Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 42383

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Computer Science and Engineering

CS 2303 – THEORY OF COMPUTATION

(Common to Information Technology)

(Regulations 2008)

(Also common to PTCS 2303 – Theory of Computation for B.E. (Part-Time)

Fifth Semester – CSE – Regulations 2009)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

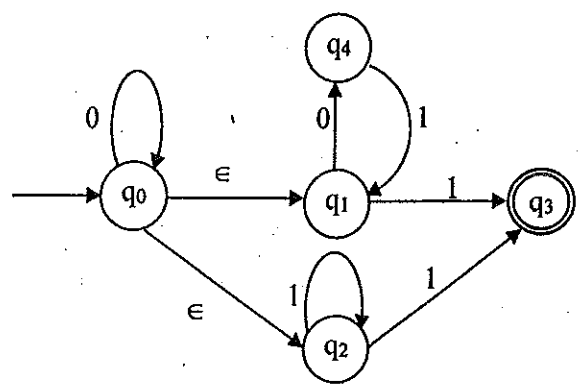
1. Compare NFA and DFA.
2. Differentiate proof by contradiction and proof by contrapositive. Prove that with an example.
3. Define a regular expression for the language that consists of set of strings over {0, 1} such that the number of 0's odd.
4. Show that the language $L = \{0^p \mid p \text{ is a prime number}\}$ is not regular.
5. Check whether the following grammar ({S, A}, {0, 1}, P, S) where P is defined as follows is ambiguous

   $S \rightarrow 0 \mid 01S1 \mid 0A1$

   $A \rightarrow 1S \mid 0AA1.$
6. Define push down automata.
7. Design a turing machine over {0, 1} to compute the exclusive or of strings "x" and "y" which is available on the tape separated by 'A'. Store the result in the tape.
8. Prove that complement of context free language is not context free.
9. If a language L is recursively enumerable but not recursive, comment on the recursive and recursively enumerable nature of its complement.
10. Define the diagonal language L_d.

PART – B (5×16=80 Marks)

11. a) i) Construct a DFA equivalent to the following ϵ – NFA. (10)



ii) Prove that if L = L(A) for some ϵ–NFA A, then there is a DFA M such that
L = L(M). (6)

(OR)

b) i) Prove by structural induction that the number of left and right parenthesis are the same for an expression. (6)

ii) Construct a NFA for the language denoted by the expression (0*1 + 1*0) and prove that string 0001 belongs to the NFA and the string 111 doesn't belong to it. (10)

12. a) Explain equivalence and minimization of automata with example. (16)

(OR)

b) Discuss the properties (Union, Intersection, Kleene Closure, Complement and Difference) of regular languages and explain with an example. (16)

13. a) i) Let G = (V, T, P, S) be a context free grammar. If the recursive inference procedure tells us that the terminal string "w" is in the language of the variable A then there is a parse tree with root A and yield "w". (8)

ii) Construct a context free grammar for the language. $L = \{ww^R \mid w \text{ is in } (0+1)^*\}$. (8)

(OR)

b) i) Convert the following PDA defined, by $(\{q_0, q_1\}, \{0, 1\} \{Z, X\}, \delta, q_0, Z, \Phi)$ to a CFG where δ is defined as follows : (10)

$\delta(q_0, 1, Z) = \{(q_0, XZ)\}$, $\delta(q_0, \varepsilon, Z) = \{(q_0, \epsilon)\}$

$\delta(q_0, 1, X) = \{(q_0, XX)\}$, $\delta(q_1, 1, X) = \{(q_1, \epsilon)\}$

$\delta(q_0, 0, X) = \{(q_1, X)\}$, $\delta(q_1, 0, Z) = \{(q_0, Z)\}$

ii) Justify deterministic PDA is less powerful than non deterministic PDA. (6)

14. a) i) Prove that every grammar G will correspond to a language L(G) that is free of useless symbols, ϵ-productions and unit production. (8)

ii) Convert the grammar ({S, A, B}, {a, b}, P, S) to Chomsky Normal form where P is defined as follows : (8)

$S \rightarrow AB$

$A \rightarrow aAA \mid \epsilon$

$B \rightarrow bBB \mid \epsilon$

(OR)

b) i) Design a turing machine to find m.n where m.n = m – n if m > n
0, otherwise (8)

ii) Discuss the various Turing machine programming techniques. (8)

15. a) i) Prove that L_u recursively enumerable bu not recursive. (10)

ii) Prove that L_d is not recursively enumerable and not recursive. (6)

(OR)

b) Prove that PCP is undecidable and show this with an example. (16)