Code No: R2022053 **R20** **SET - 1**

II B. Tech II Semester Regular Examinations, June/July - 2022

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to CSE, CST, CSE(AIML), CSE(AI), CSE(DS), CSE(AIDS), CSE(CS), CSE(IOTCSIBCT), CSE(IOT), AIDS, CS& AIML)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Outline formal language and Explain the Chomsky classification of grammars. [7M]

b) Draw a DFA which accepts strings ending with 11 where the input is {0,1} [7M]

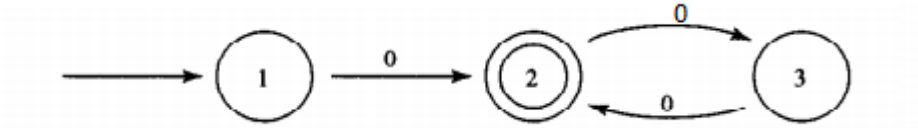
Or

2 a) List the various operations on languages in detail and relate with transition diagrams? [7M]

b) Draw a DFA which accepts strings ending with 01 where the input is {0,1} [7M]

UNIT-II

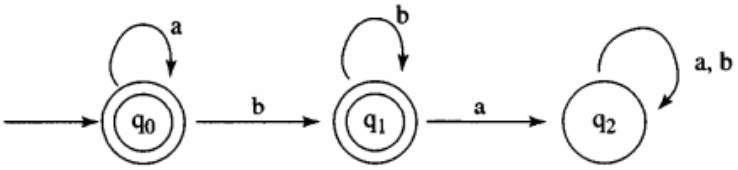
3 a) Compute the regular expression for the following machine. [7M]



b) List and explain the closure properties of Regular grammar. [7M]

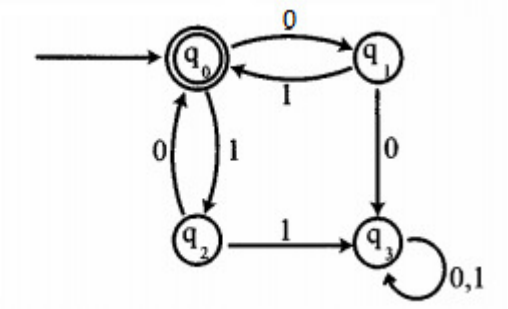
Or

4 a) [7M]



Compute the regular expression for the above machine.

b) [7M]



Construct left and right linear grammar for the given NFA

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UNIT-III

5 a) Convert the grammar into GNF [7M]

$S \rightarrow AB1|0$

$A \rightarrow 00A|B$

$B \rightarrow |A|.$

b) Discuss the applications of Context free grammar. Illustrate ambiguous grammar. [7M]

Or

6 a) Convert the grammar into Greibach Normal Form. [7M]

$S \rightarrow AB$

$A \rightarrow BSB$

$A \rightarrow a$

$B \rightarrow b$

b) Discuss the simplification of context free grammar. What is the importance of useless symbols and unit productions in it? [7M]

UNIT-IV

7 a) Explain the elements of PDA. Construct PDA for L = $\{0^n1^m2^{k)}\}$ Where n,m,k>=1 [7M]

b) Show the procedure and explain to find the equivalence of PDA and context free grammer. [7M]

Or

8 a) Outline the PDA with example. In what ways a PDA can show the acceptance of a string. Explain with example [7M]

b) Demonstrate the conversion of PDA to grammar with a case study. [7M]

UNIT-V

9 a) Construct a TM that computes a function f(m, n) = m+ni.e, addition of two numbers. [7M]

b) Construct a TM for computing ones complement calculation. [7M]

Or

10 a) Discuss the languages accepted by Turing machines. [7M]

b) Construct the Turing machine that computes subtraction, where the fist operand length is more than the second operand. X is a symbol that separates the two operands.
Example: 0000X00. [7M]

