AUTOMATA THEORY AND COMPUTABILITY
SEMESTER – V

Question Bank
Module 1

1. Define the following terms with examples:

   i. Alphabet

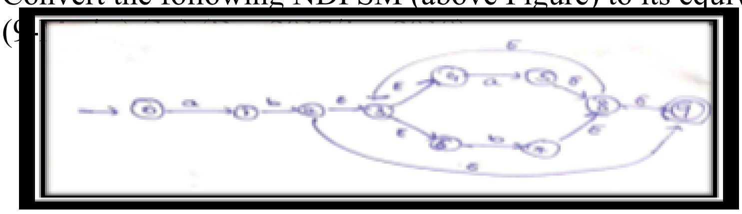
   ii. Power of an alphabet

   iii. Concatenation,

   iv. Languages (4-Marks) (1a) (Dec.2017/Jan.2018)

2. Draw a DFA to accept strings of a's and b's ending with 'bab'. (3-Marks) (1b) (Dec.2017/Jan.2018)

3. Convert the following NDFSM (above Figure) to its equivalent DFSM. (9



4. Draw a DFSM to accept the language,

   $L = \{\omega \in \{a,b\}^* : \forall x, y \in \{a,b\}^* ((\omega = x\ abbaay) \vee (\omega = x\ babay))\}$

   (3-Marks) (2a) (Dec.2017/Jan.2018)

5. Define distinguishable and indistinguishable states, Minimize the following DFSM,

S	0	1
A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

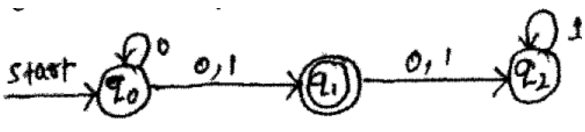
   i. Draw the table of distinguishable and indistinguishable state for the automata.
   ii. Construct minimum state equivalent of automata. (9-Marks) (2b) (Dec.2017/Jan.2018)

6. Write differences between DFA, NFA an ϵ.NFA (4-Marks) (2c) (Dec.2017/Jan.2018)

7. With a neat diagram, explain a hierarchy of language classes in automata theory. (4-Marks) (1a) (June/July 2018)

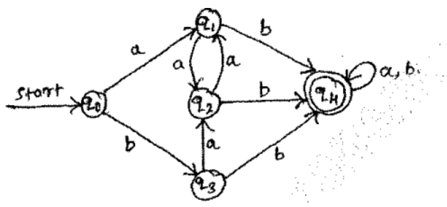
8. Define deterministic FSM. Draw a DFSM to accept decimal strings which are divisible by 3. (6-Marks) (1b) (June/July 2018)

9. Convert the following NDFSM to its equivalent DFSM.



Also write transition table for DFSM. (6-Marks) (1c) (June/July 2018)

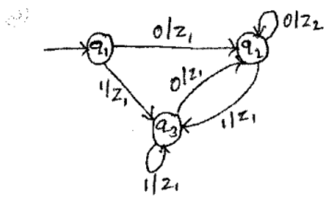
10. Minimize the following finite automata, (6-Marks) (2a) (June/July 2018)



11. Construct a mealy machine for the following:

   i. Design a mealy machine for a binary. input sequence. Such that, if it has a substring 101, the machine outputs A. If input has substring 110, the machine outputs B. Otherwise it outputs C.
   ii. Design a mealy machine that takes binary number as input and produces 2's complement of that number as output. Assume the string is read from LSB to MSB and end carry is discarded. (6- Marks)(2b) (June/July 2018)

12. Convert the following mealy. machine to Moore machine. (4-Marks) (2c) (June/July 2018)



13. Define the following with example :

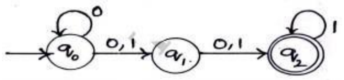
   i. String
   ii. Language
   iii. Alphabet

iv. DFSM. (08 Marks) (1a) (Dec.2018/Jan.2019)

14. Design a DFSM to accept each of the following languages :

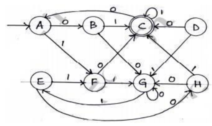
   i. L = {W Є {0, 1}* : W has 001 as a substring}
   ii. L = {W Є {a, b} * : W has even number of a's and even number of b's}. (8-Marks) (1b) (Dec.2018/Jan.2019)

15. Define NDFSM. Convert the following NDFSM to its



equivalent DFSM. (8-Marks) (2a) (Dec.2018/Jan.2019)

16. Minimize the following DFSM. (8-Marks) (2b) (Dec.2018/Jan.2019)

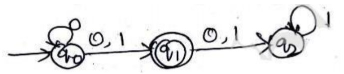


17. Define DFA. Construct the DFA for the following languages:

i. String of a's and b's ending with abb.

ii. L= { w/ |w| mod S=0 } on = { a}. (6-Marks) (1b) (Dec.2018/Jan.2019|10 Scheme)

18. Convert the following NFA into equivalent DFA (8-Marks) (1c) (Dec.2018/Jan.2019|10 Scheme)



19. Write the Regular expressions for following languages:

i. L(R)={ w| w Є {0, 1}* with at least 3 consecutive zeros }

ii. L= {$a^n b^m$ | m + n is even} (6-Marks)(2a) (Dec.2018/Jan.2019|10 Scheme)

20. Prove that every language defined by regular expression is also defined by finite automata. (8-Marks) (2b) (Dec.2018/Jan.2019|10 Scheme)

21. Convert the following regular expressions to NFA with Є- Transitions:

i. ab(at+b)*

ii. aa(b + a)* (6-Marks) (2c) (Dec.2018/Jan.2019|10 Scheme)

