

Tutorial No. 1

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Tutorial 1 : Design of intelligent Agent

Aim :- To understand the concept of Agent Abstraction by studying definition of rational agent, Agent environment, Task Environment Descriptor, environments types.

Theory :- An Artificial Intelligent system is composed of an agent & its environment. The agents acts in their environment. An agent is anything that can perceive its environment through sensors & acts upon that environment through effectors. This can be clearly seen in Fig. 1. An agent in particular can be :

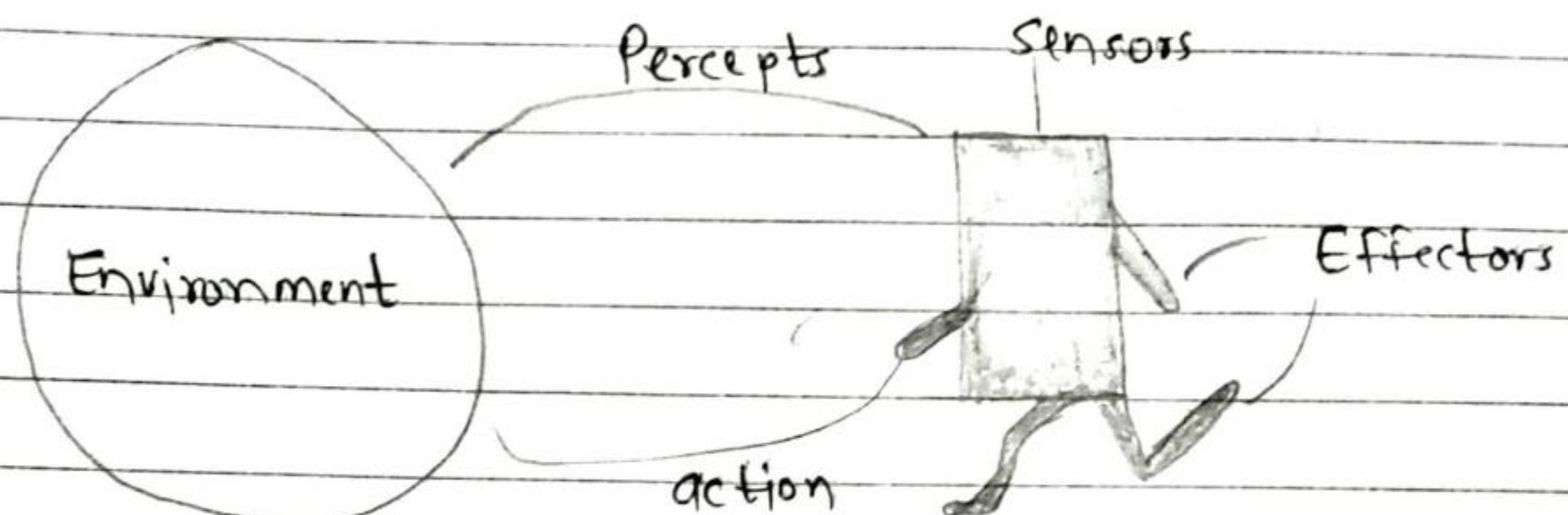
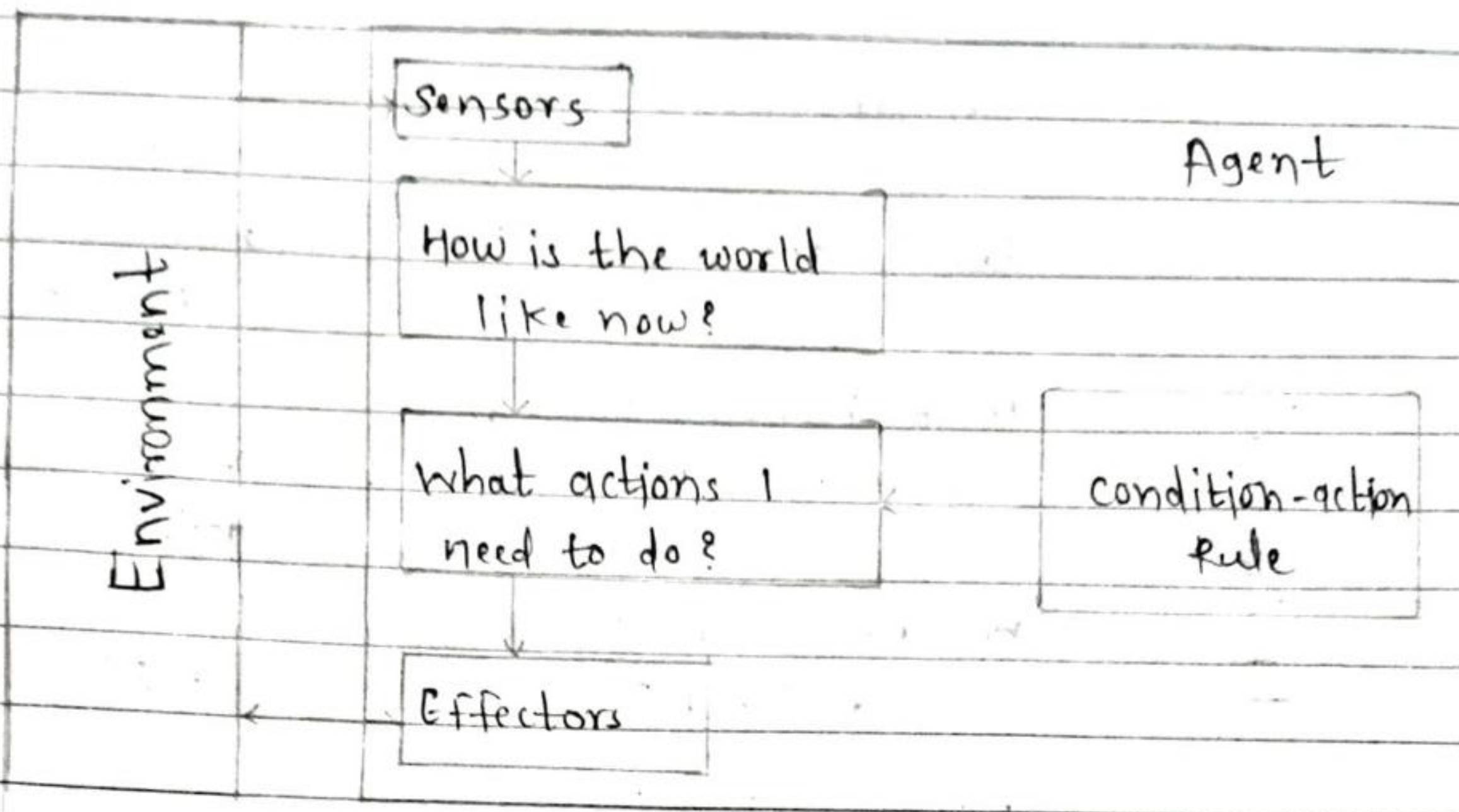
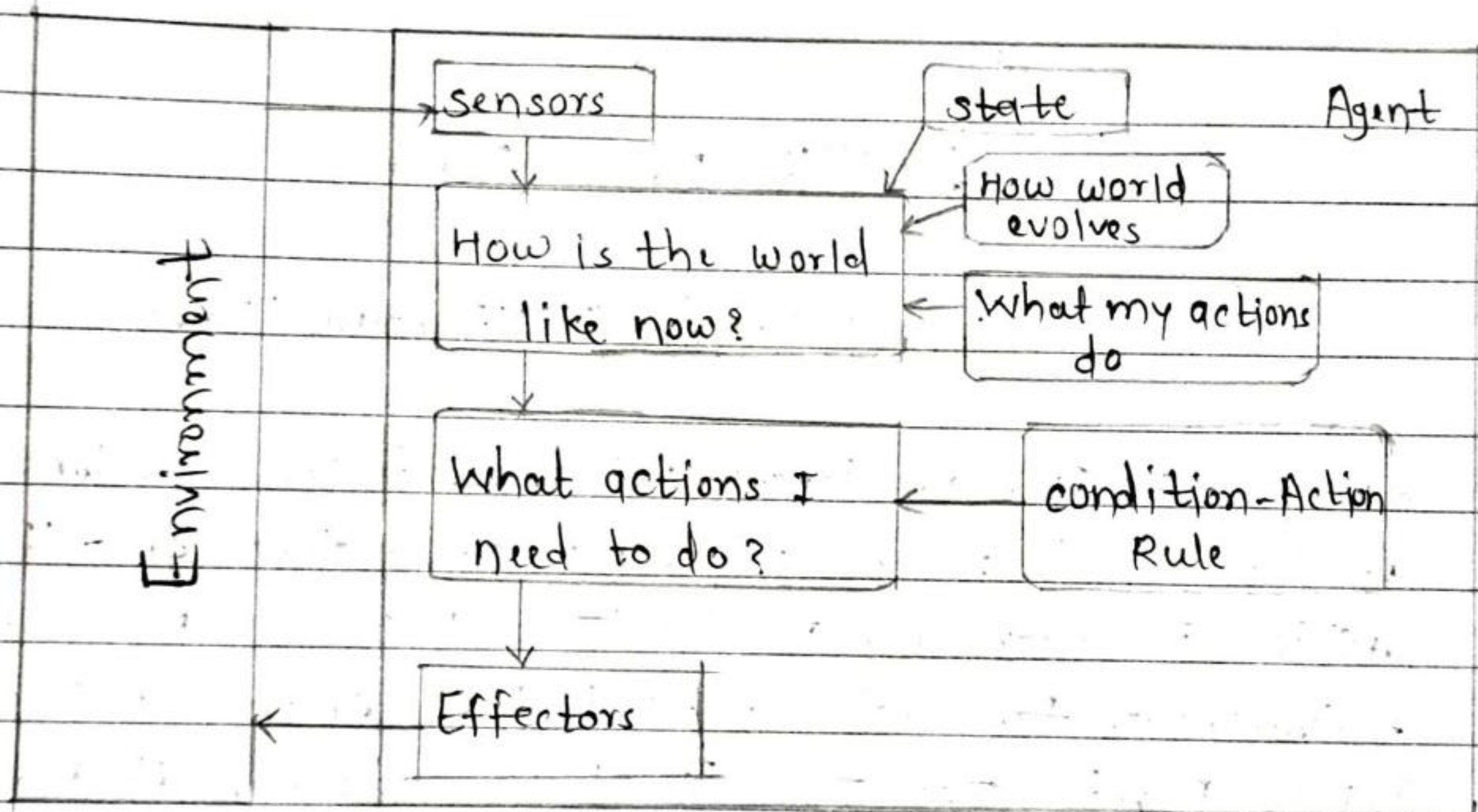


