SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : FLAT(**18CS0509**)   **Course & Branch**: B.Tech – CSE

Year & Sem: II / II   **Regulation:** R18

UNIT I
Inroduction, Finite Automata

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

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

     (i) 1110   (ii) 0001   (iii) 1010   [L2,2+2+2M]
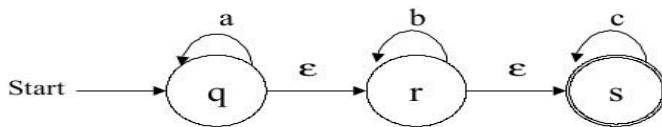   b) Define NFA. What are the differences between DFA & NFA?   [L2,4M]
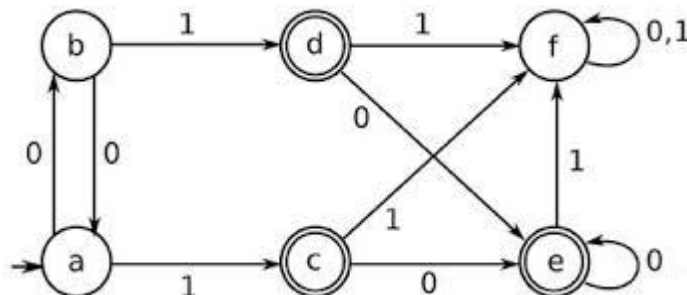2. Convert the following NFA with ε moves to DFA without ε moves.   [L2,10M]

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) Define alphabets, strings, Languages?   [L3,2M]
   e) Define Melay 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) i) Define equivalence of DFA and NFA?
       ii) Write a procedure for conversion of NFA to DFA?   [L3,2+3M]
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 a) Write the Procedure for Minimization of FA(Equivalent Method)? [L3,3M]

b) Minimize the following DFA [L2,7M]

Present states	i/p=0	i/p=1
q0	q1	q2
q1	q2	q3
q2	q2	q4
* q3	q3	q3
*q4	q4	q4
q5	q5	q4

**Here q0 is initial state and q3 and q4 are final states.
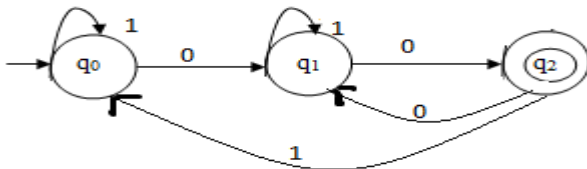
UNIT II
Regular Languages

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.
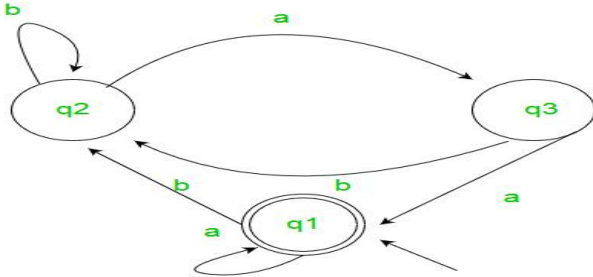
      [Ll,5M]

2. Explain about Arden's theorem, Construct RE from given Finite Automata.   [L1,10M]

3. a) List out the identities rules of Regular expression.   [L1,4M]

   b) Prove that   [L2,6M]

        i) $10+(1010)*[^+(1010)*]=10+(1010)*$

        ii) $(0+011*)+(0+011*)(01+0100*)(01+0100*)*=01*(010*)*$

3. a) Construct FA from RG
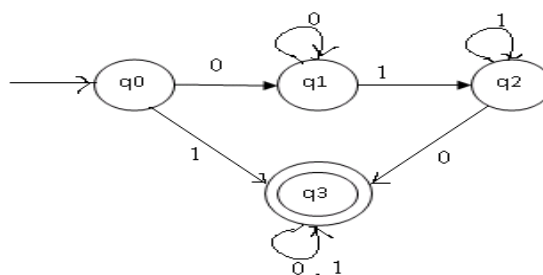
   S->aA/bB/a/b

   A->aS/bB/b

   B-> aA/bS   [L3,4M]

   b) Construct an equivalent FA for given regular expression $(0+1)*(00+11)(0+1)*$ [L3,6M]

5. a) Prove R=Q+RP has unique solution, R=QP*   [L1,3M]

   b) Explain about the Arden' theorem, Construct RE for given FA   [L1,7M]

6. Explain how equivalence b/n two FA's are verified with an example. [L2,10M]

7. Prove that the language L= $\{a^n b^n \mid n>=1\}$ is not regular using pumping lemma   [L2,10M]
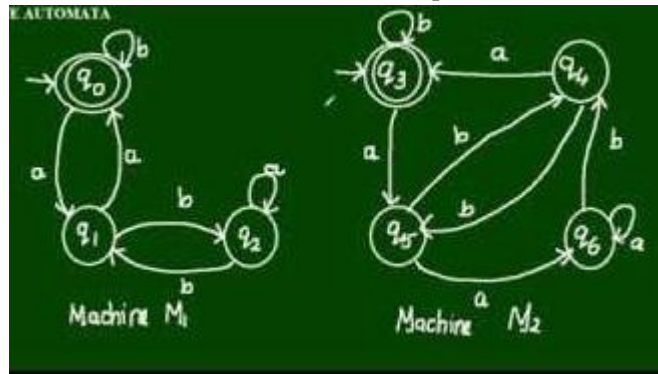   with procedure.

