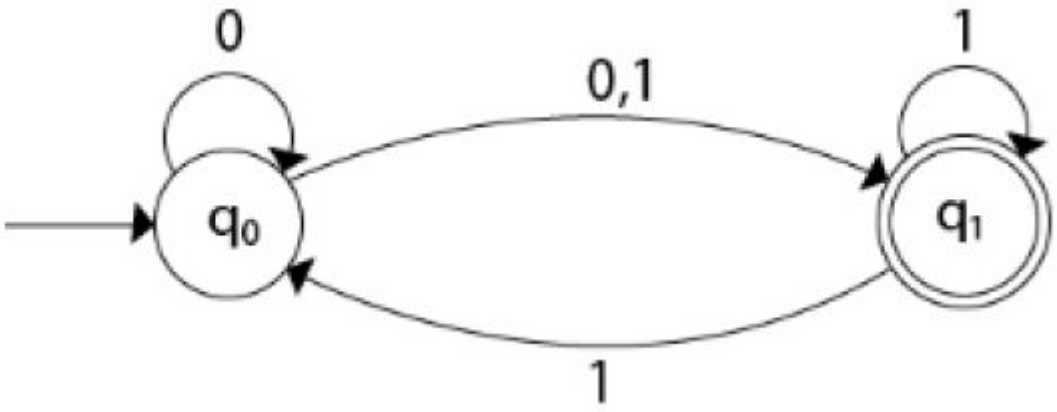
SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai — 600 044.
B.Sc.(Maths) END SEMESTER EXAMINATIONS NOVEMBER -2023
SEMESTER - VI
14UMACE6A02 - Formal Languages and Automata Theory

Total Duration : 2 Hrs 30 Mins. Total Marks : 60

Section B

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

1. Determine the type of grammar G which contains the following productions:
   (i) S $\rightarrow$ aAB, S $\rightarrow$ AB, A $\rightarrow$ a, B $\rightarrow$ b.
   (ii) S $\rightarrow$ aB, B $\rightarrow$ AB, aA $\rightarrow$ b, A $\rightarrow$ a, B $\rightarrow$ b.
   (iii) S $\rightarrow$ aAB, AB $\rightarrow$ bB, B $\rightarrow$ b, A $\rightarrow$ aB.
2. Prove that if L1 and L2 are context-free languages then $L_1 \cup L_2$ is also Context-free.
3. Examine whether the following grammar is ambiguous or not.
   G = {(S, A), (a,b), S, P} where P contains productions S $\rightarrow$ aAb / abSb / a, A $\rightarrow$ bS / aAAb.
4. From the Grammar: S $\rightarrow$ a/ aA / B/ D; A $\rightarrow$ aB / ϵ; B $\rightarrow$ Aa / b.
   Eliminate ϵ – production, any unit productions, and any useless production in the resulting Grammar.
5. Explain CNF and GNF.
6. Convert the given NFA into its equivalent DFA



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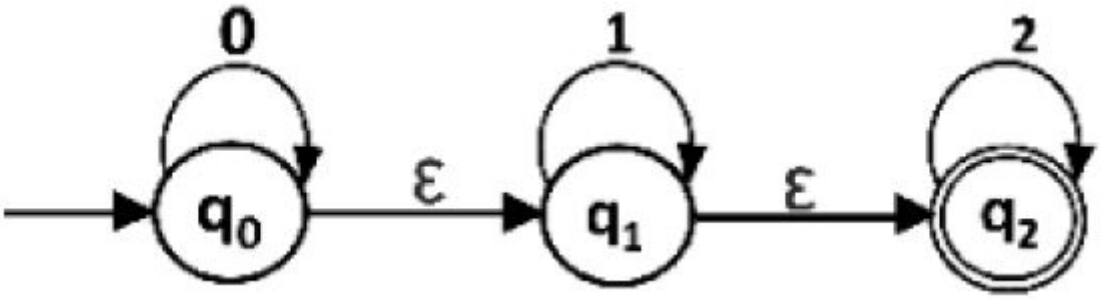
7. Convert the given NFA - ϵ into its equivalent DFA.



8. State Pumping lemma. Use the pumping lemma to show that L = $\{a^n b^n : n \geq 0\}$ is not regular.

Section C

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

9. Define Phrase-Structure Grammar and Discuss its types with example.
10. Convert the given grammar to CNF: S $\rightarrow$ aAD, A $\rightarrow$ aB / bAB, B $\rightarrow$ b,D $\rightarrow$ d.
11. Prove that if D = (Q_D, $\sum$, δ_D, {q0}, F_D) is the DFA constructed from NFA N = (Q_N, $\sum$, δ_N, q0, F_N) by the subset construction, then L(D) = L(N).
12. Design a FA from given regular expression 10 + (0 + 11)0* 1.
13. (i) If G = {(S, A), (a, b), S, P} where P contains productions S $\rightarrow$ aAS / a, A $\rightarrow$ SbA / SS/ ba generate the string aabbaa by using left and right most derivation.
    (ii) Construct derivation trees for the words (a) ababbbba, (b) bbbcbbba using the grammars G1 and G2 respectively
    G1: S $\rightarrow$ AbS, A $\rightarrow$ aS, S $\rightarrow$ ba, A $\rightarrow$ b.
    G2: S $\rightarrow$ bcS, S $\rightarrow$ bbS, S $\rightarrow$ cb, S $\rightarrow$ a.

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