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QUESTION BANK (DESCRIPTIVE)

Subject with Code : FLAT(16CS517)
Year & Sem: III-B.Tech & I-Sem

Course & Branch: B.Tech – CSE & CSIT
Regulation: R16

UNIT I
Introduction To Finite Automata

1. a) Consider the below finite automata and check the strings are accepted or not

States (Q)	Input Alphabtes	
	0	1
→q0	q1	q3
q1	q0	q2
⊙q2	q3	q1
q3	q2	q0

- (i) 1110 (ii) 0001 (iii) 1010

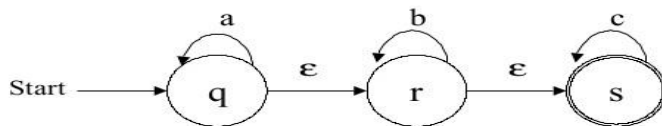
[L2,2+2+2M]

b) Define NFA. What are the differences between DFA & NFA?

[L2,4M]

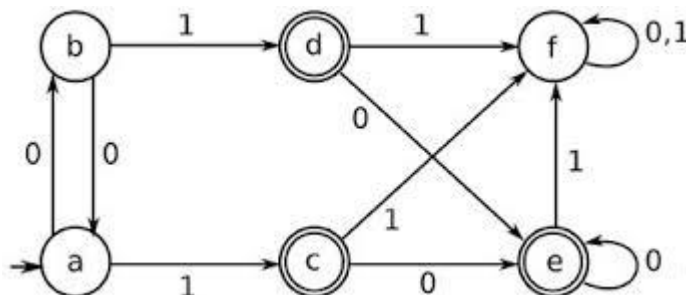
2. Convert the following NFA with ϵ moves to DFA without ϵ moves.

[L2,10M]



3. Minimize the following finite automata.

[L3,10M]



4. Convert the following Mealy machine into its equivalent Moore machine. [L2,10M]

Present State	I/P=0		I/P=1	
	Next State	O/P	Next State	O/P
→ A	C	0	B	0
B	A	1	D	0
C	B	1	A	1
D	D	1	C	0

5. a) Write about relations on sets. [L1,2M]
 b) Define Grammar? What are the tuples? [L1,2M]
 c) Define Finite Automaton. [L2,2M]
 d) Show that $(0^*1^*)^* = (0+1)^*$. [L3,2M]
 e) Define Mealy machine and Moore machine. [L2,2M]
6. a) Discuss Chomsky's Hierarchy of formal languages. [L1,5M]
 b) Explain briefly about DFA and NFA? [L1,5M]
7. a) Define Moore machine? Construct Mealy machine corresponding to Moore machine? [L2,5M]

States (Q)	Next States		Output
	I/P=0	I/P=1	
→ q1	q1	q2	0
q2	q1	q3	0
q3	q1	q3	1

- b) Prove i) $R=(1+00^*1) + (1+00^*1)(0+10^*1)^*(0+10^*1)^* = 0^*1(0+10^*1)^*$
 ii) $R= \epsilon + 1^*(011)^*(1^*(011)^*)^* = (1+011)^*$

[L3, 21/2+21/2M]

8. Write down procedure for Myhill- Nerode theorem with a given example. (** means final states). [L2, 10M]

Present State	Next State	
	I/P=a	I/P=b
→ A	B	F
B	A	F
C	G	A
D	H	B
E	A	G
*F	H	C
*G	A	D
*H	A	C

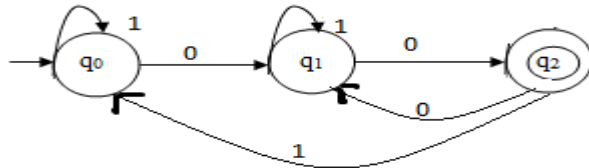
9. a) Define relations on set and explain its property with an example [L1,3M]
 b) Define NFA and DFA. Construct DFA for the given NFA [L2,7M]

	Next state	
	0	1
→ q0	q0,q1	q0
q1	q2	q1
q2	q3	q3
⊙ q3	-	q2

10. a) List out the identities of Regular expression. [L3,4M]
 b) From the identities of RE, prove that
 i) $10+(1010)^*[(1010)^*]=10+(1010)^*$ [L3,2M]
 ii) $(0+011^*)+(0+011^*)(01+0100^*)(01+0100^*)^*=01^*(010^*)^*$ [L3,2M]
 c) Define finite automata? Explain detail about the tuples. [L2,2M]

UNIT II
Regular Languages

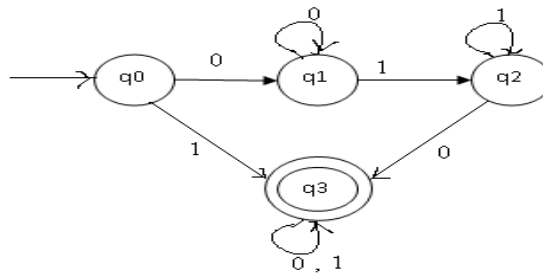
1. a) Construct an equivalent FA for the given regular expression $(0+1)^*(00+11)(0+1)^*$ [L1,5M]
 b) State Arden's theorem and construct the regular expression for the following FA using Arden's theorem. [L1,5M]
2. Explain about Arden's theorem, for constructing the RE from a FA with an example. [L1,10M]