Fig. 1 AI agent with environment

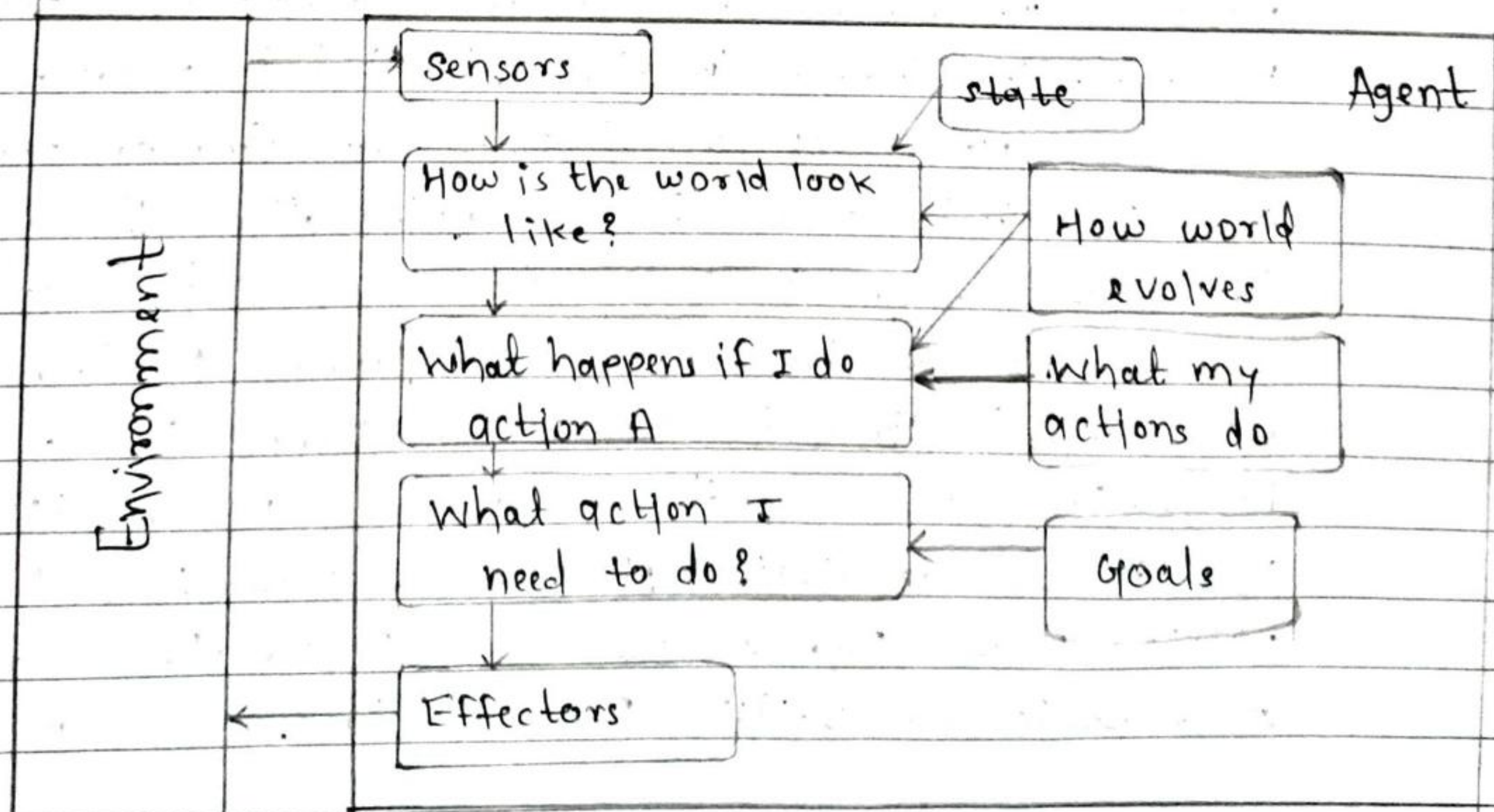
- Human Agent : has sensory organs such as eyes, ears, nose, tongue & skin parallel to the sensors, & other organs such as hands, legs, mouth for effectors.
- Robotic Agent : replaces cameras & infrared range finders for the sensors & various motors & actuators for effectors.
- Software agent : has encoded bit string as its program & actions.
- Agent structure : can be viewed as a combination of agent architecture & Agent program. Agent architecture refers to the machinery that an agent executes on whereas Agent Program is an implementation of an agent functions. Fig. 2 shows four important types of agent architectures.



