Code No: R09220504 **R09** **Set No. 2**

II B.Tech II Semester Examinations,December-January, 2011-2012
FORMAL LANGUAGES AND AUTOMATA THEORY
Computer Science And Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the procedure to convert Context Free Grammar to Push Down Automata.
   (b) Convert the following Context Free Grammar to Push Down Automata
   S→ aAA
   A→aS | bS | a. [7+8]

2. Describe, in the English language, the sets represented by the following regular expressions:
   (a) a(a+b)*ab
   (b) a*b + b*a [15]

3. (a) What is unit production? Explain the procedure to eliminate unit production with example.
   (b) What is ε-production?
   (c) What is the use of Chomsky Normal Form or Greibach Normal Form?[6+5+4]

4. The grammar E→ E + E | E * E | (E) | id. Generate the set of arithmetic expressions with +, *, paranthesis and id. The grammar is ambiguous since id + id * id can be generated by two distinct left most derivations.
   (a) Construct an equivalent unambiguous grammar.
   (b) Construct an unambiguous grammar for all arithmetic expressions with no redundant paranthesis. A set of paranthesis is redundant if its removal does not change the expressions. [7+8]

5. (a) Construct a Mealy machine which is equivalent to the Moore machine given in table.

Present State	Next State		Output
	a=0	a=1	
$\rightarrow q_0$	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	0

   (b) Construct the corresponding Mealy machine to the Moore machine described by the transition table given.

Present State	Next State		Output
	a=0	a=1	
$\rightarrow q_1$	q_1	q_2	0
q_2	q_1	q_3	0
q_3	q_1	q_3	1

[7+8]

6. Design Turing Machine for recognition of binary palindromes. [15]

7. (a) Consider the Finite State Machine whose Transition function δ is given in the form of a transition table (figure 1). Here, Q = {q_0,q_1,q_2,q_3}, Σ ={0,1},F={q_0}. Give the entire sequence of states for the inputstring 110001.

Transition Table:

States	Input	
	1	0
q_0	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
((q_3))	q_1	q_2

Figure 1:

(b) Let M = (Q,Σ,δ, q0, F) be a finite automaton. Let R be a relation in Q defined by q_1 R q_2 if δ (q_1,a)=δ(q_2,a) for some a $\in \Sigma$. Is R an equivalence relation? [8+7]

8. Construct LR(0) items for the grammar given find it's equivalent DFA
S $\rightarrow$ AB | aaB
A $\rightarrow$ a | Aa
B $\rightarrow$ b [15]

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Code No: R09220504 **R09** **Set No. 4**

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FORMAL LANGUAGES AND AUTOMATA THEORY
Computer Science And Engineering

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

Answer any FIVE Questions
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1. Represent the following sets by regular expressions
   (a) {0,1,2}
   (b) $\{1^{2n+1} \mid n>0\}$
   (c) {w ε{a, b}* | w has only one a }
   (d) The set of all strings over {0,1}, which has at most two zeros [15]

2. Convert the following grammar to Greibach Normal Form G = ({A1, A2, A3}, {a,b},P,A)
   Where P consists of the following
   A1→A2 A3
   A2→A3 A1 | b
   A3→A1 A2 | a [15]

3. Construct
   (a) A context-free but not regular grammar.
   (b) A regular grammar to generate $\{a^n \mid n>=1\}$. [15]

4. (a) Design a Turing Machine to perform following computations
   $q_0w \rightarrow q_f$ ww, w ε {0}*
   (b) "Turing Machine not only used for recognizing language but also computes". Explain. [9+6]

5. (a) Draw the transition diagram of a FA which accepts all strings of 1's and 0's in which both the number of 0's and 1's are even.
   (b) Construct NFA which accepts the set of all strings over $\{0, 1\}$ in which there are at least two occurrences of 1 between any two occurrences of 0. Construct DFA for the same set. [7+8]

6. (a) Construct a NFA accepting {ab,ba} and use it to find a DFA accepting the same set.
   (b) Write the steps in construction of minimum automaton. [8+7]

