B.E. Fifth Semester (Computer Engineering) (C.B.S.)

Theory of Computation

P. Pages : 3 **NKT/KS/17/7360**

Time : Three Hours * 0 0 5 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) What do you mean by finite state machine? Give its application. **5**

b) Design DFA for language of (a, b) containing 'aba' as substing and not containing 'bab' as substing. **8**

OR

2. a) Construct DFA equivalent to the NFA **6**

$= (\{a, b, c, d\}\{0, 1\}, \delta, a, \{d\})$

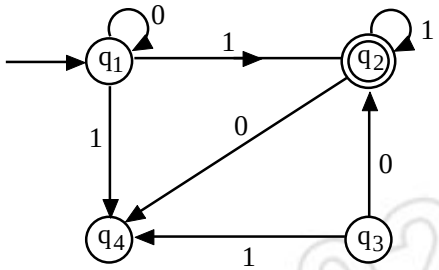
where δ is given by –

δ	0	1
→ a	a, b	a
b	c	c
c	d	-
(d)	d	d

b) Construct a Moore machine equivalent to the Mealy machine M given in the table. **7**

Present State	Next State			
	a = 0		a = 1	
	State	Output	State	Output
→ q_1	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

3. a) Construct equivalent Regular expression for the given Finite state machine. **8**



b) Construct an equivalent left linear grammar for the right Linear grammar given as – **6**

$S \rightarrow 0A \mid 1B$

$A \rightarrow 0C \mid 1A \mid 0$

$B \rightarrow 1B \mid 1A \mid 1$

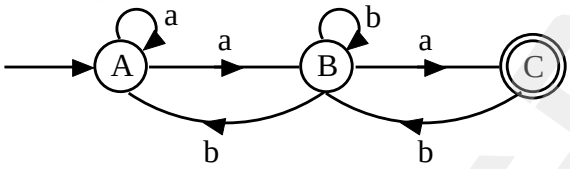
$C \rightarrow 0 \mid 0A$

OR

4. a) Shown that the string recognised by the given automata is given by the regular expression **8**

$r = (a + a(b + aa)^*b)^*a(b + aa)^*a$

The automata is :-



b) State and prove theorem of pumping Lemma. Give its application. **6**

5. a) What do you mean by ambiguous grammar? Find whether the following grammar are ambiguous or not **8**

(i) $S \rightarrow a \mid abSb \mid aAb$

$A \rightarrow bS \mid aAAb$

(ii) $S \rightarrow ab \mid aB$

$A \rightarrow aAB \mid a$

$B \rightarrow ABb \mid b$

b) Convert the following grammar to CNF **5**

$S \rightarrow 1A \mid 0B$

$A \rightarrow 1AA \mid 0S \mid 0$

$B \rightarrow 0BB \mid 1S \mid A$

OR

6. a) Construct PDA accepting the following language **8**

$L = \{0^m\ 1^n\ 0^{m+n} \mid m \geq 1\ \&\ n \geq 1$

b) Obtain simplified CFG for the given CFG **5**

$S \rightarrow AB \mid CA$

$A \rightarrow a$

$B \rightarrow BC \mid AB$

$C \rightarrow aB \mid b$

7. a) Design Turing Machine which accepts the language **8**

$L = \{a^n\ b^n\ c^n \mid n \geq 1\}$

b) What do you mean by context sensitive grammar? Explain the model of computation used to process context sensitive grammar. **5**

OR

8. a) Explain the various properties of Recursive Enumerable language. **6**

b) Explain briefly about – **7**

i) Universal Turing machine. ii) Counter Machine.

9. a) What do you mean by halting problem? Discuss halting problem in brief. **5**

b) What is undecidability of a problem? with suitable example, explain undecidability of a problem. **5**

c) Explain Church hypothesis. **4**

OR

10. a) Ackerman's function is defined by **7**

$A(0, y) = y + 1$

$A(x + 1, 0) = A(x, 1)$

$A(x + 1, y + 1) = A(x, A(x + 1, y))$

Compute –

A(1, 1), A (2, 1), A(1, 2) and A(2, 2)

b) Does a PCP with two list **7**

$x = (b, bab^3, ba)$ and

$y = (b^3, ba, a)$ have solution ? Explain .

11. a) Define and Explain Primitive Recursive function. **6**

b) Show that the addition of two integers x & y is primitive recursive. **7**

OR

12. Write short notes on : **13**

i) MOD and DIV functions. ii) Bounded Minimalization.

iii) Unbound Minimalization. iv) μ-Recursive function.

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