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Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, April - 2018
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define DFA. [2]
b) Write about the applications of Finite Automata? [3]
c) If a Regular grammar G is given by S→aS/a Find DFA (M) accepting L(G)? [2]
d) Construct a regular grammar for L= $\{0^n11/n>=1\}$. [3]
e) For the Grammar {S→AS/a, A→SbA/SS/ba} construct Left most derivation for the string aabbaaa? [2]
f) Define Push Down Automata. [3]
g) What is the purpose of studying Turing Machine? [2]
h) Write a Context free grammar for the language $\{0^n1^n/n>=1\}$. [3]
i) Give an example of un decidable problem. [2]
j) Define Post correspondence Problem. [3]

PART-B

(50 Marks)

2.a) Construct Minimum state Automata for the following DFA?
* denotes final state

δ	0	1
→Q1	q2	q6
q2	q1	q3
*q3	q2	q4
q4	q4	q2
q5	q4	q5
*q6	q5	q4

b) Differentiate between NFA and DFA. [6+4]

OR

3.a) Design DFA for the following over {a,b}.
i) All strings containing not more than three a's.
ii) All strings that has at least two occurrences of b between any two occurrences of a.
b) Construct a DFA accepting the set of all strings ending with 00? [5+5]

4.a) Define Regular Expression? Explain about the Properties of Regular Expressions.
b) Construct a DFA for the Regular Language consisting of any number of a's and b's. [5+5]

OR

5.a) Construct a DFA for the Regular expression $(0+1)^*(00+11)(0+1)^*$.
b) Explain about the identity rules of Regular Expressions. [5+5]

6.a) Define Ambiguous Grammar. Check whether the grammar.
S→aAB, A→bC/cd, C→cd, B→c/d Is Ambiguous or not?
b) Construct a PDA for the following grammar S→AA/a, A→SA/b. [5+5]

OR

7.a) Show that for every PDA there exists a CFG such that L(G)=N(P).
b) Convert the grammar S→0AA, A →0S/1S/0 to a PDA that Accepts the same Language by Empty Stack. [5+5]

8.a) Construct a Turing Machine that will accept the Language consists of all palindromes of 0's and 1's?
b) Explain about types of Turing Machine. [5+5]

OR

9.a) Obtain GNF for S→AB, A→BS/b , B→SA/a.
b) Design a Turing Machine for $L=\{0^n1^m0^n1^m/m,n>=1\}$. [5+5]

10.a) Discuss in brief about NP Hard problems.
b) Explain about the Decidability and Undecidability Problems. [5+5]

OR

11.a) Give an overview of recursively enumerable language.
b) Give the correspondence between P, NP and NP-complete problems. [5+5]

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Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, April/May - 2023
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Define Kleene Closure and Positive Closure. [2]
b) Write about the applications of Finite Automata. [3]
c) Find the simplified regular expression for the following regular expression r (r*r + r*) + r*. [2]
d) Construct a regular grammar for $L= \{0^n1^n1/n>=1\}$. [3]
e) For the Grammar {S→AS/a, A→SbA/SS/ba} construct Left most derivation for the string aabbaaa? [2]
f) Define ambiguity in CFG with an example. [3]
g) What is the purpose of studying Turing Machine? [2]
h) Write about the programming techniques for Turing Machines. [3]
i) Define undecidability. Give an example of an undecidable problems. [2]
j) Compare recursive and recursive enumerable languages. [3]

PART – B

(50 Marks)

2. Construct NFA with ε which accepts a language consisting the strings of any number of 0's followed by any number of 1's followed by any number of 2's and also convert into NFA without ε transitions. [10]

OR

3.a) Design DFA for the following over {a,b}.
i) All strings containing not more than three a's.
ii) All strings that has at least two occurrences of b between any two occurrences of a.
b) Construct a DFA accepting the set of all strings ending with 00. [6+4]

4. Design a FA for the following languages:
a) $(0^*1^*)^*$
b) (0+1)* 111*
c) (0* 11* + 101). [3+3+4]

OR

5.a) Construct a DFA for the Regular Language consisting of any number of a's and b's.
b) Apply pumping lemma for the language $L=\{a^n/n$ is prime$\}$ and prove that it is not regular. [5+5]

