1641357

16CS42

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B.E. Fourth Semester Examination – June 2019

Finite Automata and Formal Languages

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting atleast ONE full question from each Module.

Module – I

1. a) Define the following : i) Alphabets ii) Strings iii) Language (06 Marks)

   b) Construct a DFA to accept strings of a's and b's having i) atleast one a ii) Exactly one a. (06 Marks)

   c) Obtain a DFA to accept set of all strings on the alphabet $\Sigma = \{0, 1\}$ that either begins or ends or both with substring 01. (08 Marks)

2. a) Obtain DFA for the following NFA using subset construction method. (10 Marks)

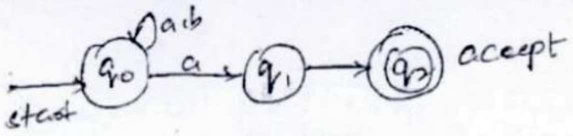

Fig Q 2(a)

   b) Obtain an NFA with E-transitions (E-NFA) and its equivalent DFA to accept decimal numbers and also explain obtain $\delta^*(q_0, 4.7)$. (10 Marks)

Module – II

3. a) Obtain a Regular expression for the FA shown in Fig Q 3(a) using Kleene's theorem. (12 Marks)

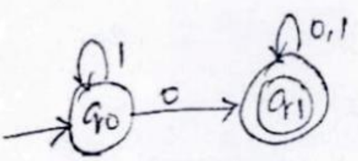

Fig Q 3(a)

   b) Explain the application of Regular expressions. (08 Marks)

4. a) State and prove pumping lemma for Regular languages. (06 Marks)

   b) Show that $L = \{ a^n / n = k^2 \text{ for } k \geq 0\}$ is not regular (08 Marks)

   c) If L_1 and L_2 are regular, prove that regular language is closed under intersection. (06 Marks)

Module – III

5. a) Discuss decision properties of regular languages (10 Marks)

   b) Minimize the following DFA using table filling algorithm. (10 Marks)

δ	a	b
→ A	B	F
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

6. a) Obtain a grammar to generate a language consisting of all non-palindromes over $\{a, b\}$. (06 Marks)

b) For the grammar given below, obtain the string aaabbabbba by applying left most derivation and parse tree

$S \rightarrow aB \mid bA$

$A \rightarrow aS \mid bAA \mid a$

$B \rightarrow bS \mid aBB \mid b$ (06 Marks)

c) Show that the following grammar is ambiguous

$S \rightarrow aSbS$

$S \rightarrow bSaS$

$S \rightarrow \in$ (08 Marks)

Module – IV

7. a) Obtain a PDA to accept the language $L = \{ w/w \in (a/b)^* \text{ and } h_a(w) > n_b(w)\}$. (10 Marks)

b) Is the PDA to accept the language $L(M) = \{ w(w^R \mid w \in (a + b)^*\}$ deterministic? (10 Marks)

8. a) Eliminate all $\in$ productions for the grammar.

$S \rightarrow ABC_a \mid bD$

$A \rightarrow Bc \mid b$

$B \rightarrow b \mid \in$

$C \rightarrow c \mid \in$

$D \rightarrow d$ (10 Marks)

b) Show that $L = \{w \mid w \in \{a, b, c\}^*$ where $n_a(w) = n_b(w) = n_c(w)$ is not context free. (10 Marks)

Module – V

9. a) Obtain a turing machine to accept a string w of a's and b's such that $N_a(w)$ is equal to $N_b(w)$. (10 Marks)

b) Discuss Multitape turing machines in detail. (10 Marks)

10. a) Prove that there is no turing machine that accepts Ld ie Ld is not a recursively enumerable language. (06 Marks)

b) Explain post correspondence problem. (07 Marks)

c) Write a note on undecidability of Ambiguity for CFG's. (07 Marks)

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B. E. Fourth Semester Examination – June 2019 (Make – Up)

Finite Automata and Formal Languages

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting at least ONE full question from each Module.

