Describe the various applications of NLP.

1. Natural Language Interface to Database: It enables users to query databases using natural language, simplifying data access without requiring knowledge of formal query languages like SQL.

2. Natural Language Interface to Computers: It allows users to interact with computers using natural language commands or queries, facilitating intuitive interactions with devices and software applications.

3. Question Answering System: Systems that interpret natural language questions, search for relevant information, and provide accurate answers, ranging from simple fact-based to complex reasoning-based systems.

4. Story Understanding: Systems that analyze narrative text to comprehend plot, themes, and characters, involving tasks like summarization, sentiment analysis, and event extraction.

5. Machine Translation: Automatic translation of text between languages using computational techniques, leveraging NLP to analyze and generate fluent translations.

What are the features and major goals of Anusaaraka system?

Features:

1. **Multilingual Support:** Anusaaraka is designed to work with multiple Indian languages, catering to the linguistic diversity of India.
2. **Morphological Analysis:** It includes robust morphological analyzers for various Indian languages, enabling tasks like stemming, lemmatization, and morphological parsing.
3. **Named Entity Recognition (NER):** Anusaaraka can identify and classify named entities such as names of persons, organizations, locations, etc., in text data.
4. **Syntax Parsing:** It supports syntactic parsing, which involves analyzing the grammatical structure of sentences to understand relationships between words.
5. **Semantic Analysis:** Anusaaraka aims to perform semantic analysis to extract meaning from text, enabling tasks like sentiment analysis, information extraction, and question answering.

Major Goals:

1. **Improving NLP for Indian Languages:** Anusaaraka aims to address the challenges of NLP specific to Indian languages, including complex morphology, limited linguistic resources, and diverse scripts.
2. **Enabling Language Technology Applications:** By providing robust linguistic analysis tools, the system facilitates the development of various language technology applications such as machine translation, information retrieval, and text mining for Indian languages.

3. **Supporting Language Processing Research:** Anusaaraka serves as a platform for researchers and developers to collaborate on language processing research, develop language resources, and advance the state-of-the-art in NLP for Indian languages.

Explain different approaches to Morphology.

1. **Morpheme-Based Morphology:** Morpheme-based morphology focuses on the smallest meaningful units of language, called morphemes. These units include roots, prefixes, suffixes, and infixes.
2. **Lexeme-Based Morphology:** Lexeme-based morphology focuses on lexemes, which are abstract units of meaning underlying different word forms. It considers the relationship between different forms of a lexeme, such as its various inflected forms.
3. **Word-Based Morphology:** Word-based morphology takes entire words as the primary unit of analysis, considering the relations and transformations between whole words rather than decomposing them into smaller units.

Define derived and derivation trees. Draw the derived and derivation trees for the following sentence-"The boy kicked the bucket".

Definition (Derived Tree): A derived tree is any of the following:

1. An initial tree or an auxiliary tree.
2. A tree obtained by substituting a completed derived tree (without a footnode) in an initial tree.
3. A tree obtained by adjoining a completed derived tree (with a foot node) in a completed derived tree.

Derivation Tree: It shows derivations to be performed to obtain the derived structure. In a derivation tree, a leaf node d is a child of a node c if d is substituted in c.

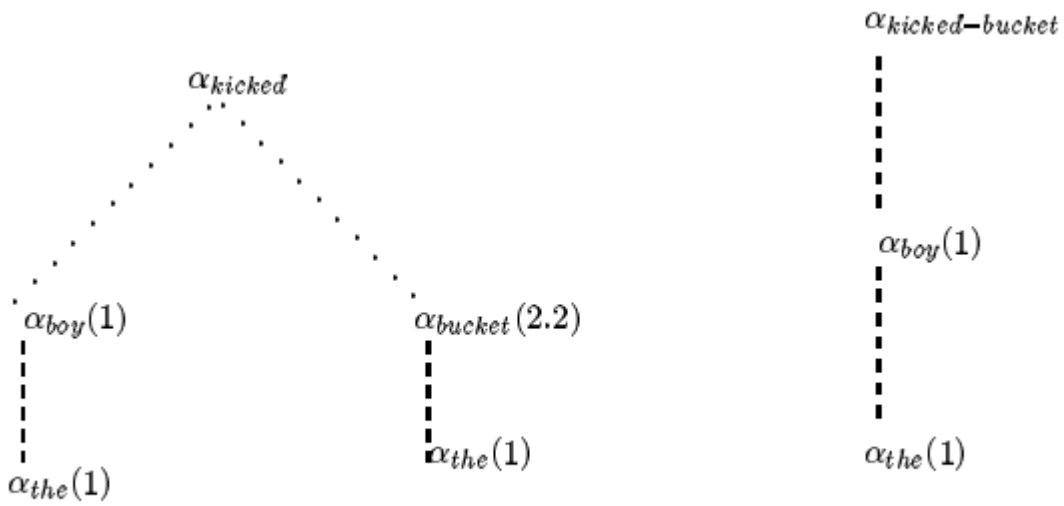


Figure 10.6: Derivation trees for 'the boy kicked the bucket'

