AUTOMATA THEORY AND COMPUTABILITY
SEMESTER – V

Question Bank

Module 2

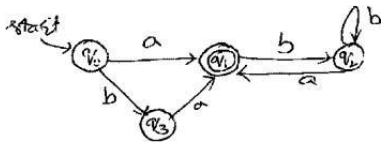
1. Consider the DFA shown below:

States	0	1
→q_1	q_2	q_1
q_2	q_3	q_1
*q_3	q_3	q_2

Obtain the regular expressions $R_{ij}^{(0)}$, $R_{ij}^{(1)}$ and simplify the regular expressions as much as possible. (9-Marks) (3a) (Dec.2017/Jan.2018)

2. Give Regular expressions for the following languages on Σ = {a, b, c}
   i. all strings containing exactly one a
   ii. all strings containing no more than 3 a's.
   iii. all strings that contain at least one occurrence of each symbol in Σ. (3-Marks) (3b) (Dec.2017/Jan.2018)

3. Let L be the language accepted by the following finite state machine.



Indicate for each of the following regular expressions, whether it correctly, describes L: (6-Marks) (3c) (Dec.2017/Jan.2018)

4. Prove that the following language in not regular : L ={0^n1^n | n > 0}. (5- Marks) (4a) (Dec.2017/Jan.2018)

5. If L_1 and L_2 are regular languages then prove that L_1 U L_2, $L_1.L_2$ and L_1* are regular languages. (5-Marks) (4b) (Dec.2017/Jan.2018)

6. Is the following grammar is ambiguous? S
   → iC + S| iC + SeS|a
   C → b (6-Marks) (4c) (Dec.2017/Jan.2018)

7. Define regular expression. Obtain a regular expression for the following languages:
   i. L={a_nb_m|m+n is even}.
   ii. L={a_nb_m|m>=1,n>=1, nm >= 3}
   iii. L={w:|w|mod3=0 where w Є (a,b)*} . (8-Marks) (3a) (June/July 2018)

8. Design an NDFSM that accept the language L(aa*(a+b)). (4-Marks) (3b) (June/July 2018)

9. Convert the regular expression (0+1)*1(0+1) to NDFSM. (4-Marks) (3c)

(June/July 2018)

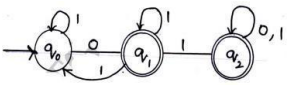
10. If the regular grammars define exactly the regular language, then prove that the class of languages that can be defined with regular grammars is exactly the regular languages. (4-Marks) (4a) (June/July 2018)

11. Prove that the regular languages are closed under complement, intersection, difference, reverse and letter substitution. (8-Marks) (4b) (June/July 2018)

12. State and prove pumping theorem for regular language. (4-Marks) (4c) (June/July 2018)

13. Define Regular expression and write Regular expression for the following language.
    i. $L = \{a^{2n} b^{2m} \mid n \geq 0 , m \geq 0 \}$
    ii. $L = \{a^n b^m \mid m \geq 1 , n \geq 1 , nm \geq 3\}$. (8-Marks) (3a) (Dec.2018/Jan.2019)

14. Obtain the Regular expression for the following FSM. (8-Marks) (3b) (Dec.2018/Jan.2019)



15. Define a Regular grammar. Design regular grammars for the following languages.
    i. Strings of a's and b's with at least one a.
    ii. Strings of a's and b's having strings without ending with ab.
    iii. Strings of 0's and 1's with three consecutive 0's. (8-Marks) (4a) (Dec.2018/Jan.2019)

16. Prove that the following languages are not regular:
    i. $\{a^i b^j \mid i>j\}$
    ii. $L = \{ w \mid n_a(w) = n_b(w) \}$ (8-Marks) (3b) (Dec.2018/Jan.2019|10 Scheme)

17. Show that if L_1 and L_2 are regular, so is $L_1 \cap L_2$. (4-Marks) (3c) (Dec.2018/Jan.2019|10 Scheme)

18. Define context free grammar. Obtain the CFG for following languages:
    i. $L=\{a^n b^m c^k \mid n+2m=k$ for $n>=0,m>=0\}$
    ii. $L= \{ ww^R / w \in \{a, b\}^*\}$ (8-Marks) (4a) (Dec.2018/Jan.2019|10 Scheme)

19. Construct the left most derivation, right most derivation and parse trees for the grammar.
    E→E+E|E-E|E*E]id for input string "id + id * id". (6-Marks) (4b) (Dec.2018/Jan.2019|10 Scheme)

20. Prove that if L is a regular language SO LR. (5-Marks) (3b) (June/July.2017|10 Scheme)

21. Minimize the following DFA using table filling Algorithm. (10-Marks) (3c) (June/July.2017|10 Scheme)

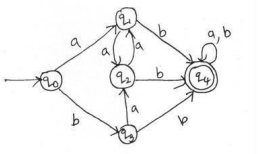
22. Define context free grammar. Write a CFG for palindromes over {0, 1}*. (5-Marks) (4a) (June/July.2017|10 Scheme)

23. If L and M are regular languages prove that L∩M is also regular. (5- Marks) (3a) (Dec.2016/Jan.2017|10 Scheme)

24. Prove that the following language is not regular

    L= $\{0^n | n \text{ is prime}\}$ (5-Marks) (3b) (Dec.2016/Jan.2017|10 Scheme)

25. Minimize the following DFA (10-Marks) (3c) (Dec.2016/Jan.2017|10 Scheme)



26. Is the following grammar ambiguous?

    S→aS|X
    X→aX|a (6-Marks) (4c) (Dec.2018/Jan.2019|10 Scheme)

27. Consider the grammar

    E → +EE| *EE | -EE | x | y

    Find leftmost and rightmost derivation for the string +* — xyxy and write parse tree. (8-Marks) (4b) (Dec.2016/Jan.2017|10 Scheme)

28. Write the application of CFG (6-Marks) (4c) (Dec.2016/Jan.2017|10 Scheme)

29. State and prove pumping lemma for regular languages. (7-Marks) (3a) (June/July.2016|10 Scheme)

30. Show that the language L = $\{a^n b^n | n > 0\}$ is not regular. (6-Marks) (3b) (June/July.2016|10 Scheme)

31. Minimize the following DFA using table filling algorithm. (7-Marks) (3c) (June/July.2016|10 Scheme)

δ	0	1
→q_1	q_2	q_3
q_2	q_3	q_5
*q_3	q_4	q_3
q_4	q_3	q_5
*q_5	q_2	q_5

32. Define CFG. Design CFG's for the following languages:
    i. L= $\{a^n b^{2n} | n>=0\}$
    ii. L= $\{\infty\infty^R / \infty \in \{a, b\}^*\}$ (8-Marks) (4a) (June/July.2016|10 Scheme)

33. Write the LMD, RMD and parse tree for the string '+*-xyxy' using the grammar

    E → +EE | *EE | -EE |x| y (6-Marks) (4b) (June/July.2016|10 Scheme)

34. What is an ambiguous grammar? Show that the following grammar is ambiguous:

    E → E+E | E*E | (E) | id (6-Marks) (4c) (June/July.2016|10 Scheme)

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