Reg No.										

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

FIFTH SEMESTER BE DEGREE END SEMESTER EXAMINATION
14th NOVEMBER 2009
THEORY OF COMPUTATION (CSE 301)
(REVISED CREDIT SYSTEM)

TIME: 3 HOURS **MAX.MARKS: 50**

Instructions to Candidates

- Answer **any five** full questions.
- Missing data can be suitably assumed.

1a. Prove that for any positive integer number n, $(n^3 + 2n)$ is divisible by 3.

1b. Construct DFAs for the following language. In all cases the alphabet is {0, 1}.

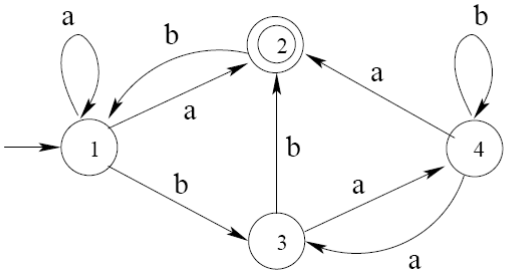
i. L_1 = {w |w begins with 1 and ends with 0}

ii. L_2 = {w | w contains an even number of 0's, or exactly two 1's}

1c. Let $\sum$ = {a, b}. Let L be the language of all words that contain at least one letter, and that begin and end with the same letter. Write a regular expression that defines L.

(4+4+2)

2a. Consider the following state diagram N.



Apply the subset construction to obtain a DFA M that is equivalent to N and state the corresponding elements in its formal definition.

2b. Design a CFG for the language $L = \{a^i b^j c^k d^m \mid i + j = k + m\}$ with i, j, k, m≥0.

2c. If $L = 0^*1^*0^+$, Provide an NFA recognizing L with exactly three states.

(5+3+2)

3a. State and prove the Pumping Lemma for regular languages.
3b. Remove all unit productions, useless productions, and λ productions from the grammar given below.

S -> Aa / aBB
B -> bB / bbC
A -> aaA / λ
C -> B

3c. What is an ambiguous grammar? Explain with an example.

(4+3+3)

4a. Prove that L={ $a^{2n}b^{2m}c^{n}d^{m}$: n,m≥0} is not a CFL using pumping lemma for CFL's.
4b. Show that L = {w ϵ {a,b}* : $n_a(w) \neq n_b(w)$ is a deterministic context free language.
4c. Define Chomsky Normal form and Greibach Normal form.

(4+4+2)

5a. Design a deterministic turing machine for a palindrome of even length ∑ = (a,b). Show the instantaneous descriptions for any string accepted by the machine of length 4.
5b. Explain the working of turing machine as a transducer with an example.
5c. Discuss the Closure properties of CFL's.

(5+3+2)

6a. What are multitape Turing machines? How can they be simulated using a single tape Turing machine.
6b. Explain the Chomsky hierarchy.
6c. Write notes on the halting problem.

(5+3+2)

****