ANNA UNIVERSITY – UNIVERSITY DEPARTMENT
B.Tech (FULL TIME) DEGREE EXAMINATION, APR/MAY 2011

Fifth Semester :: Regulation 2004
Branch: Information Technology

IT510 – THEORY OF COMPUTATION
(End-Semester Arrear Examination)

Time: Three Hours Max. Marks: 100

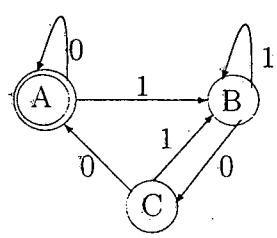
Answer **ALL** Questions

Part A ($10 \times 2 = 20$ Marks)

1. Prove by induction on $n \geq 1$ that

$$\sum_{i=1}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1}$$

2. Formally define deterministic finite automata.
3. Construct regular expression corresponding to the state diagram



4. State pumping lemma for regular languages.
5. When do you say a CFG is ambiguous?
6. Give a formal definition of PDA.
7. What are the advantages of having a normal form for a grammar?
8. Define the language recognize by the Turing machine.
9. When do you say a Turing machine is an algorithm?
10. Define NP-Complete.

Part B ($5 \times 16 = 80$ Marks)

11. (a) Prove that for any language L recognized by an NFA, there exists a DFA to recognize L. (8)

    (b) Construct DFA equivalent to NFA $(\{p, q, r, s\}, \{0, 1\}, \delta, p, \{s\})$, where δ is defined as (8)

δ	0	1
p	$\{p, q\}$	$\{p\}$
q	$\{r\}$	$\{r\}$
r	$\{s\}$	$-$
s	$\{s\}$	$\{s\}$

12. (a) i. Prove that any language accepted by a DFA can be represented by a regular expression. (8)

    ii. Construct a finite automata for the regular expression $10 + (0 + 11)0^*1$. (8)

(OR)

(b) Prove that the following languages are not regular.

i. $\{w \in \{a, b\}^* | w = w^R\}$ (8)

ii. Set of strings of 0's and 1's, beginning with a 1, whose value treated as a binary number is a prime. (8)

13. (a) i. Suppose $L = L(G)$ for some CFG $G = (V, T, P, S)$, then prove that $L - \{\epsilon\}$ is $L(G')$ for a CFG G' with no useless symbols or ϵ-productions. (10)

    ii. Find a CFG with no useless symbols equivalent to (8)

$$S \rightarrow AB|CA \qquad B \rightarrow AB|BC$$
$$A \rightarrow a \qquad C \rightarrow aB|b$$

(OR)

(b) Prove that the languages accepted by PDA using empty stack and final states are equivalent.

14. (a) i. State and prove Greibach normal form. (10)

    ii. Find Greibach normal form equivalent to the CFG (8)

$$S \rightarrow AA|0 \qquad A \rightarrow SS|1$$

(OR)

(b) i. Design a Turing machine to compute proper subtraction. (8)

ii. Design a Turing machine to recognize the language $\{0^n 1^n 0^n | n \geq 1\}$ (8)

15. (a) Prove that Post Correspondence Problem is undecidable.

(OR)

(b) Prove that the universal language L_u is recursively enumerable but not recursive.

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