Enrollment No: ____________________ **Exam Seat No:**____________________

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name : Theory of Computation

Subject Code : 4TE06TOC1 **Branch: B.Tech (CE)**

Semester : 6 **Date: 29/04/2019** **Time: 10:30 To 01:30** **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 regular expression corresponding to the language of all strings that begins or end with 00 or 11 over {0, 1}*.

b) List out applications of Theory of Computation.

c) Show that the statement p ∨ q ∨ r ∨ s and (┐p ∧ ┐p ∧ ┐r) → s are equivalent.

d) Differentiate Deterministic Finite Automata with Non-Deterministic Finite Automata.

e) Number of states requires accepting string ends with 101.
(i) 3 (ii) 2 (iii) 4 (iv) can't be represented

f) Give definition of Regular Grammar.

g) State Arden's Theorem.

h) Which of the following is most powerful?
(i) Non-Deterministic Finite Automata
(ii) Deterministic Finite Automata
(iii)Deterministic Pushdown Automata
(iv)Non-Deterministic Pushdown Automata

i) The logic of a pumping lemma is a good example of
(i) The pigeon hole principal
(ii) Divide and Conquer Method
(iii)Iteration
(iv)Recursion

j) How many strings of length less than 4 contains the language described by the regular expression (x+y)*y(a+ab)*?
(i) 7 (ii) 10 (iii) 12 (iv) 11

k) Regular expressions are closed under
(i) Union (ii) Intersection
(iii) Kleen star (iv) All of the mentioned

l) Given the language L-{ab, aa, baa}, which of the following strings are in L*?
1) abaabaaabaa, 2) aaaabaaaa, 3) baaaaabaaaab, 4) baaaaabaa

(i) 1, 2, and 3 (ii) 2, 3, and 4
(iii)1, 2, and 4 (iv) 1, 3, and 4

m) Describe the language corresponding to given regular expression:
(1+01)*(0+01)*

n) The number of eight-bit strings beginning with either 111 or 101 is ____.
(i) 64 (ii) 128
(iii) 265 (iv) None of the above

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

Q-2 **Attempt all questions** **(14)**

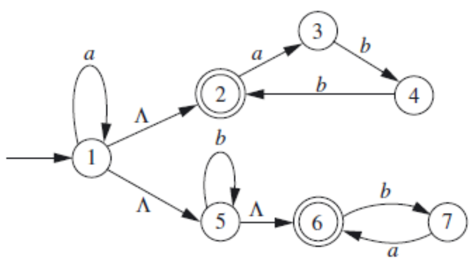
(a) What is a finite automaton? For each of the following regular expressions, draw an FA recognizing the corresponding language:
i) (111 + 000)* 0
ii) (0 + 1)* (01 + 110)
iii) 0 + 10* + 01*0

(b) Using Principle of Mathematical Induction, prove that for every n >= 1,
7 + 13 + 19 + . . . + (6n + 1) = n(3n +4)

Q-3 **Attempt all questions** **(14)**

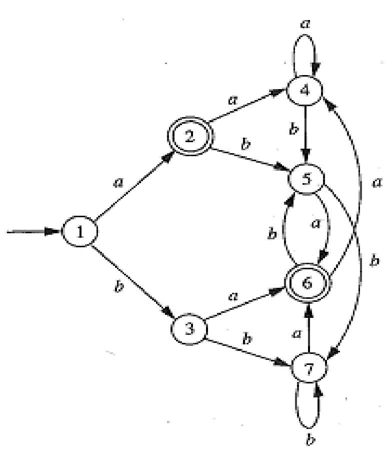
(a) Draw Finite Automata (FA) for following languages:
L1 = {x | 11 is not a substring of x, x ε {0,1}*}
L2 = {x | x ends with 10, x ε {0,1}* }
Find FA accepting languages (i) L2 – L1 and (ii) L1 ∩ L2

(b) For given NFA-Λ, draw an NFA and using subset construction method also draw an FA accepting the same language.



Q-4 **Attempt all questions**

(a) For given FA, find a minimum-state FA recognizing the same language: **(04)**

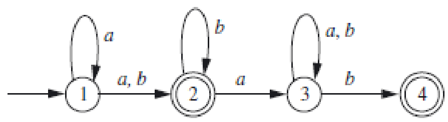


(b) Give definition of context-free grammar. Find context-free grammars generating each of these languages: **(07)**

(i) $\{a^i b^j c^k \mid i = j + k\}$

(ii) $\{ a^i b^j c^k \mid i = j \text{ or } i = k\}$

(c) Find regular expression corresponding to given FA. **(03)**



Q-5 **Attempt all questions**

(a) For each of these regular expressions over {0, 1}, draw an NFA-^ recognizing the corresponding language. **(04)**

(i) (0 + 1) (01)* (011)*

(ii) (0+1)* (011 + 01010) (0 +1)*

(b) Using pumping lemma show that the language L = {ww | w ε {0, 1}*} is not regular. **(03)**

(c) Convert a given CFG (Context free grammar) to Chomsky Normal Form (CNF) **(07)**

S→ AACD
A → aAb | ^
C→ aC | a
D → aDa | bDb | ^

Q-6 **Attempt all questions** **(14)**

(a) Design and draw a deterministic PDA accepting strings of the language $L = \{ x \in \{ a, b\}^* \mid n_a(x) > n_b(x) \}$. Trace it for the string "aababaab"

(b) Show that the following CFGs are ambiguous and find an equivalent unambiguous grammar.

(i) S → a | Sa | bSS | SSb | SbS

(ii) S → ABA A→ aA | ^ B→ bB | ^

Q-7 **Attempt all questions** **(14)**

(a) Define Turing Machine. Draw a Turing Machine(TM) to accept Palindromes over {a,b}. (Even as well as Odd length Palindromes)

(b) Explain following terms:

(i) Basic complexity classes

(ii) Equivalence Relation

(iii) P and NP Completeness

Q-8 **Attempt all questions** **(14)**

(a) Write a short note on

(i) Universal Turing Machine

(ii) Halting Problem

(b) Explain unbounded minimalization and μ-recursive functions.