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Fundamental of Computer

Assignment - 2

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① Explain about lexical, syntactic, semantic analysis.

Lexical, Syntactic, and Semantic analysis are three fundamental stages in the process of understanding and processing natural language. These stages are commonly associated with compiler construction and natural language processing systems. Let's explore each of these analyses:

Lexical Analysis:

⇒ Lexical analysis is the first phase in processing a piece of text or source code.

⇒ It deals with the lowest level of language processing, where the input text is broken down into a sequence of tokens (words, numbers, symbols, etc.).

⇒ Tokens are the basic building blocks of a language.

⇒ This process involves removing any unnecessary whitespace and comments and categorizing the characters into meaningful units.

⇒ For example, consider the following sentence:

The quick brown fox jumps over the lazy dog.

➡ The lexical analysis of this sentence might generate tokens like:

["The", "quick", "brown", "fox", "Jump", "over", "the",
"lazy", "dog", ". "]

➡ These tokens are later used in the subsequent stages of analysis.

Syntactic Analysis (Parsing):

➡ Syntactic analysis, also known as parsing, is the second phase in language processing.

➡ It deals with the arrangement and structure of the tokens obtained from the lexical analysis.

➡ The primary goal of syntactic analysis is to determine if the given sequence of tokens adheres to the rules of the language's grammar.

➡ This process generates a hierarchical representation of the input text, such as a syntax tree or abstract Syntax Tree (AST).

➡ The Syntax tree represents the Syntactic Structure of the Input. It helps in understanding how different elements of the language are related to each other.

➡ If the Input is grammatically correct, a valid Syntax tree can be constructed; otherwise, a Syntax error is reported.

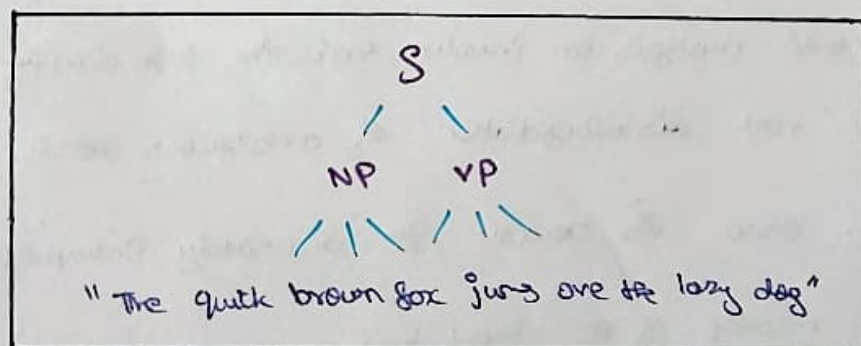
➡ For example, considering a simple grammar for noun phrases (NP) and verb phrases (VP):

$S \rightarrow NP VP$

$NP \rightarrow \text{"the" "quick" "brown" "fox"}$

$VP \rightarrow \text{"jumps" "over" "the" "lazy" "dog"}$

➡ The Syntactic analysis would combine these rules to produce the Syntax tree:



➡ This shows how the sentence can be broken down into a noun phrase (NP) and a verb phrase (VP) according to the defined grammar rules.

Semantic Analysis:

⇒ Semantic analysis is the final phase of language processing. It focuses on understanding the meaning of the text based on the syntactic structure obtained from the previous phase.

⇒ In this stage, the system analyzes the semantics or the intended meaning of the sentence.

⇒ It checks for any inconsistencies or ambiguities in the expression and ensures that the sentence is both syntactically and semantically correct.

⇒ For instance, it may check if verb-subject agreement is followed correctly or if there are any contradictions in the statements.

⇒ Semantic analysis can involve tasks like type checking, scope resolution, and disambiguation of ambiguous words.

⇒ This phase is crucial for accurately interpreting the intended meaning of the input text.

➤ In Summary, lexical analysis breaks down the input text into tokens, Syntactic analysis establishes the hierarchical structure for the tokens according to the grammar, and Semantic analysis determines the meaning and correctness of the sentence in the context of the language's rules and semantics.

➤ Together, these three analyses enable computers to process and understand natural language, making them essential components in various language-related applications and systems.