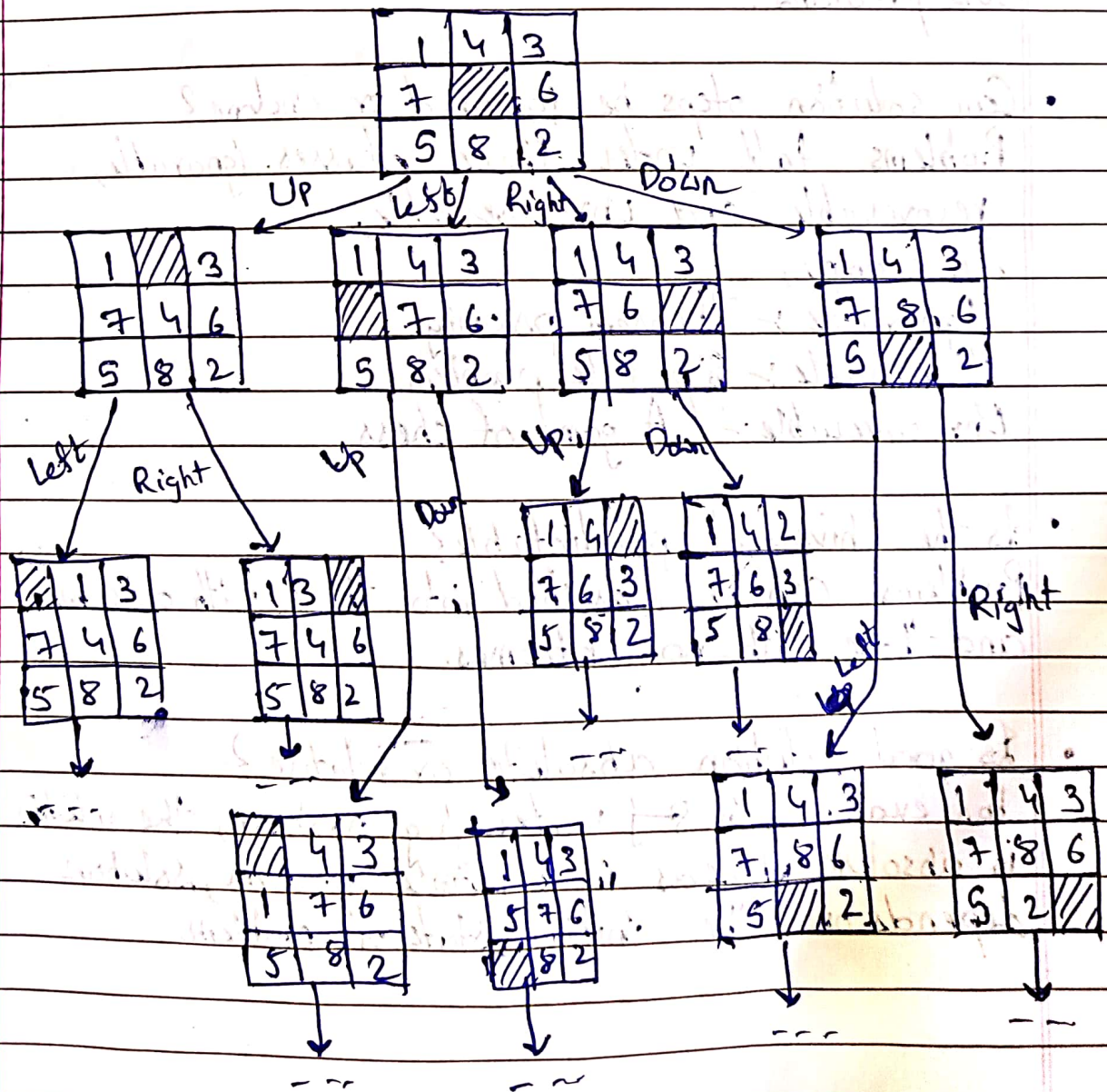
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Ans 4: The 8 puzzle involves moving the tiles on the board board into a particular configuration. The black square on the board represents a space. The player can move a tile into the space, freeing that position for another tile to be moved into and so on.

The ~~see~~ state space tree for the problem is roughly described as follows:-



Ans 5: Heuristic search is a very general method applicable to a large class of problem. It includes a variety of techniques. In order to choose an appropriate method, it is necessary to analyze the problem with the following problem characteristics:

- Is the problem decomposable?
A large problem can be broken down into smaller sub problems.

- Can solution steps be ignored or undone?
Problems fall under three classes: ignorable, recoverable and unrecoverable.

For example,

Ignorable: Theorem proving

Recoverable: 8 puzzle problem

Unrecoverable: A game of chess

- Is the Universal predictable?

Problems can be classified into those with outcomes and those with no outcomes.

- Is good solution absolute or relative?

For example, in 8-j water jug problem, the solution is absolute whereas in 8 puzzle problem, solution depends on the initial state of problem.

- Is the knowledge Consistency knowledge

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- Goal F

- Problem

- Initial s

- Actions

- Transition

- Goal Te

- Path cos

- Is the knowledge base consistent?
Consistency of knowledge refers to the fact that no extra knowledge is gained or required while solving a problem.
- What is the role of knowledge?
- Does the solution involve interaction with a person?
- Problem classification

Ans 6. According to computer science, a problem-solving is a part of artificial intelligence which encompasses a number of techniques such as algorithms, heuristics to solve a problem.

Therefore a problem solving agent is a goal driven agent and focuses on satisfying the goal.

Steps performed by a problem solving agent are:-

- Goal Formulation
- Problem Formulation
- Initial state
- Actions
- Transition Model
- Goal Test
- Path cost

Ans 7: The problem can be solved using the following steps: set of total operations.

1. (X, Y) if $X < 4 \rightarrow (4, Y)$ Fill 4L jug
2. (X, Y) if $Y < 3 \rightarrow (X, 3)$ Fill 3L jug
3. (X, Y) if $X = d \text{ \& } d > 0 \rightarrow (X-d, Y)$ Pour water from 4L to 3L
4. (X, Y) if $Y = d \text{ \& } d > 0 \rightarrow (X, Y-d)$ Pour water from 3L to 4L
5. (X, Y) if $X > 0 \rightarrow (0, Y)$ Empty 4L jug
6. (X, Y) if $Y > 0 \rightarrow (X, 0)$ Empty 3L jug
7. (X, Y) if $Y > 0 \rightarrow X+Y \leq 4$ and $Y > 0 \rightarrow (4, (Y-(4-X)))$ Pour water from 3L to 4L jug until 4L jug is full
8. (X, Y) if $X+Y \leq 3$ and $X > 0 \rightarrow (X-(3-Y), 3)$ Pour water from 4L to 3L jug until 3L jug is full
9. $(0, 2) \rightarrow (2, 0)$ Pour from 3L to 4L jug
10. $(2, 0)$

Thus, the solution steps are:-