22. Give Formal definition of DFA. And also Design a DFA to read a string made up of letters "computer" and recognize the strings that contains the word "cut" as a substring. (10-Marks) (1a) (June/July.2017|10 Scheme)

23. Design a DFA to accept strings of a's and b's not ending with abb. (5-Marks) (1b) (June/July.2017|10 Scheme)

24. Covert the followins NFA to DFA

δ	0	1
→q_0	{q_0}	{ q_0, q_1}
q_1	q_2	q_2
*q_2	ϕ	ϕ

(5-Marks) (1c) (June/July.2017|10 Scheme)

25. Consider the following Є – NFA

δ	∈	a	b
→ P	{r}	{q}	{p, r}
q	Φ	{p}	Φ
*r	{p, q}	{r}	{p}

i. Compute the Є -closure of each state

ii. Give the set of all strings of length 3 or less accepted by the automation.

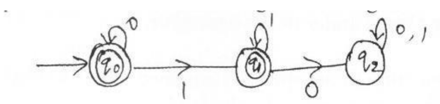
iii. Convert the automation to DFA. (8-Marks) (2a) (June/July.2017|10 Scheme)

26. Describe regular expression recursively. Write the regular expression for the following:

i. Strings of a's and b's that do not end with ab over {a, b}*

ii. String of 0^s and 1^s such that starts and ends with the same symbol. (6-Marks) (2b) (June/July.2017|10 Scheme)

27. Obtain regular expression from the following DFA using state elimination method. (6-Marks) (2c) (June/July.2017|10 Scheme)



28. Define Finite automata. Write the application of finite automata. (5-Marks) (1a) (Dec.2016/Jan.2017|10 Scheme)

29. Design a DFA to accept the following language over the alphabet {0, 1}.

i. $L=\{(01)^i .2^j \mid i>=1, j>=1\}$

ii. L={∞:|∞|mod3=|∞|mod2} (10-Marks) (1b) (Dec.2016/Jan.2017|10 Scheme)

30. What is NFA? Explain with example. (5-Marks) (1c) (Dec.2016/Jan.2017|10 Scheme)

31. Define Regular expression. Find regular expression for the following languages.

i. $L -\{a^n b^m : (m+ n) \text{is even}\}$

ii. Strings of a's and b's whose 3^{rd} symbol from right is a. (5- Marks) (2a) (Dec.2016/Jan.2017|10 Scheme)

32. Consider the following Є-NFA

δ	ε	a	b	c
→p	ϕ	p	q	r
q	p	q	r	ϕ
*r	q	r	ϕ	p

i. Compute Є-closure of each state

ii. Convert the automata to DFA (10-Marks) (2b)

33. Obtain an Є –NFA for the regular expression a* + b* +c*. (5- Marks) (2c) (Dec.2016/Jan.2017|10 Scheme)

34. Define the following with examples:

i. Alphabet,

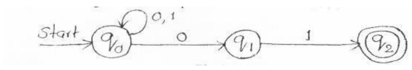
ii. String. (4-Marks) (1a) (June/July.2016|10 Scheme)

35. Define DFA. write the DFA's for the following languages on Σ = {a, b}. (June/July.2016|10 Scheme)

i. The set of all strings containing the substring ‘ab’.

ii. L: {∞|[∞] mod 3 = 0} (8-Marks) (1b)
(June/July.2016|10 Scheme)

36. Convert the following NFA to its equivalent DFA.



(8-Marks) (1c) (June/July.2016|10 Scheme)

37. Define a regular expression. Also write the regular expressions for the following languages.

i. The set of all strings ending in the substring ‘00’ on Σ= {0, 1}

ii. L= $\{a^n b^m | n>=4, m<=3\}$. (08 Marks) (2a) (June/July.2016|10 Scheme)

38. Prove that every language defined by a regular expression is also defined by a finite automation. (8- Marks)(2b) (June/July.2016|10 Scheme)

39. Write the Є-NFA for the regular expression ab(a+b)*. (4-Marks) (2c) (June/July.2016|10 Scheme)

40. What is Automata? Discuss why study automata. (6-Marks) (1a) (Dec.2015/Jan.2016|10 Scheme)

41. Mention the differences between DFA. NFA and NFA-Є. (4- Marks) (1b) (Dec.2015/Jan.2016|10 Scheme)

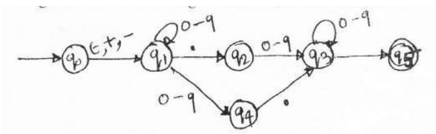
42. Design a DFA to accept the language L = {W / W is of even length and begins with 01} (6-Marks) (1c) (Dec.2015/Jan.2016|10 Scheme)

43. Design the NFA-Є or NFA forthe languages given below:

i. abc, abd and aacd {Assume Σ= a, b, c, d }

ii. {ab, abc}* {Assume Σ= a,b,c}. (4-Marks) (1d) (Dec.2015/Jan.2016|10 Scheme)

44. Convert the following NFA-e to DFA using "subset construction scheme. (8-Marks) (Dec.2015/Jan.2016|10 Scheme)



45. Define Regular expression and write regular expression for the following languages:

i. L=$\{a^{2n} b^{2m} : n>=0, m>=0\}$

ii. Language over {0, l} having all strings not containing 00. (6- Marks) (2b) (Dec.2015/Jan.2016|10 Scheme)

46. Convert the regular expression (0+1) 1(0+1) to a NFA-Є. (6- Marks) (2c) (Dec.2015/Jan.2016|10 Scheme)

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