3. a) List out the identities of Regular expression. [L1,4M]
 b) From the identities of RE, prove that [L2,6M]
 - i) $10+(1010)^*[\wedge+(1010)^*]=10+(1010)^*$
 - ii) $(0+011^*)+(0+011^*)(01+0100^*)(01+0100^)*=01^*(010^*)^*$
4. a) Consider the below finite automata and check the strings are accepted or not [L3,6M]

States (Q)	Input Alphabtes	
	0	1
$\rightarrow q_0$	q1	q3
q1	q0	q2
q2	q3	q1
q3	q2	q0

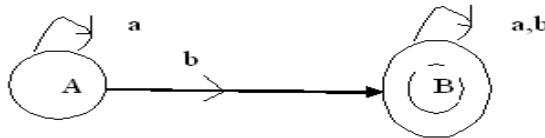
- (i) 1110 (ii) 0001 (iii) 1010
- b) Construct an equivalent FA for the given regular expression $(0+1)^*(00+11)(0+1)^*$ [L3,4M]
5. a) Prove $R=Q+RP$ has unique solution, $R=QP^*$ [L1,3M]
 b) Explain about the Arden' theorem, for constructing the RE from a FA with an example [L1,7M]



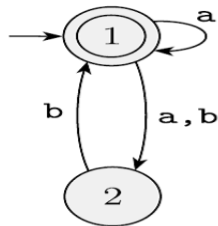
6. Explain how equivalence between two FA is verified with an example. [L2,10M]
7. Prove that the language $L= \{a^n b^n \mid n \geq 1\}$ is not regular using pumping lemma with procedure. [L2,10M]

8. a) Construct an equivalent FA for the given regular expression $(0+1)^*(00+11)(0+1)^*$ [L3,5M]
 b) State Arden's theorem and construct the regular expression for the following FA using Arden's theorem.

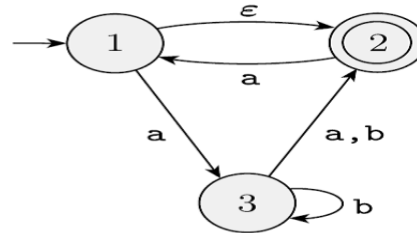
[L3,5M]



9. a) Write the process of equivalence two FA's? Find whether the equivalence two FA's or not. [L3,7M]



(a)



(b)

- b) List out the identities of Regular expression.

[L3,3M]

10. Prove that the language $L = \{a^n b^n c^n \mid n \geq 1\}$ is not regular using pumping lemma.

[L3,10M]

UNIT III**Context Free Grammars and Languages**

1. Write the procedure and Eliminate left recursion from the following Grammar [L2,10]

$$E \rightarrow E+T/T$$

$$T \rightarrow T*F/F$$

$$F \rightarrow (E)/id$$
2. a) Explain about derivation and parse trees? Construct the string 0100110 from the Leftmost and Rightmost derivation.

$$S \rightarrow 0S/1AA$$

$$A \rightarrow 0/1A/0B$$

$$B \rightarrow 1/0BB$$
 [L2,5M]

b) Find the parse tree for generating the string 11001010 from the given grammar.[L2,5M]

$$S \rightarrow 1B/0A$$

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

$$B \rightarrow 0/0S/1BB$$
3. a) Define Ambiguous grammar. [L2,4M]

b) Remove Left recursion from the grammar $S \rightarrow Sab/T$

$$T \rightarrow Tcd/F$$

$$F \rightarrow Fa/G$$
 [L2, 6M]
4. a) Explain Left recursion and Left factoring. [L3,4M]

b) Perform left factor from the grammar $A \rightarrow abB/aB/cdg/cdeB/cdfB$ [L3, 6M]
5. Simplify the following context free grammar. (Here, Λ stands for epsilon (ϵ)). [L4,10M]

$$S \rightarrow TU|V$$

$$T \rightarrow aTb|\Lambda$$

$$U \rightarrow cU|\Lambda$$

$$V \rightarrow aVc|W$$

$$W \rightarrow bW|\Lambda$$
6. Convert the following grammar into Greibach normal form. [L4,10M]

$$S \rightarrow AA/a$$

$$A \rightarrow SS/b$$
7. a) Write the process for Convert the grammar into CNF? [L3,4M]

b) Convert the following grammar into CNF. [L3, 6M]

$$S \rightarrow bA/aB \quad A \rightarrow bAA/aS/a \quad B \rightarrow aBB/bS/a.$$
8. a) What is linear grammar? Explain in detail with example. [L3,4M]

b) Explain the closure properties of context free languages. [L3, 6M]
9. a) Remove the unit production from the grammar

$$S \rightarrow AB, A \rightarrow E, B \rightarrow C, C \rightarrow D, D \rightarrow b, E \rightarrow a$$
 [L3,4M]

b) Remove ϵ productions from the grammar

$$S \rightarrow ABaC, A \rightarrow BC, B \rightarrow b/\epsilon, C \rightarrow D/\epsilon, D \rightarrow d$$
 [L3, 6M]
10. a) Write about Decision problems for CFLs with example? [L3,5M]

b) What is the differentiate between CFG and Regular Language? [L3, 4M]

