

Module-4

Question Bank

1. Define the following: (2M each)
 - i) Generating symbols
 - ii) Reachable symbol
 - iii) Unit production
 - iv) Null production
 - v) Nullable variable
 - vi) Chomsky Normal Form
2. Convert the following CFG to CNF. (5M)
 $E \rightarrow E+E \mid E * E \mid (E) \mid id$
3. What are useless productions? Eliminate ϵ , unit and useless productions from the following grammar. (10M)
 $A \rightarrow bA \mid Bba \mid aa$
 $B \rightarrow aBa \mid b \mid D$
 $C \rightarrow CA \mid AC \mid B$
 $D \rightarrow a \mid \epsilon$
4. Define Chomsky Normal Form. Convert the following CFG to CNF: (06M)
 $S \rightarrow aSb \mid ab \mid Aa$
 $A \rightarrow aab$
5. State and prove Pumping lemma for CFLs. (06M)
6. Show that $L = \{a^n b^n c^n : n \geq 0\}$ is not a context free language using pumping lemma. (05M)
7. Prove that the context free languages are closed under union, concatenation and star-closure. (08M)
8. Begin with the grammar,
 $S \rightarrow aAa \mid bBb \mid \epsilon$
 $A \rightarrow C \mid a$
 $B \rightarrow C \mid b$
 $C \rightarrow CDE \mid \epsilon$
 $D \rightarrow A \mid B \mid ab$
 - i) Eliminate ϵ -productions
 - ii) Eliminate any unit productions in the resulting grammar.
 - iii) Eliminate any useless symbols in the resulting grammar. (08M)
9. Define CNF. Also convert the following CFG to CNF: (06M)
 $S \rightarrow AB \mid a$
 $A \rightarrow aab$
 $B \rightarrow Ac$

10. Show that the language $L = \{ x \in \{0, 1\}^* : |x| \text{ is a perfect square} \}$ is not context free. (06M)
11. Eliminate ϵ , unit and useless production from the following grammar and put the resulting grammar into CNF. (12M)
- $S \rightarrow ABC \mid BaB$
 $A \rightarrow aA \mid BaC \mid aaa$
 $B \rightarrow bBb \mid a \mid D$
 $C \rightarrow CA \mid AC$
 $D \rightarrow \epsilon$
12. Prove that Context free languages are not closed under intersection. (4M)
13. Prove that CFLs are closed under reverse. (04M)
14. Prove that $L = \{ ww : w \in \{0,1\}^* \}$ is not context-free. (5M)

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