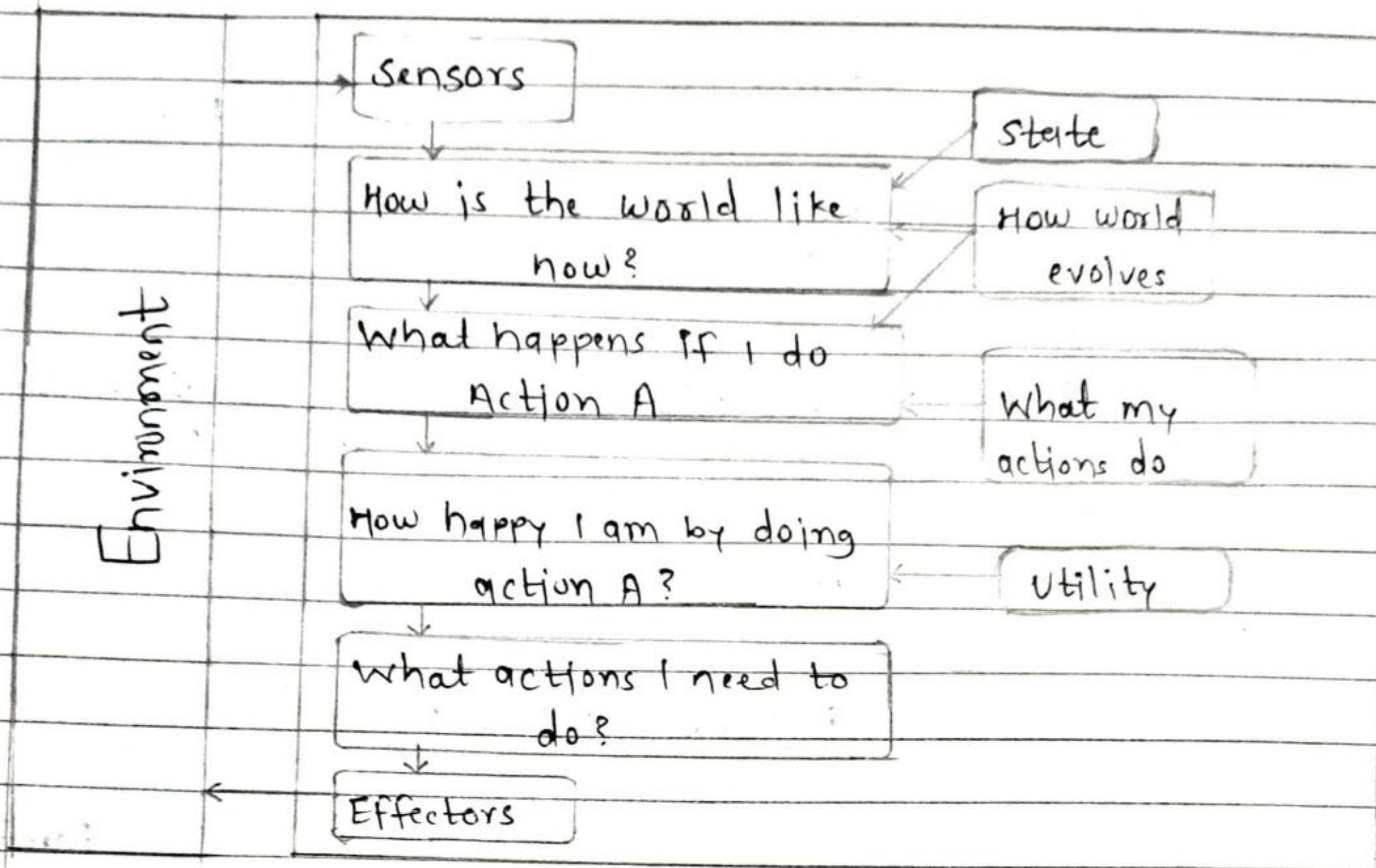
① simple Reflex Agent



② Model Based Reflex agent



③ Goal Based Agent



(d) Utility Based Agent

Fig. 2 : Agent Architecture Types

As seen in Fig. 2a, simple Reflex agent choose actions only based on the current percept only. They are rational only if a correct decision is made only on the basis of current percept. Agent environment for such agents is fully observable. Model Based Reflex Agents shown in Fig. 2b use a model of the world to choose their actions. They maintain an internal state as a persistent information. Here the model means knowledge about how the things happen in the world that is representation of unobserved aspects of current state depending on percept history. Agent take into account how its action affects the world. Goal based agents shown in Fig. 2c, choose their actions in order to achieve goals. Goal-based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications. Goal is the description of desirable situations. Finally, the Utility Based Agents shown in Fig. 2d choose actions based on a preference (utility) for each state. Goals are inadequate

when there are conflicting goals out of which only few can be achieved, goals have some uncertainty of being achieved & you need to weigh likelihood of success against the importance of a goal. On the other hand utility function objectively map how much being in a particular state is desirable.

AI agent is referred to Rational Agent. A rational agent always performs right actions, where the right actions means the action that causes the agent to be most successful in the given percept sequence. The problem the agent solves is characterized by Performance Measure, Environment, Actuators & Sensors (PEAS). These are collectively referred to as PEAS descriptors for the agent task environment. PEAS descriptors provide important insight into agent & the task environment it operates in. These insights are very useful in agent design.

Another important piece of information is task environment properties. While analyzing task environment the agent architect needs to consider following properties:

① Discrete or continuous :

If there are a limited number of distinct, clearly defined states of the environment, the environment is discrete (For example: chess); otherwise it is continuous (For example: automated driving).

