Code No: V3127 **R07** **Set No: 1**

III B.Tech. I Semester Supplementary Examinations, November/December - 2012

**FORMAL LANGUAGES AND AUTOMATA THEORY**

(Common to Computer Science and Engineering)

**Time: 3 Hours** **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Define string and alphabet and describe the operations on string.
   b) Define language? Describe its operations.

2. Prove the theorem 'Let L be a set accepted by non-deterministic finite automata, then there exists a DFA that accepts L".

3. For any string $w=w_1,w_2 \ldots\ldots\ldots w_n$ the reverse of w, written WR, is the string w in reverse order $w_n \ldots\ldots w_2,w_1$. For any language A let $A^R=\{w^R|w\varepsilon\Delta\}$ show that if A is regular so is $A^R$.

4. a) Let L be the language $(0^n1^n2^n|n\varepsilon N\}$ is L context free? i.e. there is a grammar that generates L. Explain.
   b) Prove the theorem "Let $G=(v_n,\Sigma_1,P,S)$ be a CFG. Then $s\Rightarrow\propto$ if and only if there is a derivation tree for G with yield$\propto$".

5. a) Prove that L = { x Є {a, b}* | number of b's in x is equal to the square of number of a's in in x } is not a Context Free Language.
   b) Define Greibach Normal Form (GNF) for a CFG. Convert the following grammar into GNF.
   S → AB
   A →BSB | BB
   B →aAb | a | b

6. a) Define a PDA. Design a PDA for L = $\{xcx^r / x Є \{a,b\}^*\}$. Process the string abbacabba. Note: $x^r$stands for reverse of the string x.
   b) What do you mean by an instantaneous description of a PDA. Explain with example.

7. Define a Turing Machine(TM) and the language accepted by a TM. Design a TM for recognizing the language (a+b)*aba(a+b)*. Draw it's transition diagram and table. Using the Instantaneous Description notation process the string aabaabaaab.

8. a) Explain about Chomsky hierarchy of Languages.
   b) Explain in detail about Universal Turing Machine.

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Code No: V3127 **R07** **Set No: 2**

III B.Tech. I Semester Supplementary Examinations, November/December - 2012

**FORMAL LANGUAGES AND AUTOMATA THEORY**

(Common to Computer Science and Engineering)

**Time: 3 Hours** **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. Give a finite state diagram that accepts all the floating point numbers.

2. Explain the procedure to convent NFA –ε to ordinary NFA, with a suitable example.

3. Are the following languages regular? For each language give an automation that reconozes it and give a proof that it is not regular.
   a)L= $\{a^n b^n c^n\}$, for Σ={a,b,c}.
   b)L= $\{ww^R | w \varepsilon \Sigma^*\}$, for ∑={0,1}.
   c)L= $\{ww | w \varepsilon \Sigma^*\}$, for ∑={0,1}.

4. a) Define context free grammar (CFG) and briefly explain the role of CFG in the programming language.
   b) Derive the procedure for constructing a regular grammar from regular expression.

5. a) Prove that L = { x Є {a, b, c}* | number of a's in x is equal to the number of b's or number of c's in x, which ever is maximum.} is not a CFL.
   b) Show that the grammar with following productions is ambiguous.
   S→ a | abSb | aAb A →bS | aAAb

6. a) Design a PDA for L = $\{xx^r | x \in \{a,b\}^*\}$. Process the string abbaabba. Is your PDA deterministic or non deterministic? Justify your answer.
   Note: $x^r$ stands for reverse of the string x.
   b) Explain the differences between a PDA and a FA.

7. Define a TM and the instantaneous description of a TM. Design a TM for recognizing L = { x Є {a, b}* | x ends with aba}. Specify it's transition diagram. Process the strings abaaba and ababaa using ID notation.

8.a) By giving suitable examples, explain NP hard and NP complete problems.
   b) Show that the PCP with two lists x = (b, babbb, ba) and y = (bbb, ba, a) has a solution. Give the solution.