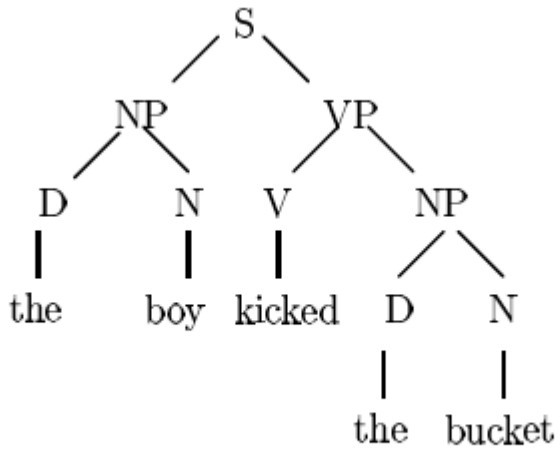


Figure 10.5: Derived tree for 'the boy kicked the bucket'

Explain semantics, pragmatics, and discourse with suitable examples.

1. **Semantics:** Semantics deals with the literal meaning of words, phrases, and sentences in a language. It focuses on understanding the relationship between linguistic expressions and their corresponding meanings.Example: In the sentence "The cat is on the mat," semantics would analyze the meanings of the words "cat," "on," and "mat" individually and how they combine to convey the message that a cat is positioned on a mat.
2. **Pragmatics:** Pragmatics considers the context, speaker's intentions, and the effects of utterances on communication. It deals with how language is used in real-world situations to achieve specific goals. Example: Consider the statement "It's cold in here." In a pragmatic analysis, we would consider factors like the speaker's tone of voice, the context (e.g., if the speaker is shivering), and the listener's interpretation to understand that the speaker may be implying a request to adjust the temperature or close a window.
3. **Discourse:** Discourse refers to the larger context of communication, including the organization of sentences and utterances into coherent conversations, narratives, or texts. It encompasses how language is structured and used to convey meaning over extended stretches of communication. Example: A conversation between two friends discussing their weekend plans involves discourse. It includes not only the individual sentences spoken but also the turn-taking, topic shifts, and overall flow of the conversation that contribute to its coherence.

Explain different kinds of modified-modifier structures with suitable examples.

1. *Nominal structure with adjective-noun modification.*[7]
   Here, the noun is the head and the adjective is a nominal. Here are some examples:

```
safeda    caadara
white     sheet

moTaa     laDakaa
fat       boy
```

   The nouns 'caadara' (sheet) and 'laDakaa' (boy) are the head in the two sentences, respectively. The nature of modification is not coded in the string.

2. *Verbal structure with noun-verb modification.*[8]

   Here, the verb is the head and the noun is a modifier. A verb denotes an activity (or state), while the noun denotes a participant in the activity (or state). For example, in the following two sentences:

```
laDakaa    douDaa.
boy        ran

laDakaa so    rahaa  thaa.
boy     was   sleeping
```

   the activity 'douDaa' (ran) and the state 'so' (sleep) have the noun modifier 'laDakaa' (boy).
   Similarly, in the following example sentence:

```
laDake    ne        paanii  piyaa
boy    ergative  water   drank
```

   the head is 'piyaa' (drank) and the modifiers are 'laDakaa' (boy) and 'paanii' (water). However, in this case the nature of modification is known. The 'boy' drinks and 'water' is what gets drunk.

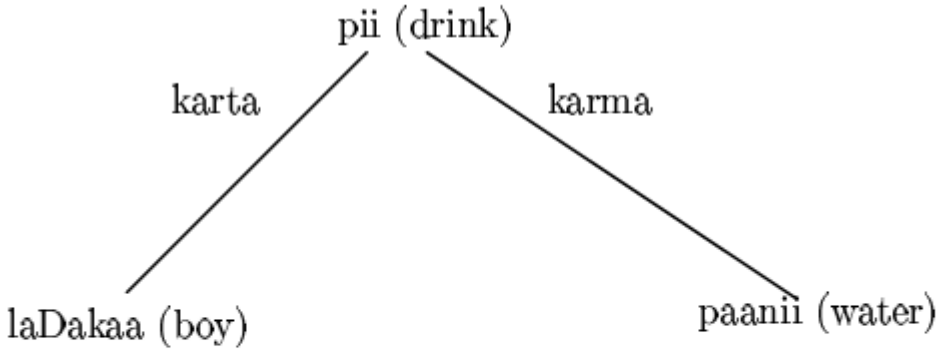


Figure 2.1: Nouns as arguments of verb

root node 'pii' gets modified by its children 'laDakaa' and 'paanii'. The nature of modification is shown by labelling the edges as karta and karma.

3. *Verbal structure with verb as argument of the head verb.*[9]

Arguments of certain verbs are verbs. Consider the sentence:

```
laDake ne kahaa ki usane patanga uDaayii.
boy  nom. said that he   kite    flew.
(The boy said that he flew a kite.)
```

Here the argument of 'say' is an entire sentence 'he flew a kite'.

