Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) ARREAR EXAMINATIONS, APR/MAY 2019

INFORMATION TECHNOLOGY

Fourth Semester

IT 8402 Formal Languages and Automata

(Regulations 2012)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART- A (10 x 2 = 20 Marks)

1. Prove that $\sqrt{2}$ is not rational.
2. Give a regular expression for the set of all strings having odd number of 1's
3. Define NFA with epsilon transitions. Give suitable example.
4. Design DFA to accept strings over $\sum$ = (0,1) with two consecutive 0's.
5. Eliminate null productions from the following grammar

   $S \rightarrow ABA, A \rightarrow aA| \varepsilon , B \rightarrow bB| \varepsilon$
6. Define formally context free grammars and context free language.
7. Construct a PDA from the following CFG.G = ({S, X}, {a, b}, P, S) where the productions are

   $S \rightarrow XS \mid \varepsilon , A \rightarrow aXb \mid Ab \mid ab$
8. Define the Basic Turing Machine model.
9. Define the classes of P and NP.
10. State when a problem is said to be decidable and give an example of an undecidable problem.

Part – B (5 x 16 = 80 marks)

11 a) i) State and prove the pumping lemma for Regular languages.
Prove that L = { $0^n 1^{2n}$ | $n \geq 1$} is not regular. (10)

11 a) ii) Explain any three closure properties of Regular Languages. (6)

12 a) i) Construct a DFA equivalent to the NFA. M=({a,b,c,d,e},{0,1},δ,a,{e}) where δ is defined in the following table. (10)

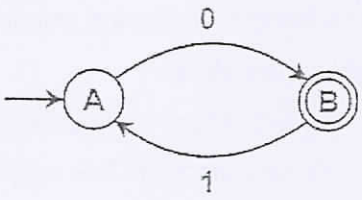
q	δ(q,0)	δ(q,1)
a	{a,b,c,d,e}	{d,e}
b	{c}	{e}
c	∅	{b}
d	{e}	∅
e	∅	∅

12 a) ii) Show by diagrams the basis of the construction of finite automata from regular expressions. (6)

(OR)

12 b) i) Show the equivalence of DFA and NFA. (10)

12 b) ii) Construct a Regular expression for the given DFA. (6)



13 a) i) Let G = (V, T, P, S) be a Context free Grammar then prove that if the recursive inference procedure tells us that terminal string w is in the language of variable A, then there is a parse tree with root A and yield w. (10)

13 a) ii) Verify whether that the following context free grammar is ambiguous or not:

$S \rightarrow 1A0S$, $S \rightarrow 1A0S1S$, $A \rightarrow 1$, $S \rightarrow 0$ (6)

(OR)

13 b) i) Convert the following grammar from Chomsky normal form, into Greibach normal form

$S \rightarrow XA \mid BB$, $B \rightarrow b \mid SB$, $X \rightarrow b$, $A \rightarrow a$ (10)

13 b) ii) Consider the following productions. (6)

$S \rightarrow aB \mid bA$ $A \rightarrow aS \mid bAA \mid a$ $B \rightarrow bS \mid aBB \mid b$

For the string aaabbabbba, find the

a) Leftmost derivation b) Rightmost derivation c) Parse Tree

14 a) i) Explain the basic structure of pushdown automata and Instantaneous Description(ID).

Define the pushdown automata for language $\{a^n b^n \mid n > 0\}$ (10)

14 a) ii) State the Pumping lemma for CFL and Show that the language $L=\{ 0^n 1^n 2^n \mid n>=1\}$ is not a CFL. (6)

(OR)

14 b) i) Construct a Turing Machine for language $L = \{0^n1^n \mid n\geq1\}$. Show how this turing machine works for **0011**. (16)

15 a) i) Explain about Post Correspondence problem. (10)

15 a) ii) Write short notes on Recursive and recursively enumerable languages. (6)

(OR)

15 b) i) Explain about the Halting problem for Turing machine. (16)