UNIT IV
Pushdown Automata

1. a) Construct a PDA which recognizes all strings that contain equal number of 0's and 1's. [L2, 6M]
b) A PDA is more powerful than a finite automaton. Justify this statement. [L2, 4M]
2. Construct PDA from the following Grammar.

$$S \rightarrow aB$$

$$B \rightarrow bA/b$$

$$A \rightarrow aB$$
[L2, 10M]
3. Construct PDA from the following Grammar

$$S \rightarrow 0BB$$

$$B \rightarrow 0S/1S/0$$
[L2, 10M]
Show an ID for the string 010000 is generated for PDA?
4. Construct a CFG equivalent to the following PDA. [L2,10M]
PDA = $\{(p, q), (0, 1), \delta, p, q, (Z, X)\}$, where p is initial state, q is final state.
 δ is defined as $\delta(p,0,Z)=(p,XX), \delta(p,0,X)=(p,XX), \delta(p,1,X)=(q,\epsilon), \delta(p,1,X)=(p,\epsilon), \delta(p,\epsilon,Z)=(p,\epsilon)$.
[L3,10M]
5. a) Construct an equivalent PDA for the following CFG [L3,7M]

$$S \rightarrow aAB \mid bBA$$

$$A \rightarrow bS \mid a$$

$$B \rightarrow aS \mid b$$
b) Explain the informal introduction and formal definition of PDA. [L2, 3M]
6. a) Define Instantaneous description (ID) in PDA. [L2,5M]
b) Explain about the graphical notation of PDA. [L2, 5M]
7. a) Write the process for convert PDA into an equivalent CFG. [L4,4M]
b) Convert the following PDA into an equivalent CFG. [L4, 6M]

$$\delta(q_0, a_0, z_0) \rightarrow (q_1, z_1 z_0)$$

$$\delta(q_0, b, z_0) \rightarrow (q_1, z_2 z_0)$$

$$\delta(q_1, a, z_1) \rightarrow (q_1, z_1 z_1)$$

$$\delta(q_1, b, z_1) \rightarrow (q_1, \lambda)$$

$$\delta(q_1, b, z_2) \rightarrow (q_1, z_2 z_2)$$

$$\delta(q_1, a, z_2) \rightarrow (q_1, \lambda)$$

$$\delta(q_1, \lambda, z_2) \rightarrow (q_1, \lambda) // \text{ accepted by the empty stack.}$$
8. a) Define push down automata? Explain acceptance of PDA with empty stack. [L2,5M]
b) Define Instantaneous description (ID) in PDA. [L2, 5M]
9. a) Explain about the graphical notation of PDA. [L2,4M]
b) Construct an equivalent PDA for the following CFG. [L3, 6M]

$$S \rightarrow aAB \mid bBA$$

$$A \rightarrow bS \mid a$$

$$B \rightarrow aS \mid b.$$
10. Explain Deterministic Push down Automata with example? [L2, 12M]

UNIT - V
Turing machines & Undecidability

1. Construct a Turing machine which multiplies two unary numbers. [L1,10M]
2. Construct a Turing machine for Language $L=a^n b^n$, where $n>0$ [L1,10M]
3. Construct a Turing machine that recognizes the language $L=\{a^n b^n, n>1\}$. Show an ID for the string 'aabb' with tape symbols. [L2,10M]
4. Explain conversion of regular Expression to TM with example. [L3,10M]
5. Explain the various types of Turing machine. [L3,10M]
6. Explain Universal turing machine [L3,10M]
7. a) Design a multi head Turing Machine for checking whether a binary string is a palindrome or not. Show the ID for 1001. [L3,6M]
b) Write about Universal TM. [L3, 4M]
8. Explain in detail about variations of the TM? [L3,10M]
9. Construct a Turing machine that recognizes the language $a^n b^n c^n$. [L3,10M]
10. a) Define PCP. Verify whether the following lists have a PCP solution. [L3,7M]

$$\left(\begin{array}{c} abab \\ ababaaa \end{array} \right), \left(\begin{array}{c} aaabbb \\ bb \end{array} \right), \left(\begin{array}{c} aab \\ baab \end{array} \right), \left(\begin{array}{c} ba \\ baa \end{array} \right), \left(\begin{array}{c} ab \\ ba \end{array} \right), \left(\begin{array}{c} aa \\ a \end{array} \right).$$
- b) Describe linear bounded automaton. [L3,3M]

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