6.a) Define Ambiguous Grammar. Check whether the grammar.
S→aAB, A→bC/cd, C→cd, B→c/d is ambiguous or not?
b) Show that for every PDA there exists a CFG such that L(G) = N(P). [5+5]

OR

7. Construct the CFG for the PDA M = ({q_0,q_1}, {0,1}, {R,Z_0}, δ, q_0, Z_0, Φ) and δ is givenby
δ(q_0,1,Z_0)=(q_0,RZ_0)
δ(q_0,1,R)=(q_0,RR)
δ(q_0,0,R)=(q_1,R)
δ(q_1,0, Z_0)=(q_0, Z_0)
δ(q_0,ε, Z_0)=(q_0,ε)
δ(q_1,1,R)=(q_1,ε). [10]

8.a) Design a Turing Machine for L={$0^n1^m0^n1^m$/m,n>=1}.
b) Define Chomsky Normal Form (CNF). Convert the following grammar to CNF
S→0S0|1S1| ε. [5+5]

OR

9.a) Explain following:
i) Closure properties of Context Free Languages.
ii) Decision properties of Context Free Languages.
b) Design a Turing machine to recognize all strings consisting of odd numbers of 1's. [5+5]

10.a) Discuss in brief about NP Hard problems.
b) Give the correspondence between P, NP and NP-complete problems. [5+5]

OR

11.a) Give an overview of recursively enumerable language.
b) Explain about the Decidability Problems. [6+4]

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Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, December - 2018
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Define the central concepts of Automata Theory. [2]
b) Write down the applications of finite automata. [3]
c) Construct a regular grammar for $L = \{0^n 11 / n \geq 1\}$. [2]
d) Explain the applications of the pumping lemma. [3]
e) Define ambiguity in CFG with an example. [2]
f) Write short notes on Parse Trees. [3]
g) Construct CFG to generate string with any numbers of 1's. [2]
h) Write about the programming techniques for Turing Machines. [3]
i) Define undecidability. Give an example of an undecidable problems. [2]
j) Write short note on NP-hard problem. [3]

PART-B

(50 Marks)

2.a) Differentiate between NFA and DFA.
b) Design DFA for the following over {a, b}
i) All strings containing not more than three a's.
ii) All strings that has at least two occurrences of b between any two occurrences of a. [5+5]

OR

3.a) Explain the procedure for converting DFA to NFA.
b) Briefly discuss about Finite Automata with Epsilon- Transitions. [5+5]

4.a) Define Regular Expression? Explain about the properties of Regular Expressions.
b) Construct a DFA for the Regular expression $(0+1)^*(00+11)(0+1)^*$. [5+5]

OR

5. Design a FA for the following languages
a) $\left(0^*1^*\right)^*$
b) $(0+1)^* 111^*$
c) (0* 11* + 101) [10]

6.a) Convert the following grammar to a PDA that accepts the language by empty stack
S → 0S1|A
A → 1A0 |S|€.

b) Show that for every PDA there exists a CFG such that L(G) = N(P). [5+5]

OR

7.a) Derive left and right most derivations for the input string a=b*c+d/e for the given Grammar.
E→E+E|E-E|E*E
E→E/E
E→(E)|id

b) Explain the followings with examples.
i) Sentential Forms
ii) Deterministic Pushdown Automata. [5+5]

8.a) Design a Turing Machine to accept the language L={wcw^R|w∈(a+b)*}.

b) Define Chomsky Normal Form (CNF). Convert the following grammar to CNF
S→0S0|1S1|∈ [5+5]

OR

9.a) Explain following:
i) Closure properties of Context Free Languages.
ii) Decision properties of Context Free Languages.

b) Design a Turing machine to recognize all strings consisting of odd numbers of 1's. [5+5]

10.a) Write the properties of recursive and non-recursive enumerable languages.

b) Let ἐ ={0,1} and A,B be the list of 3 strings each. Verify below PCP has a solution or not? [5+5]

	List A	List B
1	wi	xi
1	00	0
2	001	11
3	1000	011

OR

11.a) Give the correspondence between P,NP and NP-complete problems.

b) Define post`s correspondence problem and show that it is undecidable. [5+5]

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Code No: 155BK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February - 2022
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT, ITE)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Design a FA for the Language which accepts odd number of 0's and odd number of 1's over input alphabet $\Sigma = \{0,1\}$.

b) Convert the following NFA into equivalent DFA (figure 1). [7+8]

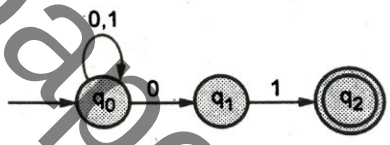

Figure 1

2.a) Convert the following NFA with € into equivalent NFA without € (figure 2).