Module – I

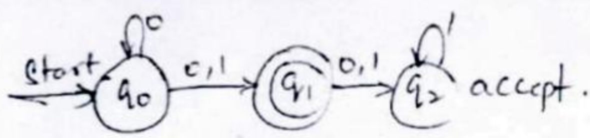
1. a) Define Finite Automata. Explain the concepts of Automata theory. **(08 Marks)**

   b) Design a DFA to accept strings of 0's , 1's and 2's beginning with a '0' followed by odd number of 1's and ending with a '2'. **(06 Marks)**

   c) Summarize the applications of finite automata. **(06 Marks)**

2. a) Design an NFA to accept the following language : $L = \{w|w \in aba^n$ where $n \geq 0\}$ **(06 Marks)**

   b) Design equivalent DFA for the given NFA.



Fig(2b) **(08 Marks)**

   c) Convert the following NFA to DFA.

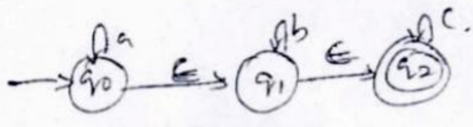


Fig 2(c) **(06 Marks)**

Module - II

3. a) Obtain a regular expression to accept strings for a's and b's such that every block of four consecutive symbols contains at least two a's **(05 Marks)**

   b) Design an NFA for the regular expression $ab(a + b)^*$ **(06 Marks)**

   c) Obtain a regular expression for the FA figure 3 (c) shown below using Kleene's theorem.

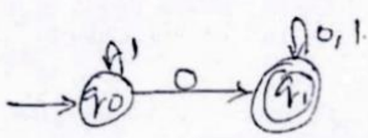


Fig 3(c) **(09 Marks)**

4. a) State and prove pumping lemma for regular languages. **(05 Marks)**

   b) Show that the language consisting of equal number of a's and b's $(a^n b^n)$ is not regular. **(05 Marks)**

   c) Obtain the distinguishable table for the automation shown below and minimize the DFA.

States	0Σ	1
→A	B	F
B	G	C
©	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

(10 Marks)

Module - III

5. a) Obtain a CFG to generate a language consisting of equal number of a's and b's. (06 Marks)

   b) Show that the grammar shown below is ambiguous.

   $S \to aB|bA$

   $A \to aS|bAA|a$

   $B \to bS|aBB|b$

   (06 Marks)

   c) Obtain string aaabbabbba by applying left most derivation and the parse tree for the grammar given below. Is it possible to obtain the same string again by applying leftmost derivation but by selecting different productions?

   $S \to aB|bA$

   $A \to aS|bAA|a$

   $B \to bS|aBB|b$

   (08 Marks)

6. a) Eliminate the useless symbols in the grammar

   $S \to aA|bB$

   $A \to aA|a$

   $B \to bB$

   $D \to ab/Ea$

   $E \to aC|d$

   (08 Marks)

   b) Eliminate all $\in$ productions from the grammar

   $S \to ABCa|bD$

   $A \to BC|b$

   $B \to b|\in$

   $C = C|\in$

   $d \to d$

   (08 Marks)

   c) Briefly explain GNF. (04 Marks)

Module - IV

7. a) Show that the regular language is closed under difference is L_1 and L_2 are regular. (08 Marks)

   b) Let $\Sigma = \{0,1\}$ $\Gamma = \{0,1,2\}$ and $b(0) = 01$, $b(1) = 112$. What is $b(010)$? If $L = \{00,010\}$, what is homeomorphic image of L? (06 Marks)

   c) Define

   i) push down Automata ii) Graphical representation of PDA

   iii) Instantaneous description of PDA. (06 Marks)

8. a) Obtain a PDA to accept the language $L(M) = \{ W(W^R|W\in(a+b)^* \}$ where W^R is reverses of W by a final state. (10 Marks)

   b) For the grammar, obtain the corresponding PDA

   $S \to aABC$

   $A \to aB|a$

   $B \to bA|b$

   $C \to a$

   (10 Marks)

Module - V

9. a) Construct a Turing machine (TM) to accept the language $L = \{0^n1^n|n\geq1\}$ (12 Marks)

   b) What are solvable and unsolvable problems? Explain halting problem. (08 Marks)

10. a) Design a TM that computes the function $f(x,y) = x+y$ if $x\geq y$

    $f(x,y) = xx$ if $x < y$. (10 Marks)

    b) Explain the following in detail (05 x 02 = 10Marks)

    i) Multi-tape Turing Machine, ii) Non deterministic Turing Machines

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B. E. Fourth Semester Examination – October 2020
(Summer Term)

Finite Automata and Formal Languages

Time: 3 hrs] [Maximum Marks: 100

Note: Answer any FIVE full questions, selecting atleast ONE full question from each module.

