Total No. of Questions : 6   Total No. of Printed Pages : 2

EH-60

B.E. IVth Semester Examination, 2014

Theory of Computation

Paper - CS-405

Time : 3 Hours]   [Maximum Marks : 60

Note :- Attempt all questions.

1. Explain the following terms :-   10

    (a) Matirx grammars.

    (b) Port System.

    (c) DFA.

    (d) Grammars.

    (e) Sets.

2. Construct a Mealy machin.   10

OR

Describe Regular Set ? Explain closure properties of regular sets.

P.T.O.

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(2)   EH-60

3. Define Normal forms ? What is the utility of normal forms ?
                                                     10

OR

Explain Regular language withits clasure properties.

4. Construct a PDA accepting, $L = \{0^n 1^n 0^{m+n}\}$ 10

OR

Write detail note on Deterministic PDA.

5. Design a Turing machine for accepting ths set of strings with an equal numbers of 0's and 1's.   10

OR

Explain the concept of multitape turing machine.

6. Prove that the function :-   10

    Max $(x, y) = x$ if $x \geq y$

    y otherwise is primitive functions.

OR

Explain with suitable examples what is meant by Primitive recursive pedicate.

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OR

The intersection of two context-free languages may or may not be context-free. Also write an algorithm for a given any context-free grammar to determine whether or not it can generate any words.

4. a) Differentiate the purpose of the study of Turing machine with Finite Automata/ Pushdown Automata.

   b) What is Turing - computable function? Define recursive function.

   c) How UTM overcomes the limitation of Turing machine? Also define UTM.

   d) Present a Turing machine that inserts symbol # in the beginning of a string on the turing tape. Assume $\Sigma = \{a, b\}$.

OR

Design a turing machine that adds two numbers presented in binary notation and leaves the answer on the tape in binary form.

5. a) Define P and NP problems.

   b) Discuss tractable and intractable problem.

   c) Draw and explain commonly believed relationship between class P, NP, NP-complete and NP-hard.

   d) Define and discuss vertex cover problem.

OR

Discuss and explain travelling sales man problem.

CS - 505

B.E. V Semester

Examination, December 2015

Theory of Computation

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

   ii) All parts of each questions are to be attempted at one place.

   iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

   iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Define DFA. List three household applications of finite Automata.

   b) What is a trap state in FA? State and explain the properties of transition functions.

   c) Design deterministic finite automation accepting the following languages over the alphabet $\{0, 1\}$:

      i) The set of all words ending in 00.

      ii) The set of all words except ε.

      iii) The set of all words that begin with 0.

d) What do you mean by Automata with output capability? Draw a Mealy machine equivalent to the following circuit.

OR
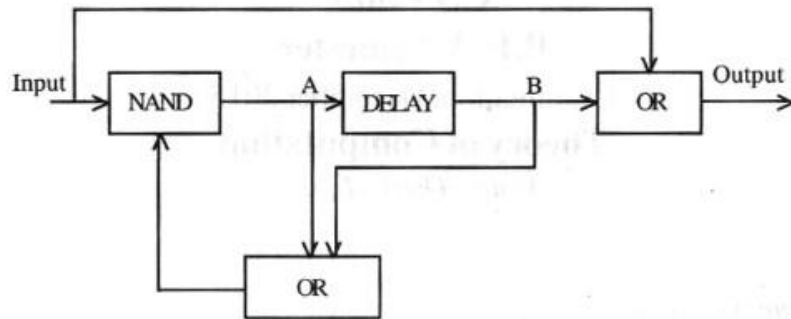
What do you mean by closure properties of regular languages? State these properties. State pumping Lemma and show that $L = \{a^i b^i \mid i >= 1\}$ is not a regular language.

2. a) Show that the following grammar is ambiguous

$S \rightarrow aSbS|bSaS|\varepsilon$ rgpvonline.com

b) What are left most and right most derivations? Explain with suitable example.

c) Why CFG is not considered adequate for describing natural language? Explain with suitable example.

d) What do you mean by Normal forms? Reduce the grammar G with following productions to CNF.