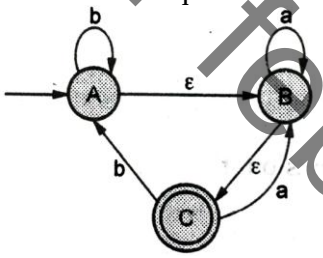

Figure 2

b) Design a Moore machine to count number of b's in a given input string with a's and b's. [7+8]

3.a) Construct the Finite Automation to accept the regular expression 1*01(0+11)*.

b) Find the minimum state automata for the following DFA (figure 3). [7+8]

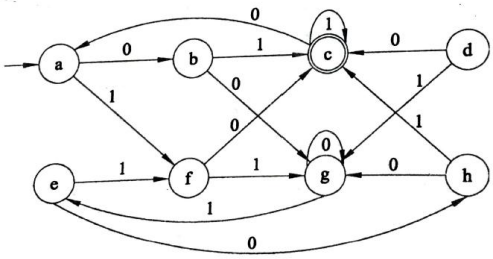

Figure 3

4.a) Obtain a regular expression for the following FA (figure 4).

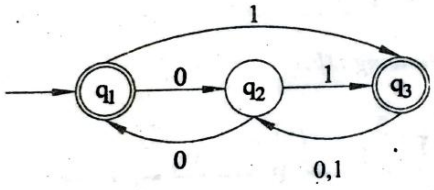

Figure 4

b) Check whether the following two FSM's are equivalent or not (figure 5)? [7+8]

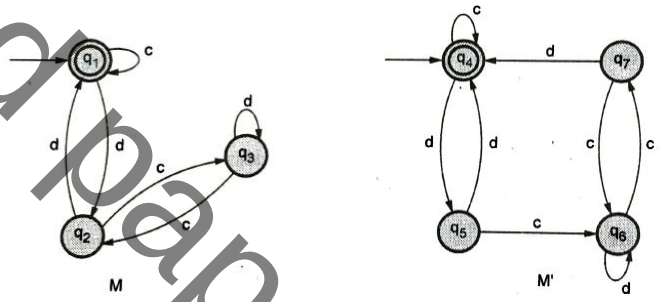

Figure 5

5.a) Construct the Context Free Grammar for the Language L= { $0^{2n}1^m \mid n\geq 0, m\geq 0$}

b) Construct the CFG for the PDA M =({q_0,q_1}, {0,1}, {R,Z_0}, δ, q_0, Z_0, Φ)
and δ is given by

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q_0, Z_0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$ [7+8]

6.a) Design Non deterministic PDA for the language L= { $ww^R \mid w\ \varepsilon(0+1)^*$ } by empty stack?

b) Show that the following grammar is ambiguous or not. [7+8]
S → AB / aaB,
A→a/Aa,
B→b

7.a) Find the GNF equivalent to the following
S → AA | 0
A → SS | 1

b) Show that L={$a^n b^n c^n \mid n\geq 0$} is not a context free language. [7+8]

8.a) Give an overview of recursively enumerable language.

b) Obtain the solution for the following post's correspondence problem [7+8]
A= { 100,0,1 }, B = { 1,100,00 }

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Code No: 155BK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT, ECM, ITE, CSE(CS))

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) What is a string? Write about concatenation of two strings. [2]
b) What is a Regular expression in the theory of Automata? [3]
c) Eliminate Useless symbols from the given grammar
A→ xyz |Xyzz X → Xz |xYz Y →yYy|Xz Z → Zy | z [2]
d) Write the design strategy for NFA-ε. [3]
e) Write any two properties of Regular languages. [2]
f) Write about Leftmost derivation and rightmost derivation with example. [3]
g) Define GNF. [2]
h) Write the advantages of parse tree in identifying ambiguity. [3]
i) What do you mean by Instantaneous Description of Turing Machine? [2]
j) What is offline Turing Machine? [3]

