MCA 3rd Semester Examination 2013
Paper - XI
(Formal Language & Automata)

Time : 3 Hrs. Full Marks : 80

1. Answer any five questions from the following $2\times5 = 10$

   (a) Define Nondeterministic Finite Automata (NFA).
   (b) What is the significance of pumping lemma?
   (c) How are initial and final state represented in Transition Diagram?
   (d) Define grammar with example.
   (e) Give two application of Turing Machine.
   (f) Describe the set using regular expression $\{a^2\ a^4\ a^6\ a^8 \ldots\}$
   (g) What are recursively enumerable language?

2. Answer any three questions from the following $4\times3 = 12$

   (a) Does the PCP with two lists $X = (1^3, 01^2)$ and $Y = (1^3, 101^3)$ has a solution.
   (b) Write short notes on (any two)
      (i) Church's Thesis
      (ii) Multi Head Turing Machine
      (iii) Pushdown Automata
   (c) Discuss any two closure properties of context free language (CFL).

(d) Draw the nondeterministic finite Automata for the regular expression $(00+11)\ (1+0)^*$ over $\{0, 1\}$.

(e) What are parse free? Draw the parse tree for the context free grammar

$S \rightarrow a\ A\ b \mid \wedge$

$A \rightarrow B\ a \mid aB$

$B \rightarrow bb \mid \wedge$

3. Answer any three questions from the following $6\times3 = 18$

(a) Convert the grammar into PDA.

$S \rightarrow a\ AA$

$A \rightarrow a\ S \mid bS \mid a$

and check whether the word aba^4 is accepted by the PDA.

(b) Prove that the langauge $L = \{a^n b^n \mid n > 0\}$ is not regular

(c) Write context free grammar for the langauge

(i) odd no. of a's over $\{a, b\}$

(ii) starts and ends with different letters

(d) Consider the grammar G. whose production are

$S \rightarrow AS$

$A \rightarrow aa\ A \mid \in$

$B \rightarrow Bb \mid \in$

Find the leftmost and righmost derivation for the a^4b^5.

(e) Construct the $\in$ – NFA for the regular expression $a\ (a+b)^* + (a+b)^*b$. Show all the steps involved.

4. Answer any four questions from the following $10\times4 = 40$

(a) Design a Turing Mechine to recognize strings having equal number of a's and b's over $\{a, b\}$

Also show that the string 'aababb' is accepted by the Turing Machine.

(b) Describe the following set by regular expression over $\Sigma = (a, b)$

(i) Set of all strings that consists of atmost two a's

(ii) Set of all strings in which all a's come before all b's.

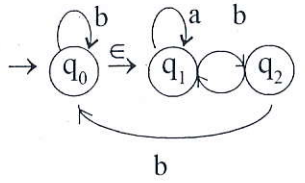
(iii) Set of all strings that end in double letter.

(iv) Set of all strings that contains odd no. of b's.

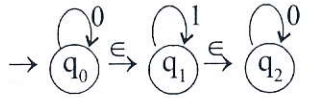
(v) Set of all strings of length 3.

(c) Construct the DFA for the following NFA.

(i)



(ii)



(d) Design a Turing Machine that accepts the words in langauge.

$L = \{w \subset w^R \mid w \in \{0, 1\}^*\}$

Also check whether the string abacaba is accepted by the TM.

(e) Construct a PDA accepting $\{a^n\ b^m\ a^n \mid m, n \geq 1\}$ by rull store. Construct the corresponding CFG for the same set.

(f) What are μ– recursive functions. Give example of primitive recursive function. Explain the turing compatibility of μ– recursive function.

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