MODULE – I

1. a) Describe the basic notations and terminologies used in FAFL. **(05 Marks)**
   b) Construct a DFA to accept strings of a's and b's starting with the string ab. **(10 Marks)**
   c) Give the applications of finite automata with explanation. **(05 Marks)**

2. a) Construct the DFA for the following NFA using (Fig Q 2(a)) **(10 Marks)**

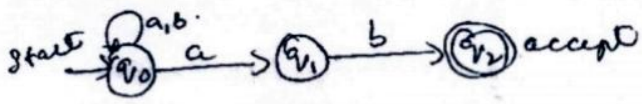

Fig Q 2(a)

   b) Convert the following NFA as shown in Fig Q 2(b) to its equivalent DFA **(10 Marks)**

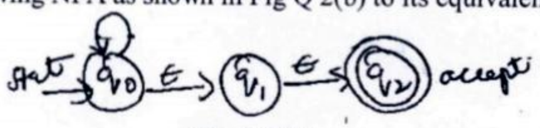

Fig Q 2(b)

MODULE - II

3. a) Obtain an NFA for the regular expression $a^* + b^* + c^*$ **(10 Marks)**
   b) Obtain a regular expression for the FA shown in Fig Q 3(b):

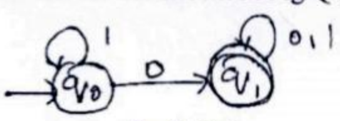

Fig Q 3(c) **(10 Marks)**

4. a) Show that $L = \{ 0^n \mid n \text{ is prime} \}$ is not prime. **(08 Marks)**
   b) Show that if L and M are regular languages , then so $\underline{L \cap M}$. **(08 Marks)**
   c) Give limitations of FA. **(04 Marks)**

MODULE - III

5. a) Minimize the following DFA using table filling algorithm where A is start state. The states C, F and I are final states. **(12 Marks)**

δ	0	1
A	B	E
B	C	F
C	D	H
D	E	H
E	F	I
F	G	B
G	H	B
H	I	C
I	A	E

b) Describe different types of grammars. **(08 Marks)**

6. a) What is the language generated by the grammar
$S \rightarrow OA \mid E$
$A \rightarrow \mid S$. **(04 Marks)**
b) Obtain the left most and right most derivation for the string aaabbabba using the following grammar
$S \rightarrow aB|bA$
$A \rightarrow aS|bAA|a$
$B \rightarrow bs|aBB|b$. **(08 Marks)**
c) Check the following grammar is ambiguous
$S \rightarrow aB|bA$
$A \rightarrow aS|bAA|a$
$B \rightarrow bS|aBB|b$. **(08 Marks)**

MODULE - IV

7. a) Obtain a PDA to accept the language L= { a^n b^n | $n \geq 1$by final state. **(10 Marks)**
b) For the grammar
$S \rightarrow aABB|aAA$
$A \rightarrow aBB|a$
$B \rightarrow bBB|A$
$C \rightarrow a$.
Obtain the corresponding PDA. **(10 Marks)**

8. a) Eliminate all $\in$ productions from the grammar
$S \rightarrow ABCa \mid bD$
$A \rightarrow BC \mid b$
$C \rightarrow C| E$
$D \rightarrow d$. **(08 Marks)**
b) Convert the following grammar into GNF
$S \rightarrow AB\,1 \mid 0$
$A \rightarrow 0\,0\,A| B$
$B \rightarrow \mid A \mid$. **(12 Marks)**

MODULE - V

9. a) Define Turing machine. **(06 Marks)**
b) Obtain a Turing machine to accept the language, L = {0^n, 1^n|$n \geq 1$}. **(14 Marks)**

10. a) Describe posts-correspondence problem. **(10 Marks)**
b) Describe Halting Problem. **(10 Marks)**