PART – B

(50 Marks)

2.a) Define Finite Automaton. Explain about the model of Finite Automaton.
b) Convert the regular expression ((((00)*(11)) + 01)* into an NFA. [5+5]

OR

3.a) Describe in brief about applications of Finite Automata.
b) Design a mealy machine to print out 1's complement of an input bit string. [5+5]

4.a) Write the steps to construct regular expression from given DFA.
b) Construct a NFA equivalent to the regular expression 10(0+11)0*1. [5+5]

OR

5.a) Write in brief about the algebraic rules for regular expressions.
b) Discuss in brief about applications of pumping lemma. [5+5]

6.a) Define Push Down Automata. Explain the basic structure of PDA with a neat graphical representation.
b) Construct a PDA that accepts $L = \{0^n 1^n \mid n \geq 0\}$. [5+5]

OR

7.a) Construct a PDA which accepts language of word over alphabet {a,b} canting $\{a^i b^j c^k / i,j,k \in N, i+k=j\}$.
b) Define Context Free Grammar. State and explain the closure properties of CFG. [5+5]

8.a) Obtain Griebech Normal Form (GNF) for: S→AB, A→BS/b, B→SA/a.

b) Define Ambiguous Grammar? Check whether the grammar S→aAB,A→bC/cd,C→cd,B→c/d Is Ambiguous or not? [5+5]

OR

9.a) Construct a Left most Derivation for the string 0011000 using the grammar S→A0S/0/SS, A→S1A/10 ?

b) Discuss in brief about decision properties of Context free languages. [5+5]

10.a) Construct Turing machine for the languages containing the set of all strings of balanced paranthesis

b) Design Turing machine and its transition diagram to accept the language: [5+5] $L = \{a^n b^n | n >= 1\}$

OR

11.a) Define LR(0) Grammar. Explain in detail about Post Correspondence Problem.

b) What is decidability? Explain in brief about any two undecidable problems. [5+5]

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Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, July/August - 2021
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Define Finite Automata. Explain about the model of Finite Automata.
b) Design a NFA for the following language L={0101^n where n>0}. [7+8]

2.a) Construct Minimum state Automata for the following DFA.
* denotes final state

Δ	0	1
→q1	q2	q3
q2	q3	q5
*q3	q4	q3
q4	q3	q5
*q5	q2	q5

b) Explain in detail about Melay and Moore Machines. [8+7]

3.a) Construct Finite Automata for the regular Expression 1(01+10)*00?
b) Explain about the Closure Properties of Regular sets. [8+7]

4.a) Show that L={a^{2n}/n<0} is Regular.
b) Construct a NFA equivalent to the regular expression 10(0+11)0*1. [7+8]

5.a) Construct a PDA for L={wcw^R /w∈ (0+1)*}
b) Explain in brief about decision properties of context free languages. [7+8]

6.a) Define Turing Machine. Explain about the Model of Turing Machine.
b) Obtain the Chomsky normal of the following grammar E→E+T/T, T→a/CE. [7+8]

7.a) Construct Turing machine for the languages containing the set of all strings of balanced paranthesis?
b) Discuss in brief about "church hypothesis". [8+7]

8.a) What is decidability? Explain in brief about any two undecidable problems.
b) Explain about Universal Turing Machine. [8+7]

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Code No: 155BK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2021
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Convert the following Mealy Machine in to an equivalent Moore Machine. (figure 1)

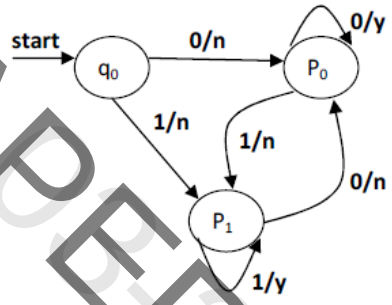

Figure 1

b) Convert the following NFA into equivalent DFA. [8+7]

δ	0	1
→q0	{q0,q1}	q1
(q1)	Φ	{q0,q1}

2.a) Construct Moore for the input from (0+1)* that give residue modulo 4 of input treated as binary.

b) Construct the minimum state automata equivalent to the following. (figure 2) [7+8]