Diagramatically it is shown in Figure 2.2. As before, a child node is

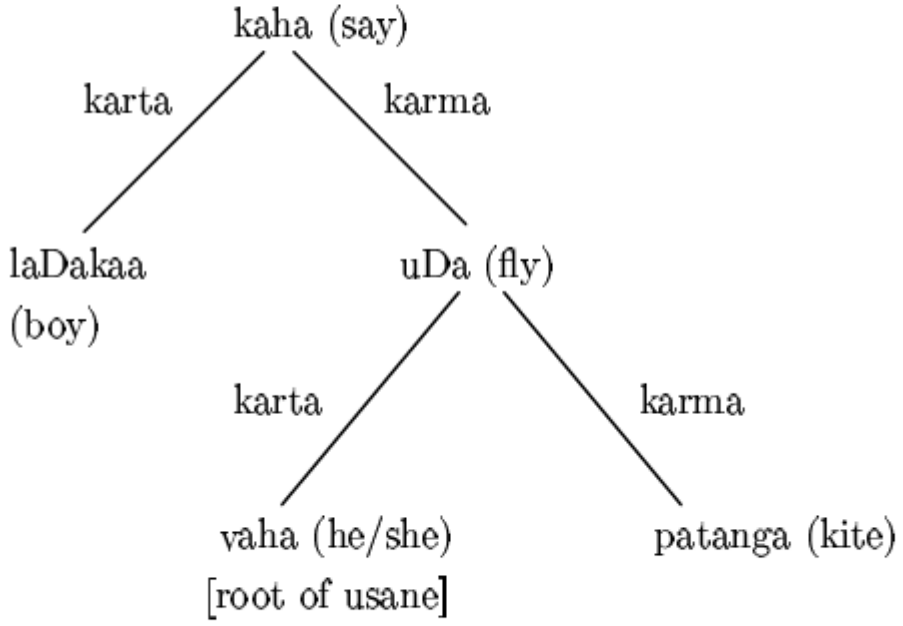


Figure 2.2: A verb (uDa) as argument of another verb (kaha)

a modifier of its parent.

4. *Nominal structure with participle verb as a modifier of a noun.*

Here, the noun is the head whose modifier is a verb. The verb typically occurs in non-finite form or participle form. As an example, consider the sentence:

```
bhaagataa  huaa  laDakaa
running          boy
```

where the head is 'laDakaa' (the boy). The verb 'bhaagataa huaa' (running) is modifying a noun (boy). The noun which is modified by the verb, is an argument of the verb. The nature of the participle form determines what the argument is. In the above example, 'bhagataa huaa' has the 'taa huaa' form which indicates karta relation with the noun it modifies.

This is shown diagrammatically in Figure 2.3. It shows that 'laDakaa' (boy) is the head whose modifier is 'bhaaga' (run). The relation between them is inverse karta, in other words, the parent node (laDakaa) is the karta of the child node (bhaaga).

Figure 2.3: Nominal with verbal modifier

5. *Verbal structure with verb-verb modification.*

One of the verbs is the head and the other is a modifier but not an argument of the verb. Here is an example:

```
laDakaa aama    khaakara      ghara  gayaa.
boy     mango   having-eaten  home   went
(Having eaten the mango, the boy went home.)
```

Here, the participle form 'khaakara' (having-eaten) is related to the main verb 'gayaa' (went). The nature of relation is temporal precedence. In other words, the eating action occurred before the going action. Similarly, we have the following example:

```
laDakaa aama    khaataa  huaa ghara  gayaa.
                eating
(The boy went home, eating a mango.)
```

Here the second action (gayaa) took place while the first one was in progress.

The modifier-modified relations in the first example sentence above are shown as in Figure 2.4. The verb node 'jaa' (go) is modified by its arguments 'laDakaa' (boy) and 'ghara' (home) as well as the verb

