# 30 Lecture - CS402

## Important Subjective

1. **What is a context-free grammar, and how is it used to generate a language?**
   Answer: A context-free grammar is a formal notation for describing the rules for generating a language. It consists of a set of production rules that specify how to derive the strings of a language. To generate a language using a context-free grammar, we start with a start symbol, and we repeatedly apply the production rules until we obtain a string of terminal symbols that belongs to the language.

2. **What is the difference between a terminal symbol and a non-terminal symbol in a context-free grammar?**
   Answer: A terminal symbol is a symbol that cannot be further derived in a context-free grammar. It represents an element of the language being generated. A non-terminal symbol, on the other hand, is a symbol that can be further derived using the production rules of the grammar. It represents a category of elements that can be generated by the grammar.

3. **What is a parse tree in the context of context-free grammars?**
   Answer: A parse tree is a graphical representation of the derivation of a string in a context-free grammar. It shows the order in which the production rules were applied to generate the string. The tree has the start symbol at the root, and the leaves represent the terminal symbols of the string.

4. **What is a leftmost derivation in a context-free grammar?**
   Answer: A leftmost derivation is a type of derivation in which the leftmost non-terminal symbol in the current string is always replaced by its corresponding production rule. This type of derivation is useful for constructing parse trees from the grammar.

5. **What is the Chomsky normal form of a context-free grammar?**
   Answer: The Chomsky normal form is a standard form for context-free grammars in which every production rule has at most two non-terminal symbols on the right-hand side. This form is useful for simplifying the grammar and for certain types of analyses of the grammar.

6. **What is the pumping lemma for context-free languages?**
   Answer: The pumping lemma for context-free languages is a tool for proving that a language is not context-free. It states that if a language is context-free, then any string in the language of sufficient length can be divided into three parts, such that the middle part can be repeated any number of times and the resulting string is still in the language.

7. **What is ambiguity in the context of context-free grammars?**
   Answer: Ambiguity occurs when a string in a language can be generated by more than one parse tree. This can lead to difficulties in parsing and understanding the meaning of the string.

8. **What is the difference between a context-free language and a regular language?**
   Answer: A context-free language is a language that can be generated by a context-free grammar, while a regular language is a language that can be generated by a regular grammar. Regular grammars are less powerful than context-free grammars, and can generate only a

subset of the languages that context-free grammars can generate.

9. **What is the purpose of the start symbol in a context-free grammar?**
   Answer: The start symbol is a non-terminal symbol that represents the entire language being generated by the grammar. It is used as the initial symbol in the derivation process.

10. **What is a derivation tree, and how is it used to analyze a context-free grammar?**
    Answer: A derivation tree is a tree that represents the derivation of a string in a context-free grammar. It shows the sequence of production rules that were applied to generate the string. Derivation trees can be used to analyze the properties of the grammar, such as ambiguity and the existence of certain types of structures in the language.