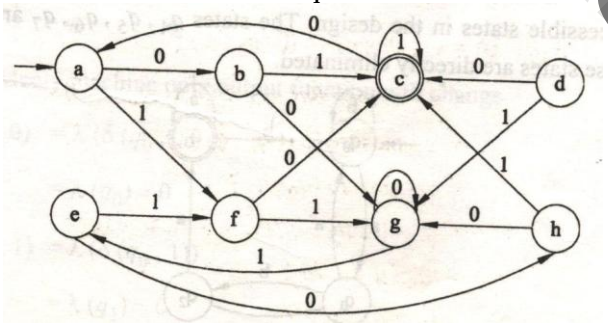

Figure 2

3.a) Describe the following sets by regular expressions.
i) The set of all strings of a's and b's beginning with 'aa'
ii) The set of all strings of a's and b's beginning with 'b' and ending with 'aa
iii) The set of all strings of a's and b's with atleast two consecutive a's

b) State pumping lemma for regular languages. Prove that the following language $\{a^n \mid n \text{ is a prime number}\}$ is not a regular. [8+7]

4.a) Construct the NFA with ε transition for the following expression (0+1)*00(0+1)*

b) Construct the regular expression for the following finite automata. (figure 3) [8+7]

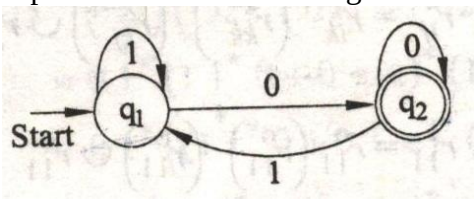

Figure 3

5.a) Find CFG for the language L={ $a^i b^j c^k$ | i=j}.

b) Let G be the grammar S→aB | bA, A→a | aS | bAA, B→b | bS | aBB. Find a Right most derivation for the string "aaabbabbba" and also draw the derivation Tree. [8+7]

6.a) Design a PDA for the following language L={ $0^n 1^{2n}$ / n≥1}.

b) Construct the CFG for the PDA M =({q_0,q_1}, {0,1}, {R,Z_0}, δ, q_0, Z_0, Φ) and δ is given by [7+8]

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q_0, Z_0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$

7.a) Convert the following grammar to Greibach Normal Form.
S→ABA | AB | BA | AA | B
A→aA | a
B→bB | b

b) Reduce the following grammar such that there are no unit productions. [8+7]
S → AA
A → B | BB
B → abB | b | bb

8.a) Design a Turing Machine to accept the language L={ WCW^R / w in (0+1)*}.

b) Discuss about Post Correspondence Problem. [8+7]

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Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, March - 2022
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Construct a DFA accepting the set of all strings ending with 'bb' over Σ={a,b}.
b) Briefly discuss about Finite Automata with Epsilon- Transition.
c) Draw the transition diagram of a FA which accepts all strings of 0's and 1's in which the number of 0's are odd and 1's are even? [5+5+5]

2.a) Show that the language L = {ww | w ε {a, b}*} is not regular.
b) Write the steps in minimization of FA.
c) Construct finite automata for the regular expression (1*0 +10*). [5+5+5]

3.a) Design Push Down Automata for the language
$L=\{ww^R \mid w \varepsilon (0+1)^*\}$.
b) Convert the following grammar into a PDA that accepts the language by empty stack
S →0S1|A
A→1A0 |S| ε [7+8]

4.a) Eliminate ε -productions from the grammar G given as
A→ aBb | bBa
B→ aB | bB | ε
b) Design Turing Machine which will recognize strings containing equal number of 0's and 1's. [7+8]

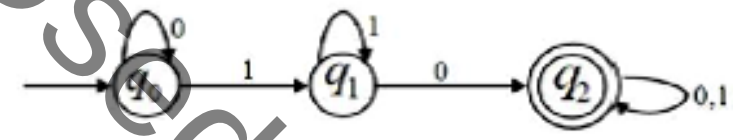
5.a) Convert the following grammar to Greibach Normal Form : S→ SS | 0S1 | 01.
b) Explain Decision properties of Context Free Languages. [8+7]

6. Write about the following:
a) Linear-Bounded Automata
b) Recursively enumerable language
c) Decidability of PCP. [5+5+5]

7.a) Let $\Sigma = \{0,1\}$ and A,B be the list of 3 strings each. Verify if PCP given below has a solution or not?