② Observable or partially observable :

If it is possible to determine the complete state of the environment at each time point from the precepts it is observable; otherwise it is only partially observable.

③ static or dynamic

If the environment does not change while an agent is acting, then it is static; otherwise it is dynamic.

④ Deterministic or Non-deterministic

If the next state of the environment is completely determined by the current state & the action of the agent, then the

environment is deterministic; otherwise it is non-deterministic.

⑤ Episodic or sequential

In an episodic environment, each episode of event consists of the agent perceiving & then acting. The quality of its action depends just on the episode itself. Subsequent episodes do not depend on the actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead. e.g. - Part Picking robots. Complementary to this is sequential environment where current action dictates the future action.

⑥ Single agent or multiple agents

The environment may contain single agent or other agents which may be co-operating or competing with each other.

⑦ Accessible or Inaccessible

If the agent's sensory apparatus can have access to the complete state of the environment, then the environment is accessible to that agent.

Working :- Search internet for AI based application in following scenarios & identify who is agent for that application. Further list out PEAS descriptors for agent environment in each of the case. Finally try to classify task environment properties like a list of attributes from above list of 7 task environment properties.

① Autonomous Lunar Rover

② Deep Blue chess playing computer program

③ Eliza the natural language processing computer program created from 1964 to 1966 at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum.

④ Automatic Portfolio management

⑤ Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics.

⑥ AlphaGo is a computer program that plays the board game Go. It was developed by Alphabet Inc DeepMind lab in London.

- ⑦ Apples virtual assistance Siri
- ⑧ Endurance: A companion for Dementia Patients.
- ⑨ Casper: Helping Insomniacs Get through the Night
- ⑩ Marvel: Guarding the Galaxy with Comic-Book Crossovers
- ⑪ Automated Cross word Solver

Resources :- The above diagrams are taken from online tutorial available at Tutoriale points on topic AI- Agents & Environments.