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Question Paper Code : 41146

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Computer Science and Engineering

080230020 — FORMAL LANGUAGES AND AUTOMATA THEORY

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the applications of FA?

2. Construct a NDFA that accepts all the strings in $\{a,b\}^+$ with either two consecutive a's or two consecutive b's.

3. Define Arden's theorem.

4. Write the regular expression for integer and floating point number.

5. What is meant by distinguishable states?

6. Show that the difference of two regular languages is regular.

7. Write a CFG for the language $L = \{0^*1^*\}$

8. Define instantaneous description of PDA.

9. What are the closure properties of CFL?

10. State pumping lemma for CFL.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove the following : if $X \leq 4$ then $2^x \leq X^2$. Use the principle of mathematical induction. (8)

(ii) Prove that if L is accepted by some DFA iff L is accepted by NFA with ε - transition. (8)

Or

(b) Construct equivalent DFA for the given NFA (16)

	0	1
$\rightarrow p$	$\{p,q\}$	$\{p\}$
q	$\{r\}$	$\{r\}$
r	$\{s\}$	Φ
$^*s$	$\{s\}$	$\{s\}$

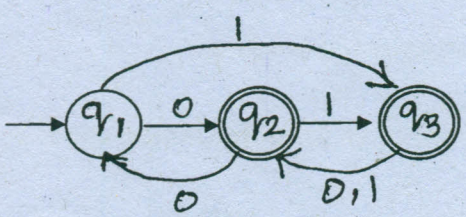
12. (a) (i) Construct a NFA for the regular expression $(aa+b)^*(bb+a)^*$. (8)

(ii) Construct regular expression to the given FA using Arden's theorem. (8)

	0	1
$\rightarrow,^* A$	A	B
B	C	B
C	A	B

Or

(b) Obtain regular expression for the following finite automata. (16)



13. (a) (i) Prove that the language $L = \{a^n \mid n = i^2\ i \geq 1\}$ is not regular. (8)

(ii) Discuss any two closure properties of RLs. (8)

Or

(b) Construct the minimal DFA for the following DFA using the state equivalence algorithm. (16)

State/input	*a*	*b*
$\rightarrow 1$	2	3
2	4	5
3	6	7
*4	4	5
5	6	7
*6	4	5
*7	6	7

14. (a) (i) Find the derivation tree of $a^*b + a^*b$ where G is given by (6)

$S \rightarrow S + S$

$S \rightarrow S * S$

$S \rightarrow a / b$

(ii) Design PDA for $L = \{a^n b^{2n} \mid n \geq 0\}$. (10)

Or

(b) Construct the CFG for the following PDA. (16)

$P = (\{q_0, q_1\}), \{0,1\}, \{X, Z_0\}, \delta, q_0, Z_0, \Phi)$ where δ is given by

$\delta(q_0, 0, Z_0) = \{(q_0, XZ_0)\}$ $\quad \delta(q_0, 0, X) = \{(q_0, XX)\}$

$\delta(q_0, 1, X) = \{(q_1, \varepsilon)\}$ $\quad \delta(q_1, 1, X) = \{(q_1, \varepsilon)\}$

$\delta(q_1, \varepsilon, X) = \{(q_1, \varepsilon)\}$ $\quad \delta(q_1, \varepsilon, Z_0) = \{(q_1, \varepsilon)\}$

15. (a) Find GNF for the grammar. (16)

$G = (\{X_1, X_2, X_3\}, \{a, b\}, P, X_1)$ where P consists of the following

$X_1 \rightarrow X_2 X_3$

$X_2 \rightarrow X_3 X_1 \mid b$

$X_3 \rightarrow X_1 X_2 \mid a$

Or

(b) (i) Write brief about the Decision Properties of CFL. (10)

(ii) Prove that if L is a CFL and R is a RL, then $L \cap R$ is a CFL. (6)