	List A	List B
1	wi	xi
1	00	0
2	001	11
3	1000	011

b) Construct the Regular expression of the following Finite Automata: [7+8]



8.a) Explain about the identity rules of Regular Expressions.

b) Construct the CFG for the PDA $M = (\{q_0,q_1\}, \{0,1\}, \{R,Z_0\}, \delta, q_0, Z_0, \Phi)$ and δ is given by:

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q0, Z0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0, \varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$. [7+8]

---ooOoo---

Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2019
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Define Kleene Closure and Positive Closure? [2]
b) Define Moore Machine? [3]
c) Define a Regular Expression. [2]
d) Find the simplified regular expression for the following regular expression r (r*r + r*) + r*? [3]
e) Define Context Free Grammar. [2]
f) Define Push Down Automata. [3]
g) Define Turing machine. [2]
h) What is Chomsky Normal Form? [3]
i) What is undecidable problem? [2]
j) Compare recursive and recursive enumerable languages. [3]

PART – B

(50 Marks)

2. Construct NFA with ε which accepts a language consisting the strings of any number of 0's followed by any number of 1's followed by any number of 2's And also convert into NFA without ε transitions. [10]

OR

3. Construct the Moore machine to determine residue mod 3 and convert into Mealy machine. [10]

4.a) Test whether the following two FSM's are equivalent.

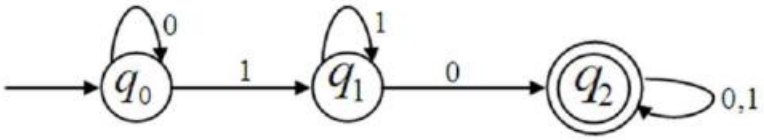
M1	0	1
→ A	B	D
(B)	A	C
C	D	B
(D)	C	A

M2	0	1
→ P	R	R
Q	R	P
(R)	P	Q

b) Apply pumping lemma for the language L={a^n/n is prime} and prove that it is not regular? [5+5]

OR

5. Construct the regular expression corresponding to the language accepted by following DFA. [10]



6.a) Elaborate on left most derivation and right most derivation.

b) Design Push down Automata for $L = \{a^{2n}b^n \mid n \geq 1\}$ 3. [5+5]

OR

7. Construct the CFG for the PDA $M = (\{q_0,q_1\}, \{0,1\}, \{R,Z_0\}, \delta, q_0, Z_0, \Phi)$ and δ is given by

$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q_0, Z_0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$. [10]

8.a) List out and discuss the closure properties of CFL.

b) Construct CFG without ε – production from the one which is given below

$S \rightarrow a \mid Ab \mid aBa$
$A \rightarrow b \mid \varepsilon$
$B \rightarrow b \mid A$ [5+5]

OR

9. Design a Turing Machine to accept $L=\{WcW^R \mid W \text{ is in } (a+b)^*\}$. [10]

10.a) Discuss in brief about NP Hard problems.

b) Discuss the examples of undecidable problems. [5+5]

OR

11.a) Explain about the undecidable problems about turing machines.

b) Distinguish between class P and class NP Problems. [5+5]

---ooOoo---

Code No: 134BD **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, November/December - 2020
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 2 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
- - -

1.a) Draw the transition diagram for a NFA which accepts all the strings with either two consecutive 0's or two consecutive 1's.
b) Define NFA with Epsilon moves. [8+7]

2.a) Write the properties of transition function.
b) Construct DFA accepting the set of all strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's. [7+8]

3.a) Convert regular expression 01*+1 to finite automata.
b) What are the properties of regular expressions? [7+8]

4.a) What are the closure properties of Regular Languages? Explain.
b) Write about the applications of Regular expressions. [7+8]

5. Discuss about:
a) Context Free Grammar
b) Left Most Derivation
c) Right Most Derivation. [5+5+5]

6.a) What is unrestricted grammar? Give an example.
b) Explain the language generated by unrestricted grammar. [7+8]

7. Write the procedure to convert CFG to PDA and also convert the following CFG to PDA.
S → B | aAA
A → aBB | a
B → bBB | A
C → a [15]

