

# C.U.SHAH UNIVERSITY

## Summer Examination-2018

**Subject Name:** Theory of Computation

**Subject Code:** 4TE06TOC1

**Branch:** B.Tech (CE)

**Semester:** 6

**Date:** 04/05/2018

**Time :** 02:30 To 05:30

**Marks :** 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

**Q-1**                      **Attempt the following questions:** **(14)**

- a) Find the grammar for language  $L = \{a^{2n}bc, \text{ where } n > 1\}$
- b) What is formal language?
- c) CFL are not closed under intersection and complementation: State true or false
- d) What is parser?
- e) When is a string accepted by PDA?
- f) Give an example of deterministic CFL.
- g) List out special features of Turing machines.
- h) What are recursive enumerable languages and recursive sets?
- i) Define: Alphabet and String
- j) What is a universal language?
- k) What is parse tree?
- l) Define: Finite Automata
- m) What is Kleene closure?
- n) What is NP complete problem?

**Attempt any four questions from Q-2 to Q-8**

**Q-2**                      **Attempt all questions**

- (a) Prove that  $\sqrt{2}$  is Irrational by method of Contradiction. **(5)**
- (b) Using Mathematical induction prove that  $2^{3n} - 3^n$  is divisible by 5 is true for all natural numbers. **(5)**
- (c) Compare NFA, DPDA and NPDA **(4)**

**Q-3**                      **Attempt all question**

- (a) Prove that following CFG is Ambiguous and convert it into unambiguous. **(5)**  
 $S \rightarrow S + S \mid S * S \mid (S) \mid a$
- (b) Find the language generated by: **(5)**  
 $S \rightarrow 0S1 \mid 0A \mid 0 \mid 1B \mid 1$   
 $A \rightarrow 0A \mid 0$   
 $B \rightarrow 1B \mid 1$
- (c) Write Regular Expressions for following **(4)**



- i. The language of all strings in  $\{0,1\}^*$  that do not end with 11.
- ii. The language of all strings containing both 1 01 and 010 as substrings.

**Q-4**

**Attempt all questions**

- (a) Define Push Down Automata (PDA). Draw PDA accepting strings of Brackets like following. (7)  
 $S \rightarrow SS \mid \{S\} \mid [S] \mid \Lambda$
- (b) Find minimum state FA recognizing the language corresponding to following R.E. (7)
  - i.  $(0^*10+1^*0)(01)^*$
  - ii.  $(010)^*1 + (1^*0)^*$

**Q-5**

**Attempt all questions**

- (a) State and prove Arden's theorem. (7)
- (b) What is pumping lemma? Use the pumping lemma to show that the following language is not regular: (7)  
 $L = \{xy \mid x, y \text{ is } \{0,1\}^* \text{ and } y \text{ is either } x \text{ or } x^r\}$

**Q-6**

**Attempt all questions**

- (a) For the following CFG, Find Chomsky normal form (7)  
 $S \rightarrow AACD, A \rightarrow aAb \mid \epsilon, C \rightarrow aC \mid a, D \rightarrow aDa \mid bDb \mid \epsilon$
- (b) Define NFA –  $\Lambda$ . Explain how to convert NFA –  $\Lambda$  into NFA and FA with Suitable example. (7)

**Q-7**

**Attempt all questions**

- (a) Design a Turing machines to copy strings. (7)
- (b) Given a CFG ,  $G = (\{S,A,B\}, \{0,1\}, P, S)$  with P as follows (7)  
 $S \rightarrow 0B \mid 1A \quad A \rightarrow 0S \mid 1AA \mid 0 \quad B \rightarrow 1S \mid 0BB \mid 1$   
 Design a PDA M corresponding to CFG, G. Show that the string 0001101110 belongs to CFL ,  $L(G)$ .

**Q-8**

**Attempt all questions**

- (a) Define functions by Primitive Recursion. Show that the function  $f(x, y) = x + y$  is Primitive recursive. (7)
- (b) Explain Universal Turing Machine and Halting Problem. (7)