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Code No: V3127 **R07** **Set No: 3**

III B.Tech. I Semester Supplementary Examinations, November/December - 2012

**FORMAL LANGUAGES AND AUTOMATA THEORY**

(Common to Computer Science and Engineering)

**Time: 3 Hours** **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Describe the following languages over the input set A={a,b}
   1) L1 = {a, ab, abb, aba}
   2) L2 = $\{a^n b^n \mid n>=1\}$
   3) L3 = $\{a^n b^n \mid n>0\}$

   b) What is the Kleen closure? Let $\sum$ = {a,b} obtain

   $\Sigma^* = \Sigma 0 \cup \Sigma 1 \cup \Sigma 2 \cup \Sigma 3$ - - - - - - - - .

2. a) Write the conversion procedure of NFA with ε to DFA.
   b) Convert the following NFA with ε to equivalent DFA.


3. Consider the language L of strings that have an equal number of occurrences of "01" and "10" under each of the following alphabets. Is this language regular? For each alphabet, give an automation that recognizes it and prove that it is not regular.

   a)Σ= {0,1}.

   b)Σ= {0,1,#}.

4. a) Consider G whose productions are S→aAS|a, A→SbA|SS|ba.
   Show that s⇒aabbaa and construct a derivation tree whose yield is aabbaa.
   b) prove "if A⇒w in G, then there is a leftmost derivation of w" .

5. a) Decide whether L = {xcx / x Є {a, b}* } is CFL or not.
   b) Prove that the grammar with following productions is ambiguous.

   S →aB | ab A →aAB | a B →ABb | b

6. a) When do we say that a PDA is non deterministic? Design a PDA for recognizing the language of palindromes over the input alphabet {a, b}.
   b) Distinguish between a DPDA and NPDA.

7. a) Design a TM for recognizing the language of palindromes over the input alphabet {a, b}. Show the moves of TM for the string abbbba.
   b) What is Instantaneous Description of a TM? Briefly explain.

8. a) Explain the universal TM in detail.
   b) Write short notes on PCP and MPCP with examples.

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Code No: V3127 **R07** **Set No: 4**

III B.Tech. I Semester Supplementary Examinations, November/December - 2012

**FORMAL LANGUAGES AND AUTOMATA THEORY**

(Common to Computer Science and Engineering)

**Time: 3 Hours** **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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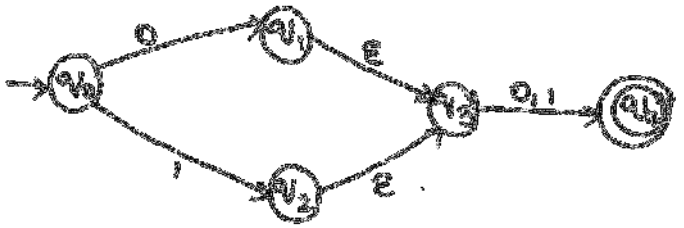
1. a) What is the finite state machine? Define finite automata and describe the representation of finite automata.
   b) Discuss the applications of finite automata.

2. a) Convert the given NFA with Σ to its equivalent DFA.




   b)What is the “”Minimization of FSM”? Explain the method for construction of minimum state automata.

3. a) Write a regular expression to denote a language L which accepts all the strings that begin or end with either 00 or 11.
   b) Construct a regular expression for the language which accept all strings with at least two c’s over the set Σ={c,b}
   c) Construct a regular expression for the language over the set Σ={a,b} in which the total number of a’s are divisible by 3.

4. a) Explain in detail, the right and left linear grammars with example.
   b) Explain the equivalence and differences between regular grammar and finite automata.

5. Prove that L = { $\mathbf{a^i b^j c^k}$ **| i>=j or i>=k }** is a CFL but it’s complement is not.

6. When do you say that a language L is recognized or accepted by a PDA? Design PDA for L = { $\mathbf{a^i b^j c^k}$ | j >= i+k and i,j,k>0}. Process the string aaabbbbbbccc using instantaneous description.

7. Design a TM for recognizing L = { xx | x Є {a, b}* }. Show the moves of the TM for the strings abaaba and abaabb.

8. a) Define LR(0) grammar. Specify a grammar and show that it is LR(0).
   b) Describe the P and NP computational complexity of problems with suitable examples.

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