A production system is based on a set of rules about behavior. These rules are a basic representation found helpful in expert systems, automated planning, and action selection. It also provides some form of [artificial intelligence](). In this article, we will talk about the production system in artificial intelligence in the following sequence:

- [What is Production System?]()
- [Features of Production System]()
- [Control/Search Strategies]()
- [Production System Rules]()
- [Classes of Production System]()
- [Advantages & Disadvantages]()
- [Production System in AI: Example]()

What is Production System?

Production system or production rule system is a computer program typically used to provide some form of artificial intelligence, which consists primarily of a set of rules about behavior but it also includes the mechanism necessary to follow those rules as the system responds to states of the world.

Components of Production System

The major components of Production System in [Artificial Intelligence]() are:

- **Global Database:** The global database is the central data structure used by the production system in Artificial Intelligence.

- **Set of Production Rules:** The production rules operate on the global database. Each rule usually has a precondition that is either satisfied or not by the global database. If the precondition is satisfied, the rule is usually be applied. The application of the rule changes the database.
- **A Control System:** The control system then chooses which applicable rule should be applied and ceases computation when a termination condition on the database is satisfied. If multiple rules are to fire at the same time, the control system resolves the conflicts.

Features of Production System in Artificial Intelligence
The main features of the production system include:
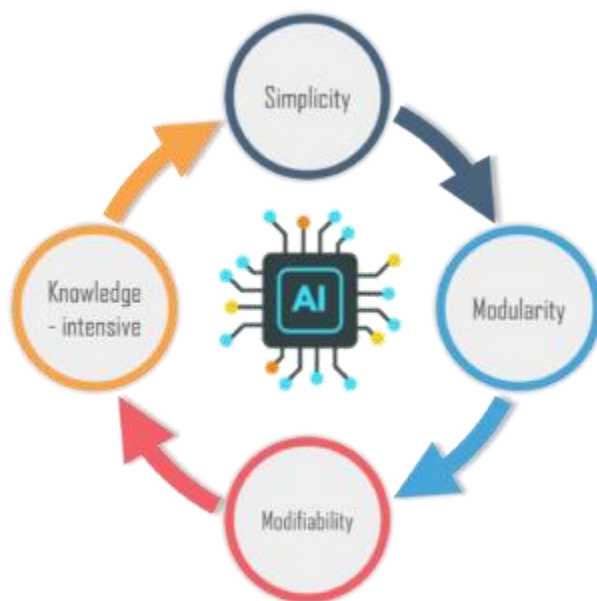
1. Simplicity: The structure of each sentence in a production system is unique and uniform as they use the "IF-THEN" structure. This structure provides simplicity in knowledge representation. This feature of the production system improves the readability of production rules.

2. Modularity: This means the production rule code the knowledge available in discrete pieces. Information can be treated as a collection of independent facts which may be added or deleted from the system with essentially no deleterious side effects.

3. Modifiability: This means the facility for modifying rules. It allows the development of production rules in a skeletal form first and then it is accurate to suit a specific application.

4. Knowledge-intensive: The knowledge base of the production system stores pure knowledge. This part does not contain any type of control or programming information. Each production rule is normally written as an English sentence; the problem of semantics is solved by the very structure of the representation.

Post Graduate Diploma in Artificial Intelligence Course
Explore Curriculum

Control/Search Strategies
How would you decide which rule to apply while searching for a solution for any problem? There are certain requirements for a good control strategy that you need to keep in mind, such as:

- The first requirement for a good control strategy is that it should **cause motion**.
- The second requirement for a good control strategy is that it should be **systematic**.
- Finally, it must be **efficient** in order to find a good answer.

Production System Rules
Production System rules can be classified as:

- **Deductive Inference Rules**
- **Abductive Inference Rules**

You can represent the knowledge in a production system as a set of rules along with a control system and database. It can be written as:

If(Condition) Then (Condition)

The production rules are also known as condition-action, antecedent-consequent, pattern-action, situation-response, feedback-result pairs.

Classes of Production System in Artificial Intelligence
There are four major classes of Production System in Artificial Intelligence:

- **Monotonic Production System**: It's a production system in which the application of a rule never prevents the later application of another rule, that could have also been applied at the time the first rule was selected.
- **Partially Commutative Production System**: It's a type of production system in which the application of a sequence of rules transforms state X into state Y, then any permutation of those rules that is allowable also transforms state x into state Y. Theorem proving falls under the monotonic partially communicative system.
- **Non-Monotonic Production Systems**: These are useful for solving ignorable problems. These systems are important from an implementation standpoint because they can be implemented without the ability to backtrack to previous states when it is discovered that an incorrect path was followed. This production system increases efficiency since it is not necessary to keep track of the changes made in the search process.
- **Commutative Systems**: These are usually useful for problems in which changes occur but can be reversed and in which the order of operation is not critical. Production systems that are not usually not partially commutative are useful for many problems in which irreversible changes occur, such as chemical analysis. When dealing with such systems, the order in which operations are performed is very important and hence correct decisions must be made at the first attempt itself.

Advantages & Disadvantages

Some of the **advantages** of Production system in artificial intelligence are:

- Provides **excellent tools** for structuring AI programs
- The system is highly **modular** because individual rules can be added, removed or modified independently
- Separation of **knowledge** and **Control-Recognises Act Cycle**
- A natural **mapping** onto state-space research data or goal-driven
- The system uses pattern directed control which is more **flexible** than algorithmic control
- Provides opportunities for **heuristic control** of the search
- A good way to model the **state-driven nature** of intelligent machines
- Quite helpful in **a real-time** environment and applications.

Now, let's have a look at some of the **disadvantages**:

- eIt is very **difficult** to analyze th flow of control within a production system
- It describes the operations that can be performed in a search for a solution to the problem.
- There is an **absence of learning** due to a rule-based production system that does not store the result of the problem for future use.
- The rules in the production system should not have any type of **conflict resolution** as when a new rule is added to the database it should ensure that it does not have any conflict with any existing rule.