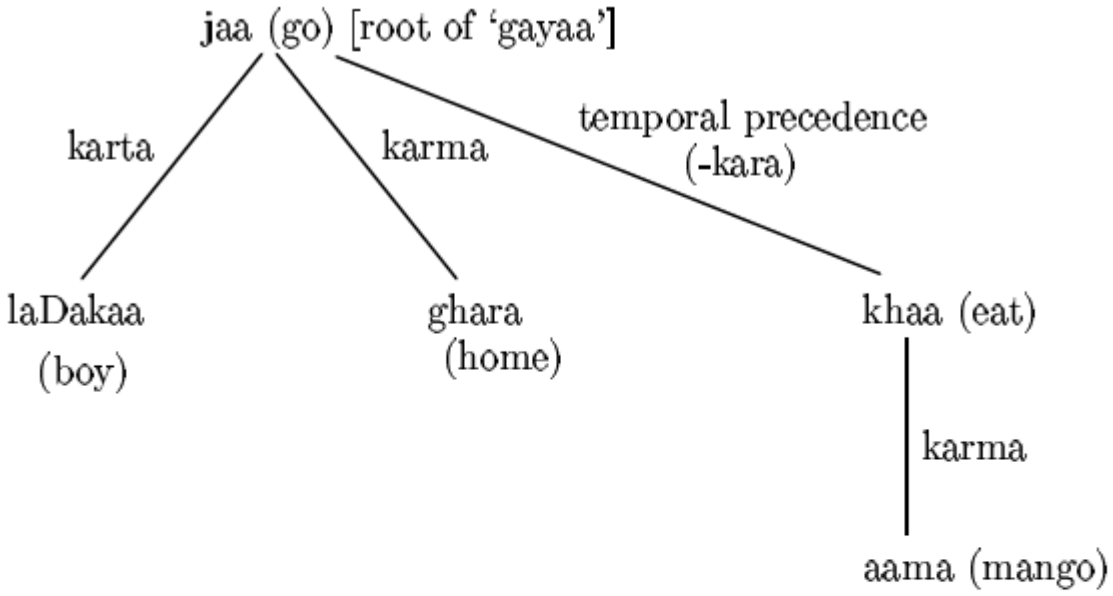


Figure 2.4: A verb-verb modification

'khaa' (eat). Note that since 'laDakaa' occurs only once, it is shown only once even though it happens to be karta of both the verbs. Which verb it modifies, is determined by looking at the sentence construction and such things as agreement. In the sentence under discussion, 'laDakaa' agrees with the verb 'gayaa' (went). If the gender of the noun is changed to feminine 'laDakii' (girl), the gender of the verb also changes to feminine: 'gayii' (went).

6. *Nominal structure with verbal nouns.*

A verbal noun behaves like a noun but it maintains many of its properties as a verb. In particular, it maintains its relations with its arguments. What this means is that its modifier-modified structures have to be identified as usual for verbs. In the following sentence, for example, even though 'jaanaa' (go) is a verbal noun, it maintains relations with its arguments (Ram and home):

```
rama  kaa ghara jaanaa  mohana ko acchaa lagaa.
Ram   's  home  to-go   Mohan  dat. good  felt
(Mohan felt good at Ram's going home.)
```

'Jaanaa' itself is an argument of the main verb as shown in Figure 2.5.

The verbal nouns can usually be identified by their endings or auxiliaries.

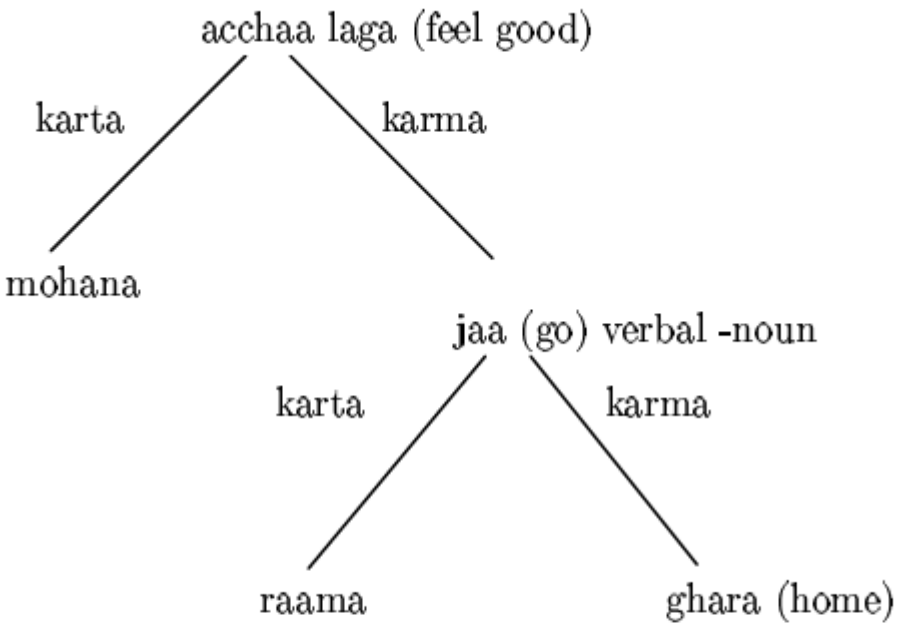


Figure 2.5: Verbal noun

The structures defined here will be added to and enriched in the sections that follow. Building such structures for input sentences will serve as the goal of the NLP systems. In other words, such structures have to be produced automatically after analysis.

Define ambiguity? Explain different kinds of ambiguities. Define the kind of ambiguity present in the following sentences.

Ambiguity in language refers to situations where a word, phrase, sentence, or utterance has multiple possible interpretations or meanings.

Types of Ambiguities : -

1. Lexical Ambiguity - When words have more than one meaning
e.g. - Match (match in context of sports) or (match in context of Partner)

2. Syntactic Ambiguity - When sequence of words or a sentence has more than one meaning.
e.g. - "One morning, I shot an elephant in my pajamas.
was Elephant in pajamas ?? or man was in pajamas ??

3. Referential Ambiguity - When the subject is pointed more than once in a sentence.
e.g. - The boy told his father the theft. He was very upset.
Here who does "He" refer to ??

4. Anaphoric Ambiguity - A phrase or word refers to something previously mentioned, but there is more than one possibility.
e.g. - Margaret invited Susan for a visit, but she told her she had to go to work.
here "she" and "her" can be used for for Susan and Margaret interchangeably, which give two different meanings.

