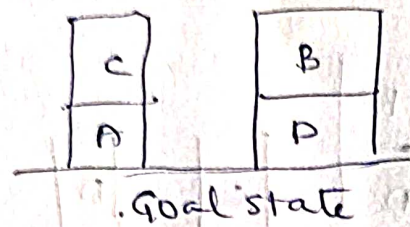
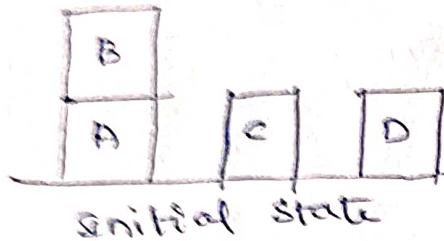


- 1) What is goal stack planning? Implement goal stack planning for the given configuration of Blocks worlds problem.



- A) Goal stack planning is one of the earliest methods in artificial intelligence in which it works the backwards from goal state to initial state.
- we start at the goal state and we try to fulfilling the preconditions require to achieve the initial state.
  - These preconditions in turn have their own set of preconditions which are required to be satisfied first. we keep solving these goals and subgoals until we finally arrive the initial state.
  - Apart from the 'initial state' and the 'Goal state', we maintain a 'world state configuration' as well.
  - At the end of this algorithm we are left with an empty stack and a set of actions which helps us navigate from the initial state to the world state.
  - Representing the configuration as a list of 'predicates'.
  - Predicates can be thought of as a statement which helps us convey the information about a configuration in Blocks world.

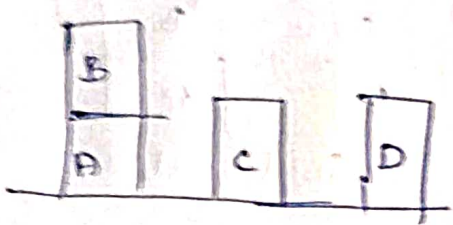
Given below are the list of predicates as well as this intended meaning.

- 1) ON (A, B) : Block A is on B.
- 2) ON TABLE (A) : A is on table.
- 3) CLEAR (A) : Nothing is on top of A.
- 4) HOLDING (A) : Arm is holding A.
- 5) ARM EMPTY : Arm is holding nothing.

Using these predicates, we represent the initial state and the goal state in our example like this:

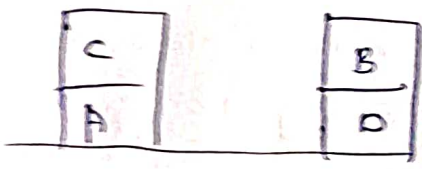
Initial state:

$ON(B,A) \wedge ON\ TABLE(A) \wedge ON\ TABLE(C) \wedge ON\ TABLE(D) \wedge ON\ TABLE(O) \wedge$   
 $CLEAR(B) \wedge CLEAR(C) \wedge CLEAR(D) \wedge ARM\ EMPTY.$



Goal state:-

$ON(C,A) \wedge ON(B,D) \wedge ON\ TABLE(A) \wedge ON\ TABLE(D) \wedge CLEAR(B) \wedge$   
 $CLEAR(C) \wedge ARM\ EMPTY.$



Thus a configuration can be thought of as a list of predicates describing the current scenario.

2) Explain about syntactic processing in NLP and how does syntactic processing work?

Ans, Syntactic processing involves a series of steps, including tokenization, parts of speech, tagging, parsing and semantic analysis.

→ Tokenization is the process of breaking up a sentence into individual words or tokens.

→ Parts of speech (pos) tagging involves identifying the part of each token.

→ Syntactic analysis also referred to as syntax analysis or parsing is the process of analyzing natural language with the rules of a formal grammar.



- Grammatical rules are applied to categories and groups of words not individual words.
- syntactic analysis basically assigns a semantic structure to text.
- It focus on understanding the grammatical structure of sentences.
- Named entity recognition (NER): Identifying and categorizing named entities such as names of people organizations and location.

### Working:-

Let us consider an example for syntactic processing. The quick brown fox jumps over the lazy dog.

#### 1) Tokenization:-

The sentence is split into individual words or tokens:

"The", "quick", "brown", "fox", "jumps", "over", "the", "lazy", "dog".