8.a) Define the classes P and NP problems. Also write brief note on NP-Complete and NP-Hard Problems.
b) Explain about post correspondence problem. [8+7]

---ooOoo---

Code No: 155BK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, September - 2021
FORMAL LANGUAGES AND AUTOMATA THEORY
(Common to CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Convert the following NFA to DFA

State	a	b
Q_0	Q_0	Q_1
Q_1	Q_0	$\{Q_0,Q_1\}$
Q_2	Q_0	Q_3
Q_3^*	Q_0	---

b) Construct a DFA to accept the binary strings consisting of even number of 0's and odd number of 1's. [8+7]

2.a) Construct a DFA to accept the binary strings divisible by 5.
b) Eliminate the €-transactions of the following NFA. [7+8]

State	a	b	€
Q_0	Q_0	Q_1	Q_2
Q_1	Q_1	Q_2	Q_3
Q_2	Q_2	Q_3	
Q_3^*	Q_0	---	

3.a) Prove that Regular Languages are closed under i) Reverse ii) Union.
b) Identify the regular expression accepted by the following DFA. [7+8]

State	a	b
Q_0	Q_2	Q_1
Q_1	$Q_{3,}$	Q_2
Q_2	Q_0	Q_3
Q_3^*	--	---

4.a) Prove that $L=\{WW^r / W$ is a binary sting$\}$ is not regular language.
b) Construct a DFA accepting language represented by (0+1)* (00+11) (0+1)*. [7+8]

5.a) Construct a PDA to accept the binary strings consists of number of 0's not equal to number of 1's.
b) Construct a PDA to accept the language generated by the following CFG. [7+8]

S→Aab
A→Aab|b

6.a) Construct a PDA to accept the following language $L= \{a^n b^n / n>0\}$.
b) Construct a CFG to generate the binary strings consisting the number of 0's is equal to the twice the number of 1's. [8+7]
ex: 010, 001010

7.a) Convert the following grammar into CNF.
S→aSa | bSb | a | b | aa | bb

b) Simplify the following CFG
S→aA|aBB
A→ Aaa|€
B→bB|bbC
C→b [8+7]

8.a) Construct Turing Machine to accept following language and give its state Transition table and diagram. Check the machine by tracing a suitable instance.

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

b) Design a TM which subtracts two unary numbers. i.e m-n where m>=n. [7+8]

---ooOoo---

Code No: 155BZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
MACHINE LEARNING
(Computer Science and Engineering – Artificial Intelligence and Machine Learning)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Define LMS weight update rule.	[2]
b)	List the advantages of converting decision trees to rules before pruning.	[3]
c)	Define sample error, true error.	[2]
d)	What set of functions can be represented by feedforward networks?	[3]
e)	List the properties of case-based reasoning systems.	[2]
f)	Outline Bayesian Belief network.	[3]
g)	Define Fitness Function and selection.	[2]
h)	List the aspects of reinforcement learning.	[3]
i)	List two stages of the KBANN algorithm.	[2]
j)	What is inductive Bias in explanation-based learning?	[3]

PART – B

(50 Marks)

2.a)	Describe the final design modules of learning systems.	
b)	How to Incorporate Continuous valued attributes in decision tree learning?	[6+4]
	OR	
3.	Illustrate the Candidate-Elimination algorithm.	[10]
4.a)	Explain Gradient Descent algorithm.	
b)	Write a short note on Binomial Distribution.	[5+5]
	OR	
5.	How to estimate the difference in error of two hypothesis? Illustrate with example.	[10]
6.	Illustrate Naïve Bayes Classifier of Bayesian learning.	[10]
	OR	
7.a)	Explain Weighted-Majority algorithm.	
b)	Compare and contrast Lazy and Eager Learning.	[6+4]

8. Describe the prototypical genetic algorithm. [10]

OR

9.a) Describe the evaluation functions used to evaluate rule performance used in Learn-One-Rule algorithm.

b) Describe Q-Learning algorithm. [5+5]

10. Appraise the key properties, capabilities and limitations of explanation-based learning. [10]

OR

11.a) Explain explanation based learning for search control knowledge.

b) Compare and contrast analytical learning and inductive learning. [6+4]

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