5. Pragmatic Ambiguity - when the statement is not specific, and the context does not provide the information needed to clarify the statement.(Some Information is Missing)
e.g. - “The police are coming”
Does this mean they are coming for you/me , they are coming down the road ?

Harry's feat made the Guinness world book of records.

Lexical Ambiguity

Mary invited Susan for a visit , but she told him she had to go to the work.

Anaphoric Ambiguity

Mary ate salad with Spinach from California for lunch on Tuesday.

Syntactic Ambiguity

John and Mary are married.

Pragmatic Ambiguity

I saw a bat.

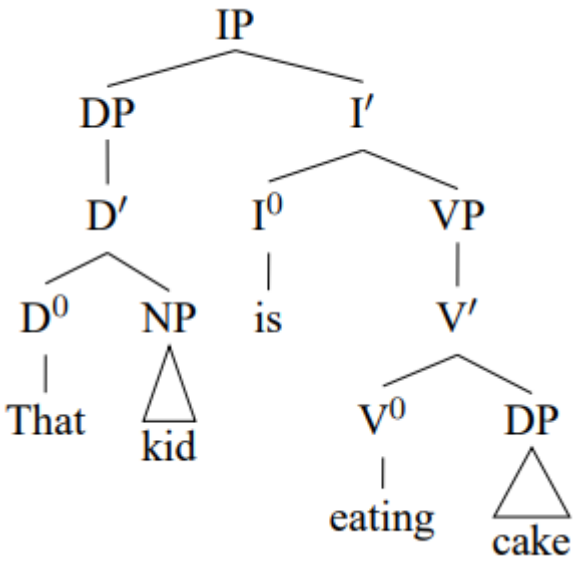
Lexical ambiguity

What is LFG? Explain its basic forms in detail.

Lexical Functional Grammar (LFG) is a strong computational formalism that addresses how to extract grammatical relations from a sentence in a positional language such as English. Its major strength is that it gives ex- plicit algorithms. Its weakness is that it does not offer

any theory regarding lexical ambiguity, adjuncts, optional theta-roles, and mapping from gram- matical relations to theta-roles.

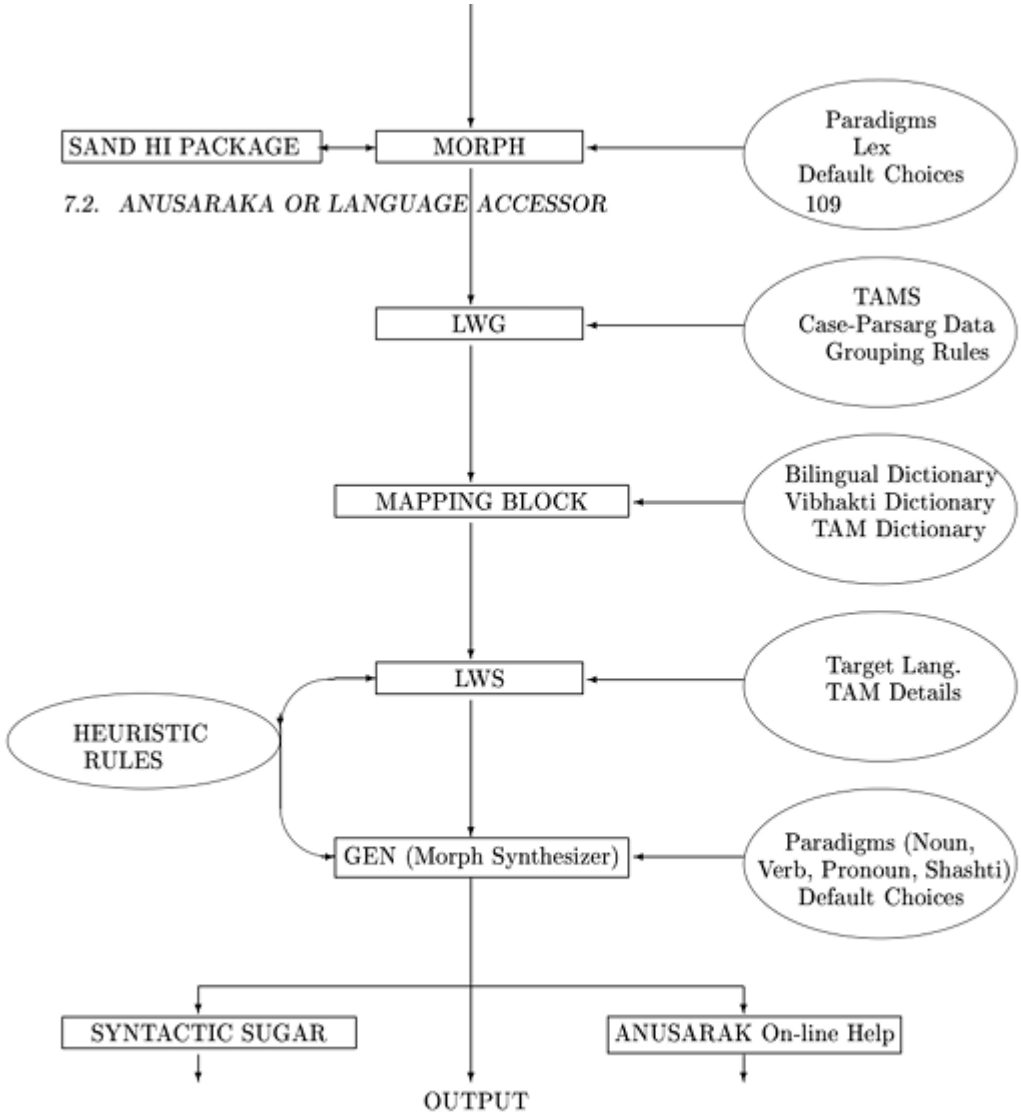
C-Structure represents the hierarchical syntactic structure of a sentence, showing how words combine to form phrases and sentences. The nodes in the C-Structure tree represent constituents such as words, phrases, and clauses, and the edges represent syntactic relationships between these constituents.



