

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)
$$\begin{aligned} A &\rightarrow bA \mid Bba \mid aa \\ B &\rightarrow aBa \mid b \mid D \\ C &\rightarrow CA \mid AC \mid B \\ D &\rightarrow a \mid \epsilon \end{aligned}$$
4. Define Chomsky Normal From. Convert the following CFG to CNF: (06M)
$$\begin{aligned} S &\rightarrow aSb \mid ab \mid Aa \\ A &\rightarrow aab \end{aligned}$$
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,
$$\begin{aligned} S &\rightarrow aAa \mid bBb \mid \epsilon \\ A &\rightarrow C \mid a \\ B &\rightarrow C \mid b \\ C &\rightarrow CDE \mid \epsilon \\ D &\rightarrow A \mid B \mid ab \end{aligned}$$
 - 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)
$$\begin{aligned} S &\rightarrow AB \mid a \\ A &\rightarrow aab \\ B &\rightarrow Ac \end{aligned}$$

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 → ABC | BaB
A → aA | BaC | aaa
B → bBb | a | D
C → CA | AC
D → ε
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)