$S \rightarrow ASA|bA$

$A \rightarrow B|S$

$B \rightarrow c$

OR

What do you mean by useless production? Consider the grammar $G = (V, T, P, S)$ where V, T, P, S are given as:

$V = \{S, A, B, C, E\}$

$T = \{a, b, c\}$

$S = \{S\}$ and

P consists of

$S \rightarrow AB$

$A \rightarrow a$

$B \rightarrow b$

$B \rightarrow C$

$E \rightarrow c$

Eliminate useless symbols and productions from the above grammar.

3. a) What is PDA? Explain instantaneous description of PDA.

b) State the difference between PDA and the FA.

c) Design a PDA to accept the language $\{x \in \{a,b\}^* | n_a(x) > n_b(x)\}$.

d) Consider the grammar

$S \rightarrow aA$

$A \rightarrow aABC|bB|a$ rgpvonline.com

$B \rightarrow b$

$C \rightarrow c$

Construct PDA corresponding to this grammar. Also provide moves of the PDA and the left most derivation for any string in the language defined by the grammar.

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Total No of Questions : 8   Total No. of Printed Pages : 3

EI-60

B.E. (IVth Sem.) (CGPA) CSE Examination-2015

THEORY OF COMPUTATION

Paper - CS-405

Time Allowed : Three Hours

Maximum Marks : 60

Note : Attempt 5 questions out of 8 question.

Q.I   (a) Discuss non-deterministic finite automata with suitable example.   4

(b) Design a FA that reads strings made up of (0, 1) and accept only those string which ends up in either '00' or '11'.   8

Q.II   (a) Explain how DFA in equilvalent to NDFA.   4

(b) Construct the DFA equivalent to the NFA (Σp, q, r, r3, Σ0, 13, δ, p, {s}) where δ is given below :   8

|	0	1
p	p, q	p
q	r	r
r	s	–
s	s	s

EI-60   P.T.O.

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(2)

Q.III   (a) Write down the properties of regular expression.   4

(b) Find the CFL generated by following grammar :   8

$$S \rightarrow XY$$
$$X \rightarrow aX \mid bX \mid a$$
$$Y \rightarrow Ya \mid Yb \mid a$$

Q.IV   (a) Explain application of pumping lamma.   4

(b) Prove that, the following langauge is non-regular using pumping lemma, $\{a^n b^{n+1} \mid n > 03\}$.   8

Q.V   (a) Explain closure properties of CFL's.   4

(b) Write regular expression for the following DFA.   8
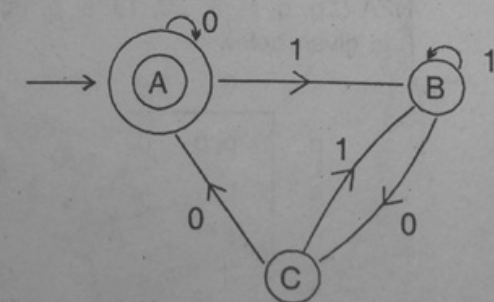
EI-60   Contd....

(3)

Q.VI (a) Discuss push down automata. 4

(b) Design a PDA which accepts the language. 8

$$L = \{W \in (a,b)^* / W \text{ has the equal number}$$

of a's and b's}.

Q.VII (a) What do you mean by turning machine. 4

(b) Design Tm which recognizes the wards of the form $0^n 1^n$. 8

Q.VIII Write short notes on following : (any two) 2

(1) NP hard Vs NP complete

(2) Tractable problem vs untractable problem.

(3) Chamsky Classification of grammar.

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Roll No ..

CS-505

B.E. V Semester
Examination, June 2016
Theory of Computation
Time : Three Hours

Maximum Marks : 70

Note: i)   Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii)   All parts of each question are to be attempted at one place.

iii)   All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv)   Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a)   Design DFA that accepts all strings with at most 3 a's.

    b)   Design a NFA for $\left\{cbab^n / n >= 0\right\}$.

    c)   Construct Moore machine for the following Mealy machine.
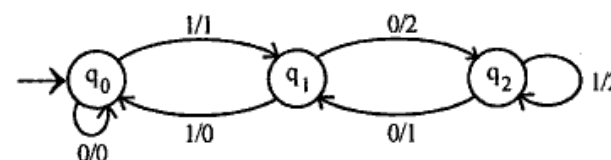
    d)   Write and explain Myhill-Nerode theorem.

