1. Define Context free grammar. Construct CFG for the following languages, (3marks each)
   i) $L = \{0^{2n} 1^m \mid m, n \geq 0\}$
   ii) $L = \{a^n b^m c^n \mid m, n \geq 0\}$
   iii) $L = \{0^m 1^m 2^n \mid m \geq 1 \text{ and } n \geq 0\}$
   iv) $L = \{0^i 1^j \mid i \neq j, i \geq 0, j \geq 0\}$
   v) $L = \{w : w \in \{a, b\}^* \text{ and } w \text{ is palindrome}\}$
   vi) $L = \{a^i b^j c^k : i+j=k, i >= 0, j >= 0\}$
   vii) $L = \{a^n b^m c^k : n + 2m = k\}$
   viii) $L = \{0^i 1^j 2^k \mid i=j \text{ or } j=k\}$
   ix) $L = \{w \in \{a, b\}^* : w = w^R\}$
   x) $L = \{a^n b^m c^k \text{ where } k=m+n, m, n >= 0\}$
   xi) $L = \{0^{n+2} 1^n : n \geq 0\}$

2. Define the following terms:
   i) Leftmost derivation
   ii) Rightmost derivation
   iii) Yield of the tree
   iv) Sentential form of the sentence

3. Consider the grammar G, with productions:
   S→AbB
   A→aA | ε
   B→aB | bB | ε
   Give the leftmost derivation, rightmost derivation and parse tree for the string aaabab. (06M)

4. What is ambiguous grammar? Prove that the following grammar is ambiguous on the string aab.
   S→aS | aSbS | ε   (04M)

5. Show that the following grammar is ambiguous:
   $E \rightarrow E + E \mid E * E \mid (E) \mid id.$
   Write an equivalent unambiguous grammar for the same. (06M)

6. Define Ambiguity. Consider the grammar

   S -> aSbS | bSaS | ε
   a) Show that this grammar is ambiguous by constructing two different leftmost derivations for the sentence **abab**.
   b) Construct the corresponding rightmost derivation for abab.
   c) Construct the corresponding parse trees for abab.
   d) What language does this grammar generate? (08M)

7. Consider the following context free grammar S → SS + | SS * | a and the input string, **aa + a***
   i. Give LMD and RMD
   ii. Parse tree
   iii. Is the grammar ambiguous? Why
   iv. Describe the language generated by the grammar

8. Define Pushdown Automata. Design a PDA to accept the following language. L={ $0^{2n}1^n$: n>=1}. Draw the transition diagram for the PDA and also show the moves made by PDA for the string "000011". (10M)
9. Define the language accepted by a Pushdown Automata.
10. Convert the following CFG to equivalent PDA.

$$S \rightarrow aABB \mid aAA$$
$$A \rightarrow aBB \mid a$$
$$B \rightarrow Bbb \mid A$$
$$C \rightarrow a$$

11. Show that the following grammar is ambiguous.
    $S \rightarrow SbS$
    $S \rightarrow a$

12. Design a PDA to accept the language L={$ww^R \mid w \in \{a, b\}+$. Draw the transisiton diagram and show IDs for the string 'abbbba'. (10M)
13. Convert the following CFG to a PDA by empty stack.
    $E \rightarrow E + E \mid E * E \mid (E) \mid I$
    $I \rightarrow Ia \mid Ib \mid I0 \mid I1 \mid a \mid b$ (05M)
14. Convert the following CFG to a PDA by empty stack.
    $E \rightarrow E+E \mid E*E \mid (E) \mid id$ (05M)

15. Define Deterministic Pushdown Automata. Also design a DPDA along with transition diagram for the following language: L={$a^n b^n \mid n \geq 0$}. (07M)
16. Design a PDA to accept the language l={w: w$\in$\{a, b\}* & na(w)=nb(w)}. (06M)
17. Design a PDA for the language L={$a^n b^m c^n \mid n. m \geq 0$}. (06M)
18. Define Context-free grammar (CFG). Design CFG for the following languages: (08M)
    i)   To generate strings of balanced parantheses.
    ii)   L={$0^m 1^m 2^n \mid m \geq 1$ and $n \geq 0$}
19. Define Deterministic PDA with example. (04M)
20. Obtain PDA to accept the language :
    L={$wCw^R \mid w \in (a+b)*$} by final state.   (07M)

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