SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai — 600 044.
B.Sc. END SEMESTER EXAMINATIONS APRIL-2022
SEMESTER - VI
14UMACE6A02 **&** UMA/CE/6A02 - **Formal Languages and Automata Theory**

Total Duration : 3 Hrs. **Total Marks : 60**

Section A

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Let G = (N,t,p,s), n=(s,b), t=(a,b,c).P consists of the following productions
   (i)S $\rightarrow$ aSBc
   (ii)S $\rightarrow$ abc
   (iii)cB $\rightarrow$ Bc
   (iv)bB $\rightarrow$ bb then prove that L(G) = $a^n b^n c^n$ / n $\geq$ 1 is a CSL.
2. Prove that the families of PSL is closed under Union.
3. Examine whether the following grammar is ambiguous or not: G= (N,T,P,S) where N={S,A}, T={a,b,c} and P is given by S$\rightarrow a^2$Sa, S$\rightarrow$aSa, S$\rightarrow$aS, S$\rightarrow\in$.
4. Show that the family of CFL is closed under substitution.
5. Given a context free grammar G = (N,T,P,S) , find an equivalent grammar G' with no rules of the form A$\rightarrow$B, A,B$\in$N.
6. Construct a context free grammars in Greibach normal form to generate the context free language L = $\{a^n b^n / n \geq 1\}$.(Given G= (N,T,P,S)where N={S}, T={a,b} and P = S$\rightarrow$aSb, S$\rightarrow$ab} generates L).
7. Explain the terms (i) Deterministic finite automaton (ii) Transition diagram
8. Prove that a language is accepted by some $\in$ - NFA if and only if L is accepted by some DFA.

Section B

Answer any **THREE** questions $(3 \times 10 = 30$ Marks)

9. Let L = {w/w is in $\{a,b\}^+$ and w consists of an equal number of a's and b's}. A CFG generating the language L is given by G=(N,T,P,S) where N = {S,A,B}, T ={a,b} and P consists of following rules:
   S$\rightarrow$aB A$\rightarrow$aAA
   S$\rightarrow$bA B$\rightarrow$b
   A $\rightarrow$a B$\rightarrow$bS
   A $\rightarrow$aS B$\rightarrow$aBB.
   Show that L(G) =L.

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10. Every context-sensitive language is generated by a context sensitive grammar in which all the rules are either of the form u-v, where u and v are strings of non-terminals only or of the, form A$\rightarrow$a where A is a non-terminal and $\acute{a}$, is a terminal.
11. State and Prove Chomsky Normal Form.
12. If D = (Q_D, $\sum$, δ_D, $\{q_0\}$, F_D) is the DFA constructed from NFA N = (Q_N, $\sum$, δ_N , q_0,F_N) by the subset construction, then prove that L(D) = L(N).
13. State and prove Pumping lemma for regular sets.

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