OR

Construct NFA for the following grammar

$S \rightarrow Ab \mid ab, A \rightarrow Ab \mid Bb, B \rightarrow Ba \mid a$

d) Design push down automata which accepts

$L = \left\{ 0^n 1^{2n} / n \geq 1 \right\}$

OR

Design a push down automata which accepts set of balanced

parentheses. $\left(\{\{( )\}\} \right)$

Unit - II

2. a) Give CFG for R.E $(011+1)*(01)*$.

b) Explain GNF conversion steps.

c) Explain ambiguous grammar problem.

d) Convert following CFG to CNF

$S \rightarrow ASB/E$

$A \rightarrow aAS/a$

$B \rightarrow SbS/A/bb$

Unit - IV

4. a) Explain ID of a turing machine.

b) Explain Multi Tape and Universal Turning machine.

c) Explain church hypothesis.

d) Design turing machine to add two numbers a and b.

OR

Convert the following grammar G into GNF

$S \rightarrow XA/BB$

$B \rightarrow b/SB$

$X \rightarrow b$

$A \rightarrow a$

OR

Design turning machine for accepting strings of the

language defined as $\left\{ \omega \omega \gamma / \omega \in (0+1)* \right\}$.

Unit - V

5. a) Explain P and NP problems.

b) Difference between NP complete w NP hard problem.

c) Explain process of Reducibility.

d) Describe Hamiltonian path problem.

Unit - III

3. a) Explain PDA.

b) Explain how many way's PDA can accept (final out null store).

c) Explain pumping lemma for CFL.

OR

Describe vertex cover problem.

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CS - 505

Contd...

CS - 505

Total No. of Questions : 8   Total No. of Printed Pages : 3

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EK-208

## B.E. (IVth Sem.) (CGPA) CSE Examination-2016

THEORY OF COMPUTATION

Paper - CS-405

Time Allowed : Three Hours
Maximum Marks : 60

Note : Attempt any five questions out of 8 questions. Each question carries equal marks.

Q.I (a) Discuss farmal language with the help of example. 4

(b) Define a FA that reads string made up of (0, 1) and accept only those strings which ends up in eighter 01 or 10. 8

Q.II (a) Explain how DFA equivalent to the NFA. 4

(b) Convert NFA with E-moves to equivalent NFA without E-moves— 8
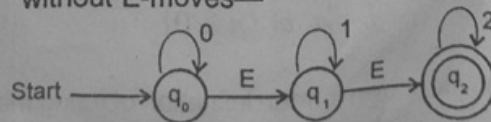
EK-208   P.T.O.

(2)

Q.III (a) Discuss propetries of regular expression with examples. 4

(b) Construct DFA for the following language—
$L(m) = w \in (0, 1)*/w$ has neither 'aa' nor 'bb' as a substring. 8

Q.IV (a) Application of regular expressions and finite automata. 4

(b) Find the CFL associated with the CFG given below— 8

$S \rightarrow aB \mid bA$

$A \rightarrow a \mid aS \mid b AA$

$B \rightarrow b \mid b s \mid a BB$

Q.V (a) Define chomsky normal farm. 4

(b) Describe in detail Chomsky hierarchy. 8

Q.VI (a) Differentiate between PDM and FSM in short. 4

(b) Construct a PDA accepting the following language—

$$L = \{a^n b^n \mid n \geq 0\}$$

Q.VII (a) Write shown formal defination of turing machine. 4

EK-208   Contd. .....

(3)

(b) Design a turing machine m to recognize the language—

$$\left\{ 1^n \; 2^n \; 3^n \; / \; n \geq 1 \right\}$$

Q.VIII (a) Define primitives recursive functions. 4

(b) Prove that there exists no turing machine that solves the halting problem. 8

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Total No. of Questions : 8]   [Total No. of Printed Pages : 2

Roll No ....