F-Structure represents the functional and grammatical relations within a sentence, focusing on the roles and functions of words and phrases in the sentence. F-Structures consist of features and attribute-value pairs that encode information such as grammatical relations, tense, aspect, agreement, and semantic roles.

$$
\begin{bmatrix}
\text{PRED} & \text{`eat}\langle\text{SUBJ,OBJ}\rangle\text{'} \\
\text{SUBJ} & \begin{bmatrix}
\text{PRED} & \text{`kid'} \\
\text{DEIXIS} & \text{DISTAL} \\
\text{DEFINITE} & + \\
\text{NUMBER} & \text{SINGULAR} \\
\text{PERSON} & 3
\end{bmatrix} \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`cake'} \\
\text{NUMBER} & \text{SINGULAR} \\
\text{PERSON} & 3
\end{bmatrix} \\
\text{TENSE} & \text{PRESENT} \\
\text{ASPECT} & \text{PROGRESSIVE} \\
\text{PARTICIPLE} & \text{PRESENT}
\end{bmatrix}
$$

Explain the Anusaaraka system architecture in detail. How it is different from Machine Translation? What problems of Machine translation were overcome by Anusaaraka system?



Morphological Analysis (Morph):

- Analyzes each word in the source sentence.
- Checks if the word is in the dictionary of indeclinable words.
- Derives grammatical features if possible using word paradigms.
- Passes compound words to the sandhi package for splitting.

Local Word Grouper:

- Groups function words with content words based on local information.
- Identifies vibhakti (case endings) of nouns and verbs.

Sentential Analysis:

- Not implemented due to data requirements.

Mapping Block:

- Uses dictionaries to find suitable roots and vibhakti in the target language.
- Generates local word groups in the target language.

Local Word Splitter (LWS) and Morphological Synthesizer (GEN):

- LWS splits local word groups into elements.
- GEN generates words from roots and features.

The Anusaaraka system differs from traditional machine translation (MT) systems in several key aspects:

Aspect	Anusaaraka System	Traditional MT Systems
Focus	Specifically designed for Indian languages	Focused on widely spoken languages
Approach	Incorporates linguistic knowledge and resources tailored to Indian languages	Relies on generic approaches to translation
Architecture	Modular architecture	Monolithic architecture
Linguistic Resources	Utilizes language-specific resources and tools for rich morphology, syntax, and semantics	Relies on parallel corpora and annotated data
Problem-Specific Solutions	Addresses challenges like rich morphology, limited linguistic resources, and semantic ambiguity in Indian languages	May not provide specialized solutions for Indian languages
Application Areas	Useful for applications requiring accurate translation and analysis of Indian language text	Applied to a wide range of language pairs and domains

Problems of machine translation overcome by Anusaaraka system:

- **Rich Morphology:** Anusaaraka incorporates morphological analyzers and sandhi splitters to accurately analyze and translate compound words and inflected forms.
- **Limited Linguistic Resources:** Anusaaraka integrates rule-based approaches and leveraging available language resources tailored to Indian languages.
- **Semantic Ambiguity:** Anusaaraka incorporates semantic analysis techniques to disambiguate meanings and improve translation quality.

Explain different Machine Translation approaches along with the challenges faced by each approach.

There are three major types of MT systems that one can imagine based on their dependence on languages. The first type of MT systems are designed for a particular pair of languages. If translation capability is needed between another pair of languages, a new system must be constructed. Because of its dependence on the languages, the system has the advantage that special features and similarities between the concerned languages can be made use of. It is called the direct approach.

The second type of system is based on the concept of interlingua. A sentence in a source language is first analyzed and is represented in an intermediate language. The intermediate language need not be a human "natural" language and is typically a formal "mathematical" language. Next a generator takes the intermediate representation and generates a sentence in the target language. The major advantage of this approach is that the analyzer of parser for the source language is independent of the generator for the target language. As a result, if one wants to build a system with translation capability amonge, say, 15 languages, only 15 parsers and generators need to be constructed. Contrast it with 210 (=15x14) systems that need to be constructed in the first approach.

