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**FACULTY OF ENGINEERING& TECHNOLOGY**

**Third Year (CSE/IT) Examination-Dec-2014**

**Theory of Computation (Revised)**

**[Time: THREE *Hours*]** **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

**N.B**
1) Q. no 1 and 6 are compulsory
2) Attempt any two questions from Q. No 2 to Q .no 5 and from Q. no. 7 to Q. no 10 of each section.
3) Figures to the right indicate full marks.

SECTION A

Q.1 Attempt any five from the following 10

a) Define NFA with epsilon transitions. Give suitable example.
b) Describe the sets for (a+b)* and $(a+b)^+$ state the difference in the two sets.
c) Define ardeus theorem and state it significance in finite automata
d) Define mealy machine with example.
e) What is the relation between finite automata and regular expressions?
f) Define derivation tree in CFG.
g) Define CFG and CFh with example.
h) Distinguish between NFA with epsilon transitions and NFA without epsilon transitions.

Q.2 a) Define ambiguity in CFG. Prove that the given grammar is ambiguous. 08

$E \rightarrow E + E$
$E \rightarrow E - E$
$E \rightarrow E * E$
$E \rightarrow (E)$
$E \rightarrow id$

b) Using pumping lemma show that $L = \{ a^n b^n | n \geq 1\}$ is not regular language. 07

Q.3 a) Construct Moore machine equivalent to Mealy machine given below. 08

| Present state | Next state | O/P | Next state | O/P |
|---|---|---|---|---|
| $q_1$ | $q_3$ | 0 | $q_2$ | 0 |
| $q_2$ | $q_1$ | 1 | $q_4$ | 0 |
| $q_3$ | $q_2$ | 1 | $q_1$ | 1 |
| $q_4$ | $q_4$ | 1 | $q_3$ | 0 |

b) Convert the given NFA to equivalent DFA 07

| State | ε a | b |
|---|---|---|
| $\rightarrow q_0$ | $\{q_0, q_1\}$ | $\{q_2\}$ |
| $q_1$ | $\{q_0\}$ | $\{q_1\}$ |
| $q_2$ | - | $\{q_0, q_1\}$ |

Q.4 a) Minimize the following DFA 08

| States | ε 0 | 1 |
|---|---|---|
| $\rightarrow q_1$ | $q_2$ | $q_6$ |
| $q_2$ | $q_1$ | $q_3$ |
| $q_3$ | $q_2$ | $q_4$ |
| $q_4$ | $q_4$ | $q_2$ |
| $q_5$ | $q_4$ | $q_5$ |
| $q_6$ | $q_5$ | $q_4$ |

b) Find regular expression for the language over {0, 1}* with set of strings beginning with substring 00. Construct finite automation with the help of regular expression. 07

Q.5 Write short notes on. 15

i) Chomsky hierarchy
ii) Applications of FA
iii) Structural representation of FA.

SECTION B

Q.6 Attempt any five questions from the following. 10

a) Define CNF and GNF.
b) What are possibilities of a TM when processing an input string?
c) Explain the two methods of acceptance of string by PDA.
d) Define unit production and null production in CFG.
e) What is the main application of pumping lemma in CFL
f) Define turingmarline.
g) State and explain any two properties of CFL.
h) Eliminate null productions from the following grammar

$$S \rightarrow ABA$$
$$A \rightarrow aA|\wedge$$
$$B \rightarrow bB|\wedge$$

Q.7 a) Construct PDA for the following grammar. 08

$$S \rightarrow a|b|Sa|Sb|So|Si$$
$$A \rightarrow S|A * A|A + A$$

b) Show that $L = \{a^{n^2}|n \geq |\}$ is not context free Language. 07

Q.8 a) Consider the grammar below and convert it into Chomsky normal form. 08

$$S \rightarrow AAA|B$$
$$A \rightarrow aA|B$$
$$B \rightarrow \wedge$$

07

b) Explain the model of linear bounded automata also state how is LBA different from TM.

Q.9 a) Explain deterministic push down automata. How does it differ from non deterministicPDA?

b) Design a Turing machine over {1, b} which can compute a concatenation function over$\sum = \{1\}$. If a pair of words (w1, w2) is the input, the output has been w1w2.

Q.10 a) Explain halting problem of Turing machine with suitable diagram. 08

b) Construct PDA for the language given below. 07

$$L = \{a^n b^n | n \geq 1\}$$