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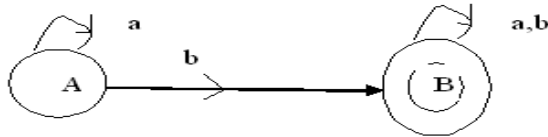
9. a)Write the process of equivalence two FA's? Find whether the equivalence two FA's or not.[L3,7M]

   b) Construct the Regular Grammar for the given Regular Expressions   [L3, 5M]
         i) ab(a+b)   ii) a*(a+b)b*
.   [L3,3M]

10. a)Prove that the language L= {aⁿbⁿ cⁿ | n>=1}is not regular using pumping lemma.   [L3,5M]

    b) Construct FA for the given RG   i) S.-> aA/b   ii) A->0B/1   [L2,5M]
                                           A-> bB/a   B-> 1C/0
                                              B->c   C->0D/1

UNIT III
Contex Free Grammars and Languages

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

   E→E+T/T

   T→T*F/F

   F→(E)/id

2. a) Define derivation tree? Construct Derivation tree, Leftmost and Rightmost derivation and Right most derivation for the string 11001010   [L2,7M]

   S→1B/0A

   A→1/1S/0AA

   B→0/0S/1BB

   b) Construct CFG for the language consisting of palindromes of the string?

3. a) Define Ambiguous grammar with one example?   [L2,4M]

   b) Remove Left recursion from the grammar S→Sab/T

   T→Tcd/F

   F→Fa/G   [L2,6M]

3. a) Explain Left recursion and Left factoring.   [L3,4M]

   b) Perform left factor from the grammar A→abB/aB/cdg/cdeB/cdfB   [L3,6M]

4. Simplify the following context free grammar. (Here, Λ stands for epsilon(ε)).   [L4,10M]

   S→TU|V

   T→aTb|Λ

   U→cU| Λ

   V→aVc|W

   W→bW| Λ

5. Convert the following grammar into Greibach normal form.   [L4,10M]

   S→AA/a

   A→SS/b

6. a) Write the procedure for Convert the grammar into CNF?   [L3,4M]

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

   S→bA/aB   A→bAA/aS/a   B→aBB/bS/a.

7. a) What is linear grammar? Explain in detail with example.   [L3,5M]

   b) Explain the closure properties of context free languages.   [L3,5M]

8. a)Remove the unit production from the grammar

   S→AB,A→E,B→C,C→D,D→b,E→a   [L3,4M]

   b)Remove ε productions from the grammar

   S→ABaC, A→BC,B→b/ ε,C→D/   ε,D→d   [L3,6M]

9. a) Explain Pumping lemma for Context free languages with one example?   [L3,6M]

   b) What are the closure properties of CFL's?   [L3,4M]

10. Simplify the following CFG   S → 0A | 1B | C, A-> 0S/00 , B-> 1/A , C->0/1   [L4,10M]

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 for the following Grammar.

   $S \rightarrow aB$

   $B \rightarrow bA/b$

   $A \rightarrow aB$ [L2,10M]

3. Construct PDA for 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 $\delta(p,0,Z)=(p,XZ)$, $\delta(p,0,X)=(p,XX)$, $\delta(p,1,X)=(q,\epsilon)$, $\delta(p,1,X)=(p,\epsilon)$, $\delta(p,\epsilon,Z)=(p,\epsilon)$. [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 formal definition of PDA.   [L2,3M]

6. a) Define Instantaneous description (ID) in PDA.   [L2,5M]

   b) Explain the graphical notation of PDA with one example?   [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]

   $\delta (q_0,a_0,z_0) \rightarrow (q_1,z_1z_0)$

   $\delta(q_0,b,z_0) \rightarrow (q_1,z_2z_0)$

   $\delta(q_1,a,z_1) \rightarrow (q_1, z_1z_1)$

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

   $\delta(q_1,b,z_2) \rightarrow (q_1,z_2z_2)$

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

   $\delta(q_1, \lambda,z_2) \rightarrow (q_1, \lambda)$ // accepted by the empty stack.

