Code: 13A05404 **R13**

B.Tech II Year II Semester (R13) Regular Examinations May/June 2015

FORMAL LANGUAGES & AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is a string? How to concatenate two strings?

(b) What is context free grammar?

(c) Describe the language generated by the regular expression: $(a+b)^*aaa(a+b)^*$.

(d) Let r_1 be the regular expression representing the language L_1, r_2 be the regular expression representing the language L_2, what is the language represented by the regular expression $r_2 + r_1$.

(e) Identify the language generated by context free grammar: $S \rightarrow (S)|()|SS$.

(f) Define ambiguous grammar with example.

(g) Can push down automata accept the regular language?

(h) Give any two examples of languages that are accepted by PDA.

(i) Define linear bounded automata.

(j) Define multi-tape Turing machine.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Construct the language generated by grammar $S \rightarrow aSb/\varepsilon$.

(b) Construct the language generated by the grammar $S \rightarrow aCa; C \rightarrow aCa/b$.

OR

3 Design a minimal DFA over the alphabet $\Sigma = \{0,1\}$ to accept the language $L = \{w|w \cong 0 \ mod \ 3\}$.

UNIT – II

4 State and prove Arden's theorem.

OR

5 (a) Write the identities of regular expressions.

(b) Draw the NFSA to accept the languages generated by aa^*bb^*

UNIT – III

6 (a) Remove unit productions in the following grammar:

$S \rightarrow ABaC$

$A \rightarrow BC$

$B \rightarrow b|\in$

$C \rightarrow D|\in$

$D \rightarrow \in$

(b) Remove unit productions in the following grammar:

$S \rightarrow aSb$

$S \rightarrow A$

$A \rightarrow cAd$

$A \rightarrow cd$

OR

7 Define Chomsky normal form, convert the following grammar into CNF:

$S \rightarrow bA|aB;\ A \rightarrow bAA|aS|a;\ B \rightarrow aBB|bS|a.$

UNIT – IV

8 Construct a PDA that accepts the language generated by the following grammar: $S \rightarrow aB;\ \ B \rightarrow bA/b;\ \ A \rightarrow aB.$

OR

9 Construct a PDA to accept the language $L = \{WCW^R/W \in (a,b)^+\}$ by the empty stack.

UNIT – V

10 Design a Turing machine to accept the language $= \{a^n b^n, n \geq 1\}$. Show an ID for the string 'aaabbb' with tape symbols.

OR

11 Write short notes on: (i) Instantaneous Description of TMs. (ii) Recursively Enumerable and Recursive Languages.

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Code: 13A05404

R13

B.Tech II Year II Semester (R13) Regular & Supplementary Examinations May/June 2016

FORMAL LANGUAGES & AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define the terms symbol, string and Language.

(b) Write short notes on proof by contradiction.

(c) Differentiate between Klean closure and positive closure.

(d) If R_1 and R_2 are two regular languages, $R_1 \cup R_2$ and $\overline{R_1}$ and $\overline{R_2}$ are also regular languages, prove by DeMorgans rules that $R_1 \cap R_2$ is also a regular language.

(e) For the grammar E→E+E, E→E*E, E→id, construct a parse tree (using leftmost derivation) for the string id*id*id+id.

(f) List the set operators under which CFLs are NOT CLOSED. Justify your answer.

(g) Explain how a stack is integrated into the functioning of a PDA.

(h) Give the formal definition of a PDA.

(i) Explain the functioning of a counter machine.

(j) State the closure properties of recursive languages.

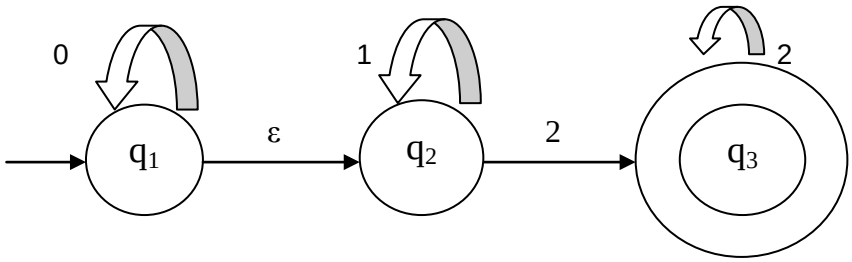
PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Construct the NFA for the RE $(0+1)^*(00+11)\ (01)\ (0+1)^*$.