Code No:R2022053 **R20** **SET - 2**

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Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Demonstrate the mathematical definition of DFA. Design DFA which accepts even number of a's and even number of b's where the input is a,b. [7M]

b) Compare features of NFA and NFA-€ transitions with example. [7M]

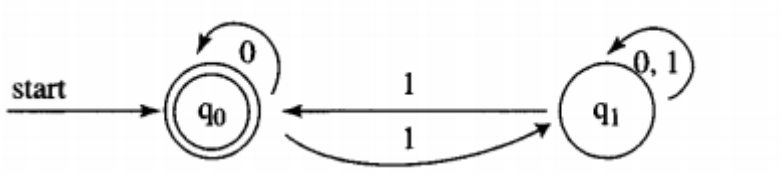
Or

2 a) Write and explain the steps for minimizing DFA with an example? [7M]

b) Design an NFA-€ to accept the string of a's and b's, such that, it can accept either the string consisting of one a followed by any number of a's or one b followed by any number of b's. [7M]

UNIT-II

3 a) Construct left and right linear grammar for the given NFA [7M]



b) Illustrate the Chomsky hierarchy with a neat sketch. [7M]

Or

4 a) Explain the step-by-step method to generate equivalent FA for the regular expressions of different forms. [7M]

b) Explain the Pumping lemma for the regular sets. [7M]

UNIT-III

5 a) Simplify the following grammar. [7M]

$S \rightarrow Aa|B$

$B \rightarrow A|bb$

$A \rightarrow a|bc|B$

b) List and explain the closure properties of regular grammar. [7M]

Or

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6 a) Simplify the grammar with the following productions. [7M]
S ->Aa/B/cA
B -> A/bb/E
A ->bc/B

b) Demonstrate the importance of PDA using acase study. [7M]

UNIT-IV

7 a) Develop a PDA to accept the strings of the form a^nb^n where n>=1. [7M]

b) Discuss the use of NPDA in solving real-world problems. [7M]

Or

8 a) Develop a PDA to accept the language WCW^R where W belongs to $(0+1)^+$ and W^R is the reverse of the string [7M]

b) Discuss the equivalence of PDA and Context free grammar. [7M]

UNIT-V

9 a) List the elements of TM's and give the block diagram of TM. [7M]

b) Design TM which accepts strings ending with 111 where the input is taken from {0,1} [7M]

Or

10 a) Explain Church's Hypothesis and Halting problem? [7M]

b) List and explain various Turing Machines with suitable diagrams. [7M]

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Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) List and explain the classifications of Finite Automata. Discuss the applications of it. [7M]

b) Draw a DFA which accepts strings ending with 00 where the input is {0,1} [7M]

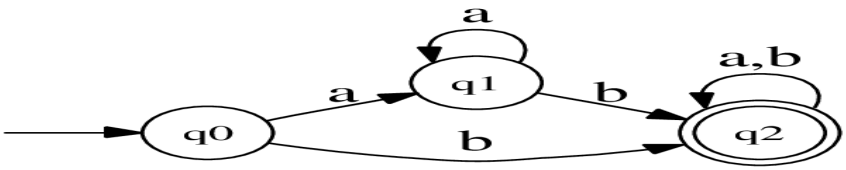
Or

2 a) List the elements and components of DFA and NFA. [7M]

b) Draw a DFA which accepts strings ending with 10 where the input is {0,1} [7M]

UNIT-II

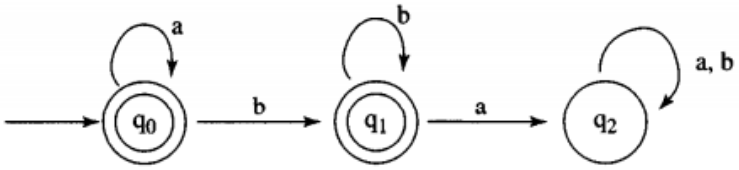
3 a) Derive the regular expression for the following DFA [7M]



b) Explain the method of developing a FA from Regular expression using a case study. [7M]

Or

4 a) [7M]