8. a) Define push down automata? How PDA acceptance can be defined.   [L2,5M]

   b) Define Instantaneous description (ID) in PDA with one example?   [L2,5M]

9. a) Explain Differences between DPDA and NPDA?.   [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 recognizes the palindrome? [L1,10M]
2. Construct a Turing machine for Language $L=\{a^n_b{}^n,/ n>0\}$ [L1,10M]
3. Construct a Turing machine that recognizes the language $L=\{a^nb^n, n>1\}$. 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 with suitable examples? [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) Differences between PCP and MPCP? [L3,4M]
8. Explain in detail about variations of the TM? [L3,10M]
9. Construct a Turing machine that recognizes the language $a^nb^nc^n$. [L3,10M]
10. a) Define PCP. Verify whether the following lists have a PCP solution. [L3,7M]
    $\left(\begin{smallmatrix} abab \\ ababaaa \end{smallmatrix}\right), \left(\begin{smallmatrix} aaabbb \\ bb \end{smallmatrix}\right), \left(\begin{smallmatrix} aab \\ baab \end{smallmatrix}\right), \left(\begin{smallmatrix} ba \\ baa \end{smallmatrix}\right), \left(\begin{smallmatrix} ab \\ ba \end{smallmatrix}\right), \left(\begin{smallmatrix} aa \\ a \end{smallmatrix}\right).$
    b) Describe Turing reducibility? [L3,3M]

Prepared by
B.Pavan Kumar, R.M.Mallika & P.Nagaraju.

UNIT-I

FINITE AUTOMATA

1. Define Set and Relation?   [2M]
2. Give the examples/applications designed as finite state system.   [2M]
3. Define: (i) Finite Automaton(FA) (ii)Transition diagram   [2M]
4. What are the applications of automata theory?   [2M]
5. Differentiate NFA and DFA?   [2M]
6. What is Є-closure of a state q0?   [2M]
7. What is a : (a) String (b) alphabet   (c)Languages   [2M]
8. Define Grammar?   [2M]
9. What is Chomsky Hierarchy of Languages?   [2M]
10. Define Moore and Mealy Machine?   [2M]

UNIT-II

REGULAR EXPRESSIONS AND LANGUAGES

1. What is a regular expression?   [2M]
2. Differentiate L* and L+.   [2M]
3. What is Arden's Theorem?   [2M]
4. Write a r.e to denote a language L which accepts all the strings which begin or end
   with either 00 or 11.   [2M]
5. Construct a r.e for the language which accepts all strings with atleast two c's over
   the set Σ={c,b}   [2M]
6. Reg exp denoting a language over Σ ={1} having   [2M]
   (i)even length of string (ii)odd length of a string
7. What are the applications of Regular expressions and Finite automata   [2M]
8. Reg exp for the language that accepts all strings in which 'a' appears tripled over
   the set Σ ={a}?   [2M]
9. What are the applications of pumping lemma?   [2M]
10. Reg exp for the language such that every string will have atleast one 'a' followed by
    atleast one 'b'.   [2M]

UNIT- III

CONTEXT FREE GRAMMARS

1. Define Context Free Grammar?   [2M]
2. What are the uses of Context free grammars?   [2M]
3. What is the language generated by the grammar G=(V,T,P,S) where
   P={S->aSb, S->ab}?   [2M]
4. What is :(a) derivation (b)derivation/parse tree ?   [2M]
5. What is a ambiguous grammar?   [2M]
6. Consider the grammarP={S->aS | aSbS | Є } is ambiguous by constructing: [2M]
   (a) two parse trees (b) two leftmost derivation (c) rightmost derivation
7. Construct a grammar for the language L which has all the strings which are all
   palindrome over Σ={a, b}.   [2M]
8. Define CNF and GNF?   [2M]
9. Define Pumping lemma for context free language?   [2M]
10. What are the three ways to simplify a context free grammar?   [2M]

UNIT- IV
PUSH DOWN AUTOMATA

1. Define Pushdown Automata?   [2M]
2. Compare NFA and PDA.   [2M]
3. Specify the two types of moves in PDA.   [2M]
4. Is it true that the language accepted by a PDA by empty stack and final states
   are different languages.   [2M]
5. Define Deterministic PDA?   [2M]
6. Define Instantaneous description(ID) in PDA?   [2M]
7. When is a string accepted by a PDA?   [2M]
8. What is the informal definition of PDA?   [2M]
9. State the equivalence of PDA and CFL.   [2M]
10. Is NPDA (Nondeterministic PDA) and DPDA (Deterministic PDA) equivalent?   [2M]

UNIT- V

TURING MACHINE

1. What is a turing machine?   [2M]
2. What are the special features of TM?   [2M]
3. Define Instantaneous description of TM.   [2M]
4. What are the applications of TM?   [2M]
5. Define a move in TM.   [2M]
6. Define Types of TM?   [2M]
7. When we say a problem is decidable? Give an example of undecidable problem?   [2M]
8. Differentiate recursive and recursively enumerable languages?   [2M]
9. Define PCP and MPCP?   [2M]