B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Fifth Semester

COMPUTER SCIENCE AND ENGINEERING

U07CS503: Theory of Computation

Time: Three Hours   **Maximum Marks: 100**

Answer ALL the Questions:-

PART A (10 × 1 = 10 Marks)

1. Consider the FA for a switch with ON/OFF facilities. The automata can be designed with minimum number of states of

   a) 2n   b) n   c) 2^n d) n+1

2. For all strings *w* and input symbol *a*, δ (q, wa) =…………………?

   a) δ (δ (q, w),a)   b) δ(q, w,a)   c) δ((q,w),q,a))   d) a) and b)

3. $(\in + R)(\in + R)*(\in + R) =$ _____

   a) R   b)   R*   c) R^+ d) $\in$

4. One of the applications of regular expression is   _____

   a) Automata Model   b) Switching Circuit   c) Lexical Analyzer   d) DFA and NFA

5. _____ property is used to check whether given language is regular or not.

   a) Idempotent   b) Union   c) Pumping Lemma   d) Concatenation

6. The equivalent automata model for the CFL is _____

   a) PDA   b) DFA   c) Linear Automata   d) NFA

7. Derivations from the start symbol produce strings. They are called as

   a) lm derivation   b) sentential form   c) rm derivation   d) ambiguous strings

8. A yield of a parse tree is a

   a) Nonterminal string   b) terminal string   c) interior node   d) leaf

9. The context free languages are closed under _____

   a) homomorphism   b) union   c) a) and b)   d) b) only

10. A problem that cannot be solved by a computer is called

    a) PCP   b) undecidable   c) decidable   d) turing

PART B (10 x 2 = 20 Marks)

11. Give regular expressions corresponding to the following sets over {0, 1}

    a) Set of all Strings {0, 1} when the 10th symbol from the right hand side is one.

    b) The set of all strings over {0, 1} containing three consecutive 0's.

12. Show that L = $\{a^{i^2} \; / \; i \geq 1\}$ is not regular.

13. Compute δ (q_0, a+b) from the table given below.

States	ε	a	B	c	d	+
→q_0	$\{q_1\}$	-	-	-	-	-
q_1	-	$\{q_1,q_4\}$	-	-	-	$\{q_2\}$
q_2	-	-	$\{q_3\}$	$\{q_2\}$	-	-
q_3	$\{q_5\}$	-	$\{q_3\}$	-	-	-
q_4	-	$\{q_5\}$	$\{q_4\}$	-	-	$\{q_3\}$
*q_5	-	-	-	-	$\{q_5\}$	-

14. Eliminate all ε-productions and Unit productions from the grammar given below.

    S → AaB / aaB   A → ε   B → bbA / ε

15. Let G be the grammar S → 0B / 1A   A → 0 / 0S / 1AA   B → 1 / 1S / 0BB.

    Find the leftmost derivation and derivation tree for the string 00110101.

16. Give the working mechanism of an Offline Turing machine.

17. Define ambiguity and give an example.

18. Write the difference between DPDA and NPDA.

19. What are undecidable problems?

20. Show that complement of a recursive language is recursive.

PART C (5 x 14 = 70 Marks)

21a) Prove the following: If x is the sum of the squares of the four positive integers, then

    $2^x \geq x^2$.

(OR)

b) i) Design a DFA to accept the language

  L = {w / w has both an even number of 0's and even number of 1's}   (4)

  ii) Prove the equivalence of NFA and DFA.   (10)

22 a) Find a regular expression that denotes the language accepted by the following transition
   table. (Initial and Final State of the DFA is 1)

States	Inputs	
	0	1
1	1	2
2	3	2
3	1	2

(OR)

b) i) Prove every language defined by a regular expression is also defined by a finite
   automaton.   (10)

  ii) Find a NFA-ε which accepts L(r) where $r = (aab* / (a / b)^*)^*$.   (4)

23 a) i) Build a parse tree corresponding to a terminal string x = ((0+1)*.2) belonging to context
   free language L = L(G), where G is given by the productions

  S → 0 / 1 / 2 / ε / (S.S) / S+S /S*   (4)

  ii) Construct a transition table for PDA which accepts the language $L = \{a^{2n}b^n / n \geq 1\}$

  Trace your PDA for the input with n = 3.   (10)

(OR)

b) State and prove the theorem for converting empty stack PDA to final state PDA.

24 a) i) Convert the following grammar into CNF

  S → cBA,   S → A,   A → cB,   A →AbbS,   B → aaa   (6)

  ii) Convert the following grammar into GNF

  S → BS,   S → Aa,   A → bc,   B → Ac   (8)

(OR)

b) i) Design a turing machine that examines a specified string of 0's and 1's on a tape and prints an 'E' if the number of 1's is even and a 'D' if odd. (parity checking)   (10)

   ii) Write short notes on mutitape turing machine.   (4)

25 a) i) Prove if L_1 and L_1 are recursive language then $L_1 U L_2$ is a recursive language.   (4)
   ii) State and prove Rice theorem.   (10)

(OR)

b) i) Prove the following: "The Complement of a recursive language is recursive."   (4)

   ii) State and prove the post's correspondence problem.   (10)

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