MANIPAL INSTITUTE OF TECHNOLOGY
(Constituent Institute of Manipal University)
MANIPAL-576104

FOURTH SEMESTER B.E (CSE) END- SEM EXAMINATION
SUBJECT: FORMAL LANGUAGE AND AUTOMATA THEORY (CSE-204)
MAY-2011
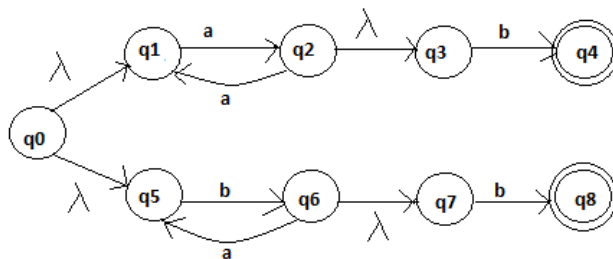(REVISED CREDIT SYSTEM)

TIME : 03 HOURS   MAX.MARKS : 50

Instructions to Candidates
• Answer ANY FIVE FULL questions.
• Missing data can be suitably assumed.

1A.   Use induction on n to show that $|u^n| = n|u|$ for all strings u and all n.   (02)

1B.   Construct a DFA equivalent to given NFA.   (04)

1C.   (i) Construct a DFA for the language over $\sum=\{0,1\}$, which accepts all strings   (02+02)
            such that begin and end symbol of the string is different.

       (ii) Construct a DFA for the language over $\sum=\{0,1\}$, that do not contain consecutive
            double zeroes (00).

                                                                                              (03)
2A.   (i) Obtain a regular expression to accept strings of 0's and 1's that do not end with '01'.

       (ii) Obtain the regular expression for the language on $\{0,1,2\}$ in which 0 comes
            consecutively, only in multiples of 2.
       (iii) Obtain the regular expression to accept strings of a's and b's containing at least 2
            a's.

2B. Find an equivalent generalized transition graph with only two states (initial and final) and give the corresponding regular expression for the following. (02)

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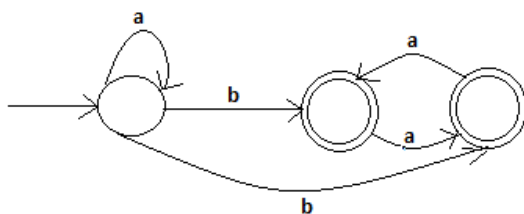
2C. Construct right and left- linear grammar for the language (03)
$$L = \{ a^n b^m \mid n \geq 2, m \geq 3\}$$

2D. Show that the family of regular languages is closed under intersection and complementation. (02)

3A. Consider the CFG with the following productions, (01)
S→ ASA | B
B→ aCb | bCa
C→ ACA | A
A→ a | b
Give two strings of length 7 in L(G).

3B. Find the Context Free Grammar for the language (02+02)
(i) L= $\{ a^n b^n c^i \mid n \geq 1, i \geq 0\}$
(ii) L= $\{ a b^n c d^n f \mid n \geq 0 \}$

3C. Eliminate λ, Unit and Useless productions from the following. (03)

S→ a | abA | B | C
A→ abB | bA | λ
B→ Aa | aabB | λ
C→ cCD
D→ ddd

3D. Convert the following grammar into CNF. (02)
S→ AB1 | 0
A→ 00A | B
B→ 1A1

4A. Obtain a PDA to accept a string of balanced parentheses. The parentheses to be considered are (,), [,]. Show the Instantaneous Description for the string " [([ ])] ". (04)

4B. Obtain a CFG for the language L= $\{ ww^R : |w| \geq 1$ for w € {a,b}*$\}$ and give the corresponding PDA. (03)

4C. Show that the language L= {ww : w □ {a,b}*} is not context free using pumping lemma.(02)
4D. Show that the family of context- free languages is closed under star closure. (01)

5A. Is the language   L= { $a^n b^n$: n≥1} U {b}deterministic?   (03)

5B. Design a Turing Machine that reads a string in $\{0,1\}^+$ and erases the rightmost symbol . (03)
    Give all transitions.

5C. Design a TM that accepts a palindrome consisting of a's and b's of even length.   (04)
    Give all transitions.

6A.Explain with suitable diagrams.   (02+02)
        (i) Multitape Turing Machine
        (ii) Linear Bounded Automata

6B. Explain about Universal Turing Machine   (02)

6C. (i) Define Unrestricted Grammar   (02+02)
    (ii) Explain Chomsky Hierarchy with diagrams that shows the relationship among different
        languages.

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