(b) For the following ε-NFA, construct its equivalent NFA without ε transitions.



OR

3 (a) Construct a Moore machine that takes strings comprising 0, 1, 2 and 3 as input (base 4 number) whose decimal equivalent modulo 7 is given as output.

(b) How do we determine equivalence of two DFA? Explain with an example

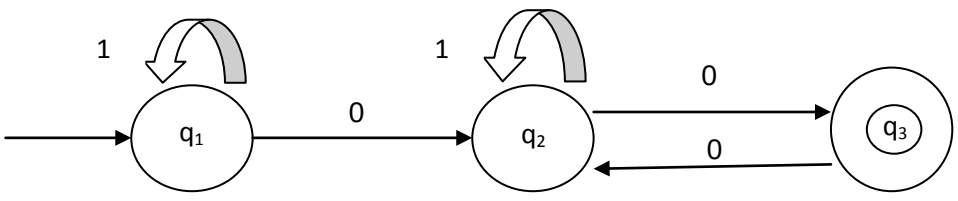
UNIT – II

4 (a) State and prove Arden's Theorem

(b) List the closure properties of Regular Languages

OR

5 Find the regular expression corresponding to the following DFA.



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UNIT – III

6 Convert the following grammar into GNF:

$X \rightarrow YZ \quad Y \rightarrow ZX \mid a \quad Z \rightarrow XY \mid b$

OR

7 (a) Explain the following terms with example:
(i) Ambiguous Grammar.
(ii) Left Recursion.
(iii) Chomsky's Normal Form.

(b) Discuss the closure properties of Context free languages.

UNIT – IV

8 (a) Construct a PDA that recognizes strings (over alphabet 0 and 1) that contain equal number of 0s and 1s.

(b) Construct a grammar in Chomsky's Normal Form that is equivalent to:

$A \rightarrow aBCb, B \rightarrow bC, C \rightarrow Cb, C \rightarrow b.$

OR

9 (a) Construct a PDA that recognizes strings of WW^r form, where W^r is the reverse of W, and strings comprise of 0s and 1s. Give the instantaneous of the PDA also.

(b) Construct a PDA that recognizes strings of type $0^n1^m \mid n>m$ using final state.

UNIT – V

10 (a) Explain the concept of Universal Turing Machine.

(b) Find a PCP solution for the following sets.

A	B
ab	aba
ba	abb
b	ab
abb	b
a	bab

OR

11 Construct a Turing Machine that computes the product of two numbers, represented in Unary form.

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Code: 13A05404 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations December 2016

FORMAL LANGUAGES & AUTOMATA THEORY

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Give the formal definition of Finite Automata.

(b) Write the regular expressions for the following languages:

(i) All the strings of a's and b's where every string ends with 'abab'

(ii) All the strings which begin or end with either 00 or 11 over the set { 0 ,1}

(c) Define the language for the following Context Free Grammars.

(i) S → 0 S 1 | 01

(ii) S → a S a | b S b | ε

(d) List any four closure properties of regular languages.

(e) Differentiate Recursive and Recursive enumerable languages.

(f) Explain briefly about two stack PDA.

(g) Show that the following grammar is ambiguous:

S->aSbS|bSaS|ε

(h) Construct NFA for the following regular expression: (00+11)*.

(i) Briefly explain about Chomsky hierarchy of languages.

(j) State Post Correspondence Problem (PCP).

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Construct DFA for the following Languages:

(i) The set of all strings over {0,1} having even number of 0's and odd number of 1's.

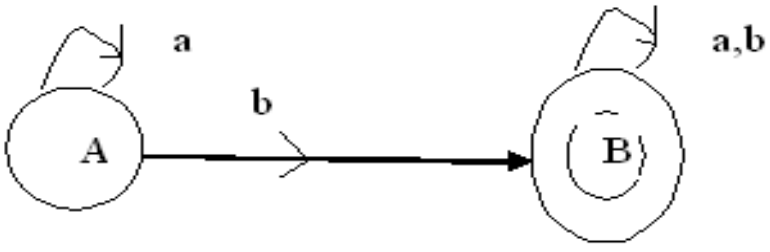
(ii) The set of all strings over {0,1} where evrey string doesnot ending with 011.

