Reg. No.										

MANIPAL UNIVERSITY

FOURTH SEMESTER B.E. (COMPUTER) DEGREE EXAMINATION – DECEMBER 2007

SUBJECT: THEORY OF COMPUTATION (CSE 202)

(CREDIT SYSTEM)

Saturday, December 15, 2007

Time: 3 Hrs. Max. Marks: 100

✍ **Answer any FIVE full questions.**

1A. Explain the concept of

i) Deterministic finite accepter.

ii) Grammar by giving one example for each.

1B. Define regular language and show that the language L = $\{awa \mid w \in \{a,b\}^*\}$ is regular.

((5+5)+(2+8) = 20 marks)

2A. Write down the procedure to convert a non deterministic finite accepter to deterministic finite accepter and hence do the same for the nfa given in the following table.

Note: q_0 is the initial state.

q_1 is the final state.

States	0	1
$\rightarrow q_0$	$\{q_0, q_1\}$	$\{q_1\}$
(q_1)	$\{q_2\}$	$\{q_2\}$
q_2	$\{\phi\}$	$\{q_2\}$

2B. Use induction on n to show that

$|v^n| = n|v|$ for all strings v and all n.

((6+6)+8 = 20 marks)

3A. i) Give an nfa that accepts the language L((a+b)*b(a+bb)*).

ii) Find dfa that accept the following language L(ab(a+ab)*(a+aa)).

3B. Prove that language generated by a right linear grammar is regular.

((5+5)+10 = 20 marks)

4A. State pumping lemma for regular languages and use it to show that the language.

L = $\{a^p \mid p \text{ is prime}\}$ is not regular.

4B. Explain the concept of exhaustive search parsing by giving one example.

((2+8)+10 = 20 marks)

5A. Let G = (V, T, S, P) be a context free grammar, suppose that P contains a production of the form $A \rightarrow x_1 B x_2$. Assume that A and B are different variables and that

$B \rightarrow y_1 | y_2 | \ldots | y_n$ is the set of all productions in P which have B as the left side. Let $\hat{G} = (V, T, S, \hat{P})$ be the grammar in which $\hat{P}$ is constructed by deleting $A \rightarrow x_1 B x_2$ from P, and adding to it $A \rightarrow x_1 y_1 x_2 | x_1 y_2 x_2 | \ldots | x_1 y_n x_2$. Then prove that $L(\hat{G}) = L(G)$.

5B. Let G = (V, T, S, P) be any context free grammar without λ - productions. Then prove that there exists a context free grammar. $\hat{G} = (\hat{V}, \hat{T}, S, \hat{P})$ that does not have any unit productions and that is equivalent to G.

(10+10 = 20 marks)

6A. Construct an npda (non deterministic pushdown accepter) for the language.
$L = \{w\, w^R | \; w \in \{a, b\}^+\}$

6B. Design a Turing machine that computes the function.

$$f(x, y) = \begin{cases} x + y & \text{if } x \geq y \\ 0 & \text{if } x < y \end{cases}$$

(10+10 = 20 marks)

7A. Prove that the family of context free languages is closed under union and concatenation.

7B. i) Discuss the concept of a universal Turing Machine.

ii) Let S be an infinite countable set. Then prove that its power set 2^S is not countable.

(8+6+6 = 20 marks)