

ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : MAY / JUNE 2010

REGULATIONS : 2007

FIFTH SEMESTER : CSE

070230033 - THEORY OF COMPUTATION

TIME : 3 Hours

Max.Marks : 100

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. Define concatenation of languages.
2. What do you mean by transition diagram.
3. What is the main difference between DFA and N DFA.
4. Define finite state machine.
5. List out the operations of regular expression.
6. Give any two closure properties of regular language.
7. What is the application of pumping lemma?
8. Write the regular expression for the language  $L = \{ W \in (a,b)^* ; n_a(W) \bmod 3 = 0 \}$
9. When do we say the grammar is context-free grammar?
10. Draw the parse tree for the string bbaaaab for the production  $s \rightarrow xx$  and  $x \rightarrow xxx/bx/xb/a$ .
11. Define ambiguous grammar.
12. Define pushdown automata.
13. Prove that the family of context-free languages is not closed under intersection and complementation.
14. Define Turing machine.
15. What is Turing hypothesis?
16. When push down automata is said to be deterministic.

17. When do we call a language is recursively enumerable.
18. Define Decidable and undecidable language.
19. Obtain the solution for the following system of posts correspondence problem where  $A = \{ 100,0,1 \}$  and  $B = \{ 1,100,00 \}$
20. List out the properties of recursively enumerable sets are not decidable.

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. a) Design DFA for the language  $L = \{ W \in (a,b)^* / n(b) \bmod 3 > 1 \}$  6  
b) Design a NFA for the language  $L = \text{all strings over } \{0,1\} \text{ that have at least two consecutive 0's or 1's.}$  6
22. a) Write the regular expression for the language  $L = \{ a^n b^m : (n+m) \text{ is even} \}$  6  
b) Prove that the language  $L = \{ 0^k / k \text{ is prime number} \}$  is not regular. 6
23. a) If  $L_1$  and  $L_2$  are regular languages then so are  $L_1 \cup L_2$ ,  $L_1 L_2$  and  $L_1^*$  that is prove that family of regular language is closed under, union, concatenation and starclosure. 6  
b) If  $L_1$  and  $L_2$  are regular language, then prove that  $L_1 \cap L_2$  is also regular language. 6

24. a) Write a CFG which generates strings having equal number of a's and b's. 6

b) Show that the following grammar is ambiguous 6

$$S \rightarrow AB/aaB$$

$$A \rightarrow a/Aa$$

$$B \rightarrow b$$

25. a) Design a PDA for the following language. 6

$$L = \{ a^n b^n : n > 0 \}$$

b) Design PDA for the grammar 6

$$G = \{ V_n, V_t, P, S \}$$

$$\text{Where } V_n = \{ S \}$$

$$V_t = \{ a, b, c \}$$

and P is defined as

$$S \rightarrow aSa$$

$$S \rightarrow bSb$$

$$S \rightarrow c$$

26. a) Explain pumping lemma for CFL. 4

b) Prove that the language  $L = \{ a^n b^n c^n \mid n \geq 0 \}$  is not context free language. 8

27. a) Design a Turing machine that recognizes the language of all strings of even length over the alphabet  $\{a,b\}$  6

b) Design a Turing machine for regular expression  $r = aa^*$  6

28. a) Prove that the union of two recursive language is recursive and the union of two recursively enumerable language is recursively enumerable. 8

b) Let  $\Sigma = \{0,1\}$  Let A and B be list of 3 strings each defined below. 4

	List A	List B
i	$W_i$	$X_i$
1	1	111
2	10111	10
3	10	0

Find the solution of PCP.

\*\*\*\*\*THE END\*\*\*\*\*