#### 2) Parts of speech (pos) tagging:-

Each word is assigned in grammatical category - "The" (Determining), "quick" (adjective), "brown" (adjective), "fox" (noun), "jumps" (verb), "over" (preposition), "the" (Determining), "lazy" (adjective), "dog" (noun).

#### 3) Parsing:-

We can perform constituency or dependency to analyze the sentences structure.

- consistency parsing might identify the structure as:

(NP (Det the) (Adjective) (Adj brown) (N fox)) (VP (V jumps) (PP (over) (NP (Det the) (Adj lazy) (N dog))))

#### 4) Named Entity Recognition:-

In this example, there are no named entities, but if there were NER would identify and categorize them. For instance, if the sentence were "Apple is buying a company", NER would identify "Apple" as an organization.

3) What is rule based expert systems? Explain the components of rule based systems.

Ans → A system that relies on a collection of predetermined rules to decide what to do next is known as a rule based system.

→ These laws are predicted on several circumstances and decide

→ for instance, if a patient has a fever, that doctor may recommend antibiotics because the patient may have an infection.

Expert systems decision support systems, and chatbots are examples of apps that use rule based systems.

#### Characteristics:-

The following are some of the primary traits of the rule based systems.

→ The rules are written simply for humans to comprehend, making rule based systems simple to troubleshoot and maintain.

→ A rule based system in A.I is transparent because the standards are clear and open to human inspection, which makes it simple to comprehend, how the system operates.

→ It is scalable.

→ It can be modified or updated more easily, because the rules can be divided into smaller components.

The components of a rule based System.

- \* The Knowledge base
- \* The database.
- \* Explanation facilities.
- \* user Interface
- \* External interface.
- \* The interface engine.
- \* working memory



### The Knowledge Base:-

It contains the specialised expertise required for solving the problem. The information is represented as a set of rules in a rule based system. Every rule has an IF (condition) THEN (action) structure and defines a relationship, suggestion, directive, strategy or heuristic.

→ The rule is activated and the action portion is carried out as soon as the conditional portion of the rule is met.

### The database:-

The database contains a collection of facts compared to the knowledge base's rule IF (condition) clause.

### Explanations facilities:-

The user can use the explanation facilities to the question the expert system on how it came to a particular conclusion or why a particular fact is necessary. The expert system must be able to define its logic recommendations, analysis and conclusions.

### User Interface:-

- The user interface is the channel through which the user interacts with the expert system to find a solution to a issue.
- The user interface should be as simple and intuitive as possible and the dialogue should be as helpful and friendly as possible.
- However the mechanism might also include a few extra parts.
- The working brain and the external interface are two examples of these parts.

### External connection:-

- An expert system can interact with external data files and programs written in traditional compiled languages like C, pascal, FORTRAN.



4) Explain about spell checking in NLP.

- Spell checking is a process of deleting and sometimes providing suggestions for incorrectly spelled words in a text.
- In computing, spell checker is an application program that flag words in a document that may not be spelled correctly.
- Spell checks may be stand alone capable of operating on a book or a text as word processor, electronic dictionary.

A basic spell checker carries out the following processes

- It scans the text and extracts the word contained in it.
- An additional step is a language dependent algorithm for handling morphology.

Spell checking typically involves two main steps.

\* Error detection

\* Error correction

1) Error detection:-

This step involves identifying the words in the text that are likely misspelled. Techniques for error detection include comparing words against a dictionary correctly, and using statistical methods to detect deviations from expected language pattern.

2) Error correction:-

Once spelling errors are detected, the next step is to suggest corrections for these errors. This can be done using various methods such as,



### Rule-based correction:-

Applying predefined rules to correct common spelling mistakes such as transpositions, omissions or substitutions of letters.

### Statistical collection:-

Using statistical models to suggest corrections based on the likelihood of observing certain word sequences. This can involve analyzing the context of misspelled word within the surrounding text to propose the most likely correction.

### → Contextual analysis:-

Considering the surrounding word and context to better understand the intended meaning and suggest appropriate corrections.

### → User feedback:-

Allowing users to provide feedback on suggested corrections to further improve the system over time.