The difficulty with the second approach, however, is that it is difficult to define the interlingua. Also, it is not possible to take advantage of similarities between languages. As a result, many research groups use a third approach called the transfer approach. In this approach, the parser produces the representation for a source language, which is then transfered to the representation for the target language. The generator takes over from there. This approach is intermediate between the first two. For 15 languages, in this approach only 15 parsers and generators are needed, however, the number of transfer components needed are 210.

In the Indian context where there are a large number of languages (officially 15 major ones) which are also very close, the interlingua approach would seem preferable, but the nature of interlingua is open.

Explain all the well-formedness conditions with suitable examples. Unique, complete, Cohesion

8.4 Well-formedness Conditions

The f-structure assigned to a sentence must satisfy certain well-formedness conditions. If any of these conditions are violated the assignment is rejected and an alternative structure is explored.

The first condition that must be satisfied by an f-structure is that of *uniqueness*. It says that an attribute in an f-structure can have at most one value. For example, if it is required that the following f-structures (corresponding to 'boys' and 'a') be made equal.

$$\begin{bmatrix} num & plural \\ pred & boy \end{bmatrix} \begin{bmatrix} num & singular \\ spec & a \end{bmatrix}$$

it will fail to yield a consistent f-structure because of the clash in the value of attribute num. Note on the other hand that the f-structures in Fig. 8.3 (a) can be made equal to yield the f-structure in Fig. 8.3 (b).

$$\begin{bmatrix} num & singular \\ pred & boy \end{bmatrix} \begin{bmatrix} num & singular \\ spec & a \end{bmatrix}$$

Figure 8.3 (a): F-structures for 'boy' and 'a'

Figure 8.3 (b): Resulting f-structure on unification of f-structures of 'boy' and 'a'

Figure 8.3: An example of unification of f-structures

$$\begin{bmatrix} num & singular \\ pred & boy \\ spec & a \end{bmatrix}$$

This process of making two f-structures equal is called unification. It will be discussed in detail later. The uniqueness condition is a general method for specifying co-occurrence restrictions including agreement.

The second condition is that of *completeness*. Approximately, an f-structure is complete if it contains all the attributes named in the arguments of its predicate. For example, if we have the attribute pred with the value:

give < (↑ subj, ↑ obj2, ↑ obj) >

the f-structure must contain values of the attributes subj, obj and obj2. This condition would cause the following sentences to be rejected for example:

```
*A boy gave the girl.
*A boy gave.
```

Note that these would not otherwise be rejected by the grammar rules.

The third and final condition relates to *coherence*. It states that if there is a grammatical function in the f-structure, it must also occur in the predicate-argument combination. For example, if there is a grammatical function obj2, then it must also occur in the value of pred. This would cause the following sentence to be rejected:

```
*The boy slept the book.
*The boy ate the apple the girl.
```

because predicate for sleep has only one argument (relating to subject), and that for eat has only two arguments.

The second and third conditions correspond to theta-criterion of GB (see Chap. 12) or aakaankshaa-yogyataa principle of Panini (see Chap. 5.). They capture sub-categorization and theta-role assignment.

Lexical functional grammar

Lexical Functional Grammar (LFG) is a strong computational formalism that addresses how to extract grammatical relations from a sentence in a positional language such as English. Its major strength is that it gives explicit algorithms. Its weakness is that it does not offer any theory regarding lexical ambiguity, adjuncts, optional theta-roles, and mapping from grammatical relations to theta-roles.

Tense aspect module

The "Tense-Aspect Module" in local word grouping within NLP focuses on identifying and analyzing the tense (time of action) and aspect (nature of action) of verbs in sentences. This module helps in understanding when actions occur and their duration or completeness.

Applications:

1. **Machine Translation:** Ensures correct translation of verb tenses and aspects.
2. **Text Summarization:** Generates temporally accurate summaries.
3. **Information Extraction:** Organizes events with temporal details.
4. **Syntactic Parsing:** Builds accurate syntactic structures.

Tree substitution grammar

A Tree Substitution Grammar (TSG) consists of initial trees and the substitution operation. An **initial tree** is a tree structure having nodes labelled by non-terminal and terminal symbols but with some restrictions: All the leaf nodes of the tree are labelled by either terminals or non-terminals; in the latter case, the leaf nodes are called substitution nodes and are marked by a down arrow. In case every initial tree has at least one terminal symbol, the grammar is called lexicalized TSG.

Substitution Operation: Substitution operation takes an (initial or a derived) tree, an address in it, and a completed tree, and replaces the node at the specified address in the first tree by the completed tree provided the following two conditions are satisfied: the addressed node is a substitution node and its label is the same as that of the root node of completed tree.

