**Problem Solving in Artificial Intelligence**

# PROBLEM DEFINITION

# A problem is characterized by a set of goals, a set of objects and a set of operations.

To build a system to solve a particular problem, we need to do four things:

1. **Define** the problem precisely. This definition must include specification of the initial situations and also final situations which constitute (i.e) acceptable solution to the problem.
2. **Analyze** the problem (i.e) important features have an immense (i.e) huge impact on the appropriateness of various techniques for solving the problems.
3. **Isolate and represent** the knowledge to solve the problem.
4. **Choose the best** problem – solving techniques and apply it to the particular problem.

The reflex agent of AI directly maps states into action. Whenever these agents fail to operate in an environment where the state of mapping is too large and not easily performed by the agent, then the stated problem dissolves and sent to a problem-solving domain which breaks the large stored problem into the smaller storage area and resolves one by one. The final integrated action will be the desired outcomes.

On the basis of the problem and their working domain, different types of problem-solving agent defined and use at an atomic level without any internal state visible with a problem-solving algorithm. The problem-solving agent performs precisely by defining problems and several solutions. So we can say that problem solving is a part of artificial intelligence that encompasses a number of techniques such as a tree, B-tree, heuristic algorithms to solve a problem.

We can also say that a problem-solving agent is a result-driven agent and always focuses on satisfying the goals.

**There are basically three types of problem in artificial intelligence:**

**1. Ignorable:**In which solution steps can be ignored.

**2. Recoverable:**In which solution steps can be undone.

**3. Irrecoverable:**Solution steps cannot be undo.

**Steps problem-solving in AI:**The problem of AI is directly associated with the nature of humans and their activities. So we need a number of finite steps to solve a problem which makes human easy works.

These are the following steps which require to solve a problem :

* **Problem definition:**Detailed specification of inputs and acceptable system solutions.
* **Problem analysis:**Analyse the problem thoroughly.
* **Knowledge Representation:**collect detailed information about the problem and define all possible techniques.
* **Problem-solving:**Selection of best techniques.

**Components to formulate the associated problem:**

* **Initial State:**This state requires an initial state for the problem which starts the AI agent towards a specified goal. In this state new methods also initialize problem domain solving by a specific class.
* **Action:** This stage of problem formulation works with function with a specific class taken from the initial state and all possible actions done in this stage.
* **Transition:**This stage of problem formulation integrates the actual action done by the previous action stage and collects the final stage to forward it to their next stage.
* **Goal test:**This stage determines that the specified goal achieved by the integrated transition model or not, whenever the goal achieves stop the action and forward into the next stage to determines the cost to achieve the goal.
* **Path costing:**This component of problem-solving numerical assigned what will be the cost to achieve the goal. It requires all hardware software and human working cost.

**Defining the problem as state space search**

* Problem solving is a process of generating solutions from observed data.
* is characterized by a set of goals,
* objects, and
* operations.
* These could be ill-defined and may evolve during problem solving.
* problem space is an abstract space.
* A problem space encompasses all valid states that can be generated by the
* application of any combination of operators on any combination of objects.
* The problem space may contain one or more solutions. A solution is a
* combination of operations and objects that achieve the goals.
* search to the search for a solution in a problem space.
* search control strategies
* The depth-first search and breadth-first search are the two common search
* strategies.

Search thru a Search thru a Problem Space / State Space

**Input**

• Set of states

• Operators [and costs]

• Start state

• Goal state [test]

**Output**

• Path: start ⇒ a state satisfying goal test

• [May require shortest path]

Example: Route Planning

**Route Planning Input:**

• Set of states

• Operators [and costs]

• Start state

• Goal state (test)