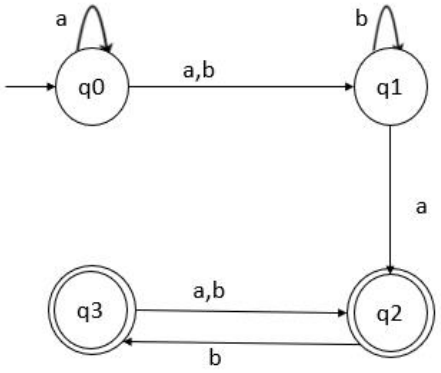
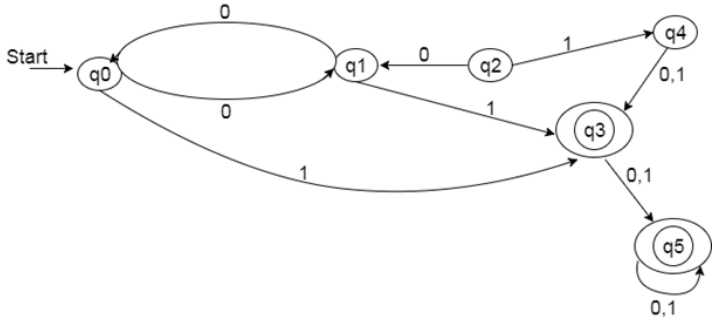
NUMERICAL PROBLEMS ON FORMAL LANGUAGE AND AUTOMATA THEORY

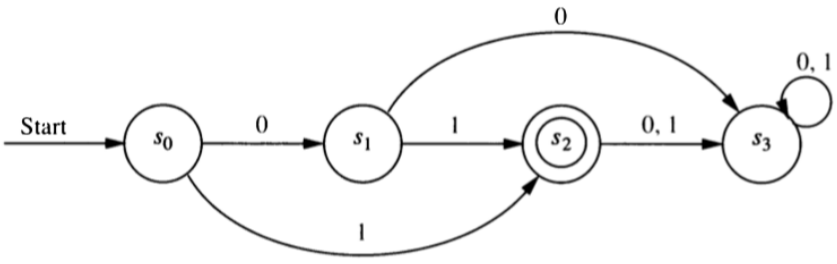
1. Design FA with ∑ = {0, 1} accepts even number of 0's and even number of 1's.
2. Draw a DFA that accepts a language L over input alphabets ∑ = {0, 1} such that L is the set of all strings starting with '00'.
3. Construct a DFA that accepts a language L over input alphabets ∑ = {a, b} such that L is the set of all strings starting with 'aa' or 'bb'.
4. Design DFA for the given regular expression a(ab)*aa.
5. Design an NFA in which all the string contains a substring 1110.
6. Design an NFA with ∑ = {0, 1} accepts all string in which the third symbol from the right end is always 0.
7. Consider a Non-deterministic finite automaton (NFA) and convert that NFA into equivalent Deterministic Finite Automata (DFA).



8. Minimize the following DFA.



9. Write a Regular Expression for the alphabet a, b, c containing at least one a and at least one b.
10. Convert the DFA into an equivalent regular expression



11. Using Pumping Lemma, prove that the language A = $\{a^n b^n \mid n \geq 0\}$ is Not Regular.

12. Prove that L= $\{a^n b^n a b^{n+1}$ for n=1,2,3,……$\}$ is not regular.
13. Design a PDA for the following language L=$\{a^n b^{2n}: n>0\}$
14. Design a PDA for the following language L=$\{a^n b^m c^{n+m}: n>=0, m>=0\}$
15. Design a TM to perform addition of two unary numbers.
16. Design a TM to perform multiplication of two unary numbers.
17. Construct a CFG for the regular expression (0+1)*
18. Construct a CFG for the language L = $a^n b^{2n}$ where n>=1.

19. Construct a derivation tree for the string aabbabba for the CFG given by,

$$S \rightarrow aB \mid bA$$
$$A \rightarrow a \mid aS \mid bAA$$
$$B \rightarrow b \mid bS \mid aBB$$

20. Check whether the given grammar G is ambiguous or not.

$$A \rightarrow AA$$
$$A \rightarrow (A)$$
$$A \rightarrow a$$

21. Show that the given grammar is ambiguous. Also, find an equivalent unambiguous grammar.

$$S \rightarrow ABA$$
$$A \rightarrow aA \mid \varepsilon$$
$$B \rightarrow bB \mid \varepsilon$$

22. Remove the production from the following CFG by preserving the meaning of it.

$$S \rightarrow XYX$$
$$X \rightarrow 0X \mid \varepsilon$$
$$Y \rightarrow 1Y \mid \varepsilon$$

23. Check whether the following grammar is in CNF or not. If not convert it into CNF form

$$S \rightarrow ASB$$
$$A \rightarrow aAS \mid a \mid \varepsilon$$
$$B \rightarrow SbS \mid A \mid bb$$

24. Check whether the following grammar is in GNF or not. If not convert it into GNF form

$$S \rightarrow XB \mid AA$$
$$A \rightarrow a \mid SA$$
$$B \rightarrow b$$
$$X \rightarrow a$$

25. Design a TM to compute 1's complement

26. Design a Turing machine to compute 2's Complement.

27. Design a Turing machine which will recognise the strings ={ 0^n.1^n.2^n | n>=1}

28. Design a Turing machine which will recognise the strings= { a^n.b^(n+1) || n>=1}

29. Discuss about P and Np Problem. Give examples of the NP problem and Np-hard Problem.