Componential theory of meaning

13.2 THE COMPONENTIAL THEORY OF MEANING

This theory based on the structural approach gives an account of word meaning. The total meaning of a word is broken up into its basic distinct components. Each component of meaning is expressed by a feature symbol with a + or – mark to indicate the presence or absence of a certain feature. In the following we can consider some features as:

HUMAN	:	+ Human (human being)
		– Human (animal)
ADULT	:	+ ADULT (adult)
		– ADULT (young)
MALE	:	+ MALE (male)
		– MALE (female)

Subsequently the meanings of some individual words can be expressed by the combinations of these features:

Man	:	+ HUMAN + ADULT + MALE
Woman	:	+ HUMAN + ADULT – MALE
Boy	:	+ HUMAN – ADULT + MALE
Girl	:	+ HUMAN – ADULT – MALE

can be excluded.

Componential analysis helps us understand meaning relations such as synonymy and antonymy. These can be understood as meaning inclusion (including of similar meanings being similarity relation) and meaning exclusion (contrasting relations). Two componential meanings are exclusive if one contains at least one feature contrasting with one feature of the other. Thus the meaning of 'woman' is opposite or contrasted to that of 'child' because of the contrast between the features + ADULT and – ADULT in these two words:

Woman = + HUMAN + ADULT – MALE
Child = + HUMAN – ADULT – MALE
or + MALE

The meaning of 'woman' contrasts with the meaning of 'man', as also with the meaning of 'child'. While + ADULT is hyponymous to 'woman' and 'man' (i.e. 'adult' includes both 'woman' and 'man'), it is incompatible with 'child' ('+ adult' is excluded from the meaning of 'child').

These are some of the basic methods of componential analysis of meaning. These are helpful in making conceptual distinctions and contrasts for the understanding of the meaning. However, they do not explain what are called 'fuzzy meanings', i.e. those meanings that are more vague and in which there is less agreement and certainty about the exact nature of objects and concepts. For example, there are many attributes that determine whether we can call something a cup, but these attributes vary in importance. 'Cup' cannot be defined in terms of a clear-cut, unvarying set of attributes (e.g. with/without handle, narrow/wide, deep/shallow) since there are so many different types of cups. Therefore 'cup' can be defined only in terms of 'fuzzy sets' of attributes.

Truth conditional theory of meaning

13.3 TRUTH-CONDITIONAL THEORY OF MEANING

This theory takes up the account of meaning of sentences. According to Leech (1983, p. 73):

> Many semanticists today assume that the main purpose of semantics is to explain that primary, conceptual aspect of meaning called 'conceptual' or 'logical' meaning, and that in particular we have to account for certain semantic categories and relationships which apply to sentences: synonymy, entailment, contradiction, semantic anomaly etc. These may be taken to be intuitively 'given'. They can be called BASIC STATEMENTS... because semantics has to explain them, by constructing theories from which they can be deduced.

The basic statement is a logical proposition which is either TRUE or FALSE. Its truth or falsity is dependent or conditional upon the truth or falsity of other statements. For example, we have a sentence 'John is in his office'. This statement will be true if the statement 'John is at home' is false. Basic statements relate to other statements in terms of the following:

(i) Synonymy. Statement X is synonymous with statement Y when if X is true, Y is also true; if X is false, Y is also false. Thus 'He is married' is synonymous with 'He has a wife'.

(ii) Entailment. Statement X entails statement Y when if X is true, Y is true; if X is false, Y is false. 'He is married' entails 'He has a wife'. (Entailment and synonymy are similar.)

(iii) Inconsistent. Statement X is inconsistent with statement Y when if X is true, Y is false; if Y is true, X is false. 'He is not married' is inconsistent with 'He has a wife'.

(iii) Inconsistent. Statement X is inconsistent with statement Y when if X is true, Y is false; if Y is true, X is false. 'He is not married' is inconsistent with 'He has a wife'.

(iv) Tautology. Statement X is invariably true, e.g. An orphan has no father.

(v) Contradiction. Statement X is invariably false, e.g. An orphan has a father.

(vi) Presupposition. Statement X presupposes statement Y when if X is true, Y is true; if negation of X is true, Y is true. 'It pleases John that the weather is hot' presupposes 'the weather is hot'.

(vii) Anomaly or Absurdity. Statement X is absurd in that it presupposes a contradiction, e.g. 'The orphan's father is at home' presupposes that 'The orphan has a father' which is a contradiction, and is therefore absurd.

The first statement entails the other two.

The goal of truth-conditional semantics is to explain meaning by explaining all the entailment relations between sentences in the language. One of the limitations of this approach is that it takes only statements into account and does not consider other sentence-types such as questions. Some semanticists say that even questions have a basis in conditions of truth as they can elicit either a positive proposition ('Yes') or a negative proposition ('No') in reply. Another limitation is that truth-conditional semantics is not concerned with synthetic truth, i.e. factual truth about the conditions which prevail in the real world; it is concerned about analytic truth, i.e. truth by the very nature of language, e.g. entailment relations between sentences, as discussed above. For instance, the statement 'All bachelors are unmarried' is true because the very definition of 'bachelor' is 'being unmarried'. This relation exists within the language. But in the sentence 'All bachelors are happy', the truth does not lie in the language but in some conditions outside it, in the real world. Truth-conditional semantics thus explains the meaning of sentences to a limited extent, but does so in a logical and scientific manner.