7. Construct LR(0) items for the grammar given find it's equivalent DFA.
   S → (S) | a [15]

8. Which of the following are CFL's? explain

(a) $\{a^i\ b^j \mid i \neq j \text{ and } i \neq 2j\}$

(b) $\{a^i\ b^j \mid i \geq 1 \text{ and } j \geq 1\}$

(c) $\{(a+b)^* - \{a^n\ b^n \mid n \geq 1\}\}$

(d) $\{a^n\ b^n\ c^m \mid n \leq m \leq 2n\ \}$. [15]

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Code No: R09220504 **R09** **Set No. 1**

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FORMAL LANGUAGES AND AUTOMATA THEORY
Computer Science And Engineering

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

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1. (a) Write the steps in construction of minimum automaton.
   (b) Draw NFA without ε-moves transition with diagram and table equivalent to NFA whose transition table is given. [7+8]

2. Discuss about
   (a) Composite Turing Machine
   (b) Universal Turing Machine (UTM). [7+8]

3. (a) Explain the procedure to convert Push Down Automata to Context Free Grammar.
   (b) Convert the following Context Free Grammar to Push Down Automata
   S→ (S) S | ε. [7+8]

4. (a) Define DFA.
   (b) Give DFA accepting the set of all strings such that every block of 5 consecutive symbols contains at least two 0's over an alphabet $\{0, 1\}$.
   (c) Construct the NFA accepting the set of all strings with an equal number of 1's and 0's such that no prefix has two more 0's than 1's nor two more 1's than 0's over an alphabet $\{0, 1\}$. Give one example string which is accepted by this NFA and write the sequence of steps. [2+6+7]

5. (a) What is context sensitive grammar? Give examples.
   (b) Let Σ = { 0 , 1 } and A,B be the list of 3 strings each. Verify below PCP has a solution or not?

	List A	List B
I	W_i	X_i
1	00	0
2	001	11
3	1000	011

[7+8]

6. Construct a transition system corresponding to the regular expressions
   (a) (ab + a)* (aa +b)
   (b) a*b + b*a [15]

7. Construct context-free grammars to generate the following

(a) $\{o^m 1^n \mid m \neq n, m, n >= 1\}$.

(b) $\{a^l b^m c^n \mid$ one of l, m, n equals 1 and the remaining two are equal$\}$. [7+8]

8. (a) Eliminate ε - productions from the grammar 'G' given as
A→ aBb | bBa
B→ aB | bB | ε.

(b) Convert the following grammar to Greibach Normal Form
S→ ABA — AB — BA — AA — B
A→ aA — a
B→ bB — b. [7+8]

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Code No: R09220504 **R09** **Set No. 3**

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

Answer any FIVE Questions
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1. (a) If G=({S}, {0, 1}, {S→0S1, S→ ε}, S), find L(G).
   (b) If G=({S}, {a}, {S→SS}, S) find the language generated by G. [7+8]

2. (a) Construct DFA and NFA accepting the set of all strings not containing 101 as a substring.
   (b) Draw the transition diagram of a FA which accepts all strings of 1's and 0's in which both the number of 0's and 1's are even.
   (c) Define NFA with an example. [6+5+4]

3. (a) Write the applications of Finite Automata.
   (b) Define NFA with ε-moves.
   (c) Draw NFA with ε -moves transition diagram and table which accepts the language consisting of any number (including zero) of 0's followed by any number (including zero) of 1's followed by any number (including zero) of 2's. [6+2+7]

4. (a) Consider the fallowing grammar G = ({S,A},{a,b},P,S)
   Where P consists of S → aAS / a
   A → SbA / SS / ba
   For the string aabbaa show
      i. Left Most Derivation
      ii. Right Most Derivation
      iii. Parse Tree
   (b) Find the Context Free Language generated by the following grammar
   G=({S},{a ,b},P,S)
   where P: S → aSb | ab [7+8]

5. Design Push Down Automata for L = $\{a^{2n}\ b^n \mid n \geq 1\}$. [15]

6. Write briefly about the following
   (a) Decidability of problems
   (b) RICE Theorem
   (c) Undecidability of post correspondence problem. [5+5+5]

7. Design Turing Machine which will recognize strings containing equal number of 0's and 1's. [15]

8. (a) construct a finite automaton accepting all strings over {0, 1} ending in 010 or 0010.

   (b) Show that the set L= $\{a^{pow(i,2)} \text{ — } >= 1\}$ is not regular. [pow(i,2) = i^2] [7+8]

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