Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name: Theory of Computation
Subject Code: 4TE06TOC1 Branch: B.Tech (CE)

Semester: 6 Date: 17/05/2016 Time: 2:30 To 5:30 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) Which of the following is true?
i) (01)*0 = 0(10)*
ii) (0+1)*0(0+1)*1(0+1) = (0+1)*01(0+1)*
iii) (0+1)*01(0+1)*+1*0* = (0+1)*
iv) All of the mentioned

(b) A language is regular if and only if
i) accepted by DFA
ii) accepted by PDA
iii) accepted by LBA
iv) accepted by Turing machine

(c) Give regular expression for the language L = {w ∈ {0, 1}* | w has no pair of consecutive zeros}.

(d) Define ambiguous grammar.

(e) What is left recursion?

(f) CFLs are not closed under
i) Union
ii) Concatenation
iii) Intersection
iv) Homomorphism

(g) If ∑ = {a, b}, then the number of possible different strings with length exactly n are
i) 2^{n-1}
ii) 2^n
iii) $2^n - 1$
iv) None of the above

(h) Define regular expression.

(i) Write the Chomsky Hierarchy of languages.

(j) Describe the language corresponding to given RE: (1+01)*(0+01)*

(k) Give the recursive definition of L*.

(l) Consider the regular language L = (111 + 11111)*. The minimum number of states in any DFA accepting the language is
i) 3
ii) 5
iii)8
iv)9

(m) Which of the following in true for the language{a^P | P is a prime}?
i) It is not accepted by a Turning Machine
ii) It is regular but not context-free
iii) It is context-free but not regular
iv) It is neither regular nor context-free, but accepted by a Turing machine

(n) The C language is :
i) A context free language
ii) A context sensitive language
iii) A regular language
iv) Parsable fully only by a Turing machine

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

Q-2 **Attempt all questions**

(a) What is meant by "one to one" and "onto" function? Check whether function f: R → R^+, $f(x) = x^2$ is one to one and onto. **(04)**

(b) Prove that Dangling-Else grammar is ambiguous. Also give an unambiguous grammar for the same. **(07)**

(c) Prove that √2 is Irrational by method of contradiction. **(03)**

Q-3 **Attempt all questions**

(a) Draw an FA recognizing the following language: **(04)**
(i) The language of all the strings in which number of 1's is even.
(ii) The language of all strings containing both 11 and 010 as substrings.

(b) Given the Context-free grammar G, find a CFG G' in Chomsky normal form generating L(G) – {^} **(07)**
S → AACD
A → aAb | ^
C → aC | a
D → aDa | bDb | ^

(c) Prove that a language L = { 0^i1^i | i ≥0} is not regular. **(03)**

Q-4 **Attempt all questions** **(14)**

(a) For regular expression (0*10 + 1*0) (01)*, draw an NFA-^ recognizing the corresponding language. Convert NFA-^ to NFA and to FA.

(b) Find context-free grammar generating following language:
(i) {$a^ib^jc^k$ | k ≥ 0, j=i or j=k}
(ii) {w | w starts and ends with the same symbol}

Q-5 **Attempt all questions** **(14)**

(a) Design and draw a deterministic PDA (DPDA) to accept strings with more a's than b's. Trace it for the string "aabab".

(b) Draw Finite Automata (FA) for following languages:
L1 = {x ε {0,1}* | 11 is not a substring of x} and L2 = {x ε {0,1}* | x ends with 01}. Find FA accepting the language (i) L1 – L2 (ii) L1 U L2

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

(a) Design a DPDA accepting Balanced Strings of Brackets. The grammar for the language is as follows:
S → SS | [S] | {S} | ^

(b) Design a Turing Machine which works as a numerical Comparator.

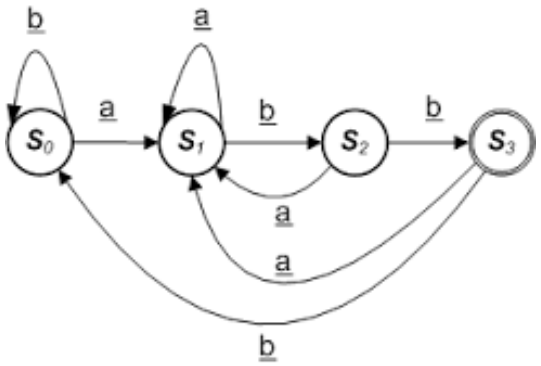
Q-7 **Attempt all questions** **(14)**

(a) Draw a transition diagram for a TM accepting palindromes over {a,b}

(b) Explain Unbounded Minimization and μ-Recursive Functions.

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

(a) Explain Arden's Theorem. Using Arden's Theorem find the regular expression corresponding to the finite automata given in the figure. (* S_3 is a final State)



(b) Explain Universal Turing Machine and Halting Problem.