Convert the regular expression for the above DFA

b) List and explain the Closure properties of Regular sets. [7M]

UNIT-III

5 a) What types of productions are accepted in CFG? [7M]
Check whether the grammar is ambiguous or unambiguous or not over alphabets {a, b}.
S →aSa\bSb\a\b\ € .

b) Explain the step-by-step method to prove that certain languages were not Regular. [7M]

Or

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6 a) Simplify the following grammar [7M]
S →ABa/B/c
B →A/bbA
A →a/bc/BS

b) What is pumping lemma? Explain its closure properties? [7M]

UNIT-IV

7 a) Develop a PDA to accept the strings of the form a^nb^{3n} where n>=1. [7M]

b) Discuss the notation and applications of two stack push down automata. [7M]

Or

8 a) Develop a PDA that accepts the strings of the form a^nb^{2n} where n>1. [7M]

b) Compare DPDA with NPDA using a suitable example. [7M]

UNIT-V

9 a) Design a Turing Machine to accept the language $L=\{a^n b^n c^n d^n/n>=1\}$ [7M]

b) Discuss the decidable and undecidable problems with examples. [7M]

Or

10 a) Develop a Turing Machine toaccept the language WCW^R where W belongs to $(0+1)^+$ and W^R is the reverse of the string. [7M]

b) Define the TM with formal notations. Explain the concept of Universal Turing Machine. [7M]

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Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Explain the formal definition of a DFA with an example. [7M]

b) Construct a DFA string accepting neither *aa* nor *bb* as a substring. [7M]

Or

2 a) Explain the formal definition of an NFA with a suitable example. [7M]

b) Compare and contrast the features of NFA with DFA. What is the importance of -€ transitions. [7M]

UNIT-II

3 a) Draw the DFA for the following Regular Expressions [7M]
1. $(0+1)^*101$
2. a^*b^*a

b) Demonstrate the Pumping lemma of a regular set with example. [7M]

Or

4 a) Draw the DFA for the following Regular Expressions [7M]
1. $(01)^*1(0+1)^*$
2. $(ab)^{*+}(a+b)^*$

b) How to find equivalence of regular grammar and finite automata? Explain with example. [7M]

UNIT-III

5 a) Define Context Free Grammar. [7M]
Derive the left most and the rightmost derivations for the string aabbaa.
$G = (\{S, A\}, \{a, b\}, S, P)$, where P is,

$$S \rightarrow aAS|a$$
$$A \rightarrow SbA|SS|ba.$$

b) Consider the following CFG into GNF [7M]
(1) S→aA|bB
(2) B→bB|Ɛ
(3) A→aA|Ɛ

Or

6 a) Design the CFG for the expressions [7M]
1. a^nb^n where n>=1
2. a^nb2^n where n>=1
3. WCW^R , where W belongs to $(a+b)^+$ and W^R is the reverse of the string

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b) Illustrate ambiguous grammar and check the grammar is ambiguous or not E→E+E|E*E|(E)|id. [7M]

UNIT-IV

7 a) Define PDA(Push Down Automata) and Construct a PDA for the following grammar [7M]
S->aSa
S->bSb
S->c

b) Demonstrate two stack PDA with an example and explain the applications of it. [7M]

Or

8 a) Define PDA and Construct a PDA for the following grammar [7M]
S->AA/a
A->SA/b

b) Compare the features of DPDA(Deterministic Push Down Automata) and NPDA (Non Deterministic Push Down Automata) with a suitable example. [7M]

[7M]

UNIT-V

9 a) Design a Turing Machine to accept the language $L=\{a^n b^{4n}/n>=1\}$ [7M]

b) Explain the concepts NP-Hard and NP-complete with examples. [7M]

Or

10 a) Define Turing Machine and design it to recognize the language $L= \{0^n 1^{2n}/ n>=1\}$.Illustrate the action of Turing machine in accepting/rejecting the word$0^3 1^3$. [7M]

b) List and explain the types of Turing machines. [7M]