OR

3 Construct a Moore machine to determine residue mod 5 for a binary number and convert it into its equivalent Mealey machine.

UNIT – II

4 State Arden's theorem and construct the regular expression for the following FA using Arden's theorem.



OR

5 State pumping lemma for regular languages and prove that the following languages are not regular by using pumping lemma.

(i) L = $\{a^p$ | where p is a prime$\}$.

(ii) L = $\{ a^n b^n$ | n>0 $\}$.

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UNIT – III

6 Convert the following Context Free Grammar to Chomsky Normal Form.

$S \rightarrow bA \mid aB$

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

$B \rightarrow aBB \mid bS \mid b$

OR

7 What is meant by left recursion in CFG and check the following grammar is left recursive or not if it is, remove it.

$E \rightarrow E+T \mid T$

$T \rightarrow T*F \mid F$

$F \rightarrow id$

UNIT – IV

8 Design a PDA whose language is {w | w contains balanced parenthesis}.

OR

9 Convert the following PDA into its equivalent CFG.

The transition function is defined as:

$\delta(q_0, 0, Z_0) = \{(q_0, 0Z_0)\}$

$\delta(q_0, 0, 0) = \{(q_0, 00)\}$

$\delta(q_0, 1, 0) = \{(q_1, \varepsilon)\}$

$\delta(q_1, 1, 0) = \{(q_1, \varepsilon)\}$

$\delta(q_1, \varepsilon, Z_0) = \{(q_2, \varepsilon)\}$

UNIT – V

10 What is Turing Machine? Specify its model and construct TM for the language.

$L=\{a^m b^n a^{m+n} \mid n \geq 1, m \geq 0\}$

OR

11 Explain various types of Turing Machines with examples.

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Code: 13A05404 **R13**

B.Tech III Year I Semester (R13) Regular Examinations December 2015

FORMAL LANGUAGES & AUTOMATA THEORY

(Information Technology)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define deterministic finite automata.

(b) Define non-deterministic finite automata.

(c) Find DFA for L = {w:|w| mod 3 = 0} where $\sum$ = {a,b}.

(d) Find NFA with three states that accepts the language {ab,abc}*.

(e) Write RE for L = {w $\in$ {0,1}* : w has no pair of consecutive zeros}.

(f) What is left factoring?

(g) Define primitive recursive function.

(h) Distinguish between DPDA and NPDA.

(i) Write variations of Turing machine.

(j) Explain about modified PCP.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Describe Chomsky hierarchy of languages with proper examples.

OR

3 State and explain Myhill-Nerode theorem.

UNIT – II

4 (a) What are the closure properties of regular languages?

(b) Prove that, the following Language is non-regular using pumping Lemma:

(i) L = $\{a^n b^{n+1} | n > 0\}$.

(ii) L = { ww| w $\in$ {0,1}* }.

OR

5 Explain left & right derivations and also left & right derivation trees with examples.

UNIT – III

6 (a) Show that L = $\{ a^i b^j | j = i^2\}$ is not context free language.

(b) Find if the given grammar is finite or infinite:

S$\rightarrow$AB, A$\rightarrow$BC|a, B$\rightarrow$CC|b, C$\rightarrow$a

OR

7 (a) Explain Ambiguity in CFGs.

(b) Convert the grammar into GNF:

S$\rightarrow$ ABb|a, A$\rightarrow$aaA|B, B$\rightarrow$ bAb

UNIT – IV

8 (a) Find the PDA that accepts the following language:

L = {x $\in$ {a,b}*: $|x|_a = 2|x|_b$} via empty stack.

(b) Explain instantaneous description.

OR

9 Give the equivalence between CFL and PDA.

UNIT – V

10 (a) What are undecidable problems? Explain why PCP problem is considered undecidable.

(b) What is a Universal Turing machine?

OR

11 Design Turing machine to accept all set of palindromes over {0,1}*.also write the instantaneous description on the string 1001001.

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