CS-4005 (CBGS)

B.E. IV Semester

Examination, May 2018

Choice Based Grading System (CBGS)

Theory of Computation

Time : Three Hours

rgpvonline.com   ***Maximum Marks : 70***

Note: i)   Attempt any five questions.

    ii)   All questions carry equal marks.

1. a)   Explain Deterministic and nondeterministic finite automata with example.   7

    b)   Explain applications of pumping lemma.   7

2. a)   Construct a NDFA accepting all string in {a, b} with either two consecutive a "s or two consecutive b "s.   7

    b)   Find a grammar in Chomsky Normal form equivalent to S->aAD; A->aB/bAB; B->b, D->d.   7

3. Explain the following: 14

    a)   Regular Grammars

    b)   Context free grammars

    c)   Derivation trees

CS-4005 (CBGS)   **PTO**

4. a)   Construct a grammar in GNF which is equivalent to the grammar S->AA/a, A->SS/b.   rgpvonline.com   7

    b)   Define deterministic Push Down Automata DPDA. It is true that DPDA and PDA are equivalent in the sense of language acceptance is concern? Justify your answer.   7

5. a)   Demonstrate the working of your TM with an example.   7

    b)   Explain in detail notes on universal Turing machines with example.   7

6. a)   Describe the recursively Enumerable Language with example.   7

    b)   Construct a PDA for set of palindrome over the alphabet {a, b} $L(M) = \{WcW^R\}$.   7

7. a)   Give a detailed description of ambiguity in Context free grammar.   7

    b)   Explain Vertex cover problem and Hamiltonian path problem.   7

8. Explain the following: 14

    a)   NP complete and NP hard

    b)   Traveling salesman problem

    c)   Partition problem

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CS-4005 (CBGS)

Total No. of Questions : 8]   *[Total No. of Printed Pages : 2*

Roll No ....

CS-227-CBCS

B.E. IV Semester

Examination, June 2020

Choice Based Credit System (CBCS)
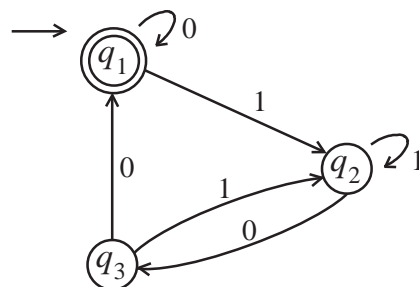
Theory of Computation

Time : Three Hours

Maximum Marks : 60

Note: i)   Attempt any five questions.

      ii)   All questions carry equal marks.

1. a)   What is Mealy Machine? How Finite Automates can be converted into Moore Machine? Explain with the help of example.

   b)   Design a $(Mod4)_2$ machine over the alphabet $(0,1)$?

2. Find out the Regular Expression from given DFA

3. Write the CFG for the following language

   i) $L = \{0^i 1^j 2^k , \ i = j \text{ or } j = k \}$

   ii) $L = \{0^n 1^n , n \geq 1\}$

   iii) $L = \{ \text{even palindrome over } (0, 1) \}$

CS-227-CBCS   PTO

[2]

4. a) Show that the grammar

   $S \rightarrow a / abSb / aAb$

   $A \rightarrow bS / aAAb$ is ambiguous

   b) Explain Chomsky Normal Form. Explain with example.

5. Construct the PDA for the following example?

   i) $a^n b^n \quad n \geq 1$

   ii) $a^m b^n c^{m+n} |m, n \geq 1|$

   iii) $\omega c \omega^R \quad \omega \varepsilon (0,1)$

6. a) Design a Turning Machine for the language

   $\left\{ L(G) = a^n b^n \quad n \geq 1 \right\}$

   b) Describe various types of Turing Machine.

7. a) How P class problem different from NP class problem?
   b) What do you mean by Vertex cover problem and Hamiltonian path problem?

8. Write a short notes (any three):
   i) NP Hard
   ii) Decidable problem
   iii) Pumping Lemma for Regular
   iv) Myhill - Nerode

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CS-227-CBCS