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PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Even Semester Session 2022-23 Pre-University

B. Tech. IV Semester

Theory of Automata and Formal Languages (KCS 402)

CO Number	Course Outcome
CO1	Define [L1:Remember] various types of automata, languages and grammars.
CO2	Express [L2:Understand] languages using grammar, automaton and to review class of language.
CO3	Interpret [L3:Apply] the behaviour of machines (such as FA, TM &PDA) and grammars.
CO4	Analyse[L4:Analysis] ambiguity and decidability of grammars and languages

Time: 3 Hrs. M. M. 100

Section A

Q1. Attempt all questions: **(2X10 =20 Marks)**

a) Define non deterministic finite automata (NDFA). CO1

b) List the difference between formal language and regular language. CO1

c) Construct DFA to accept the language L={00,11}. CO3

d) Define Moore Machine with an example. CO1

e) Construct Moore Machine to produce 1's complement. CO3

f) Discuss Chomsky's Hierarchy of Grammars. CO2

g) Give the steps to eliminate useless symbols from the given context-free grammar. CO1

h) List the properties of recursive and recursive enumerable language. CO1

i) Give the configuration of Turing machine. CO1

j) State the closure properties of context-free languages. CO1

Section B

Q2. Attempt all questions. **(10X3 = 30 Marks)**

(a) Examine that Halting problem is undecidable. CO4

b-(i) Construct Turing Machine that replace all occurrence of 111 by 101 from sequence of 0's and 1's. CO3

OR

(ii) Construct a Turing Machine to recognize binary palindrome of the even length. CO3

c-(i) Construct PDA for the language $a^n b^m c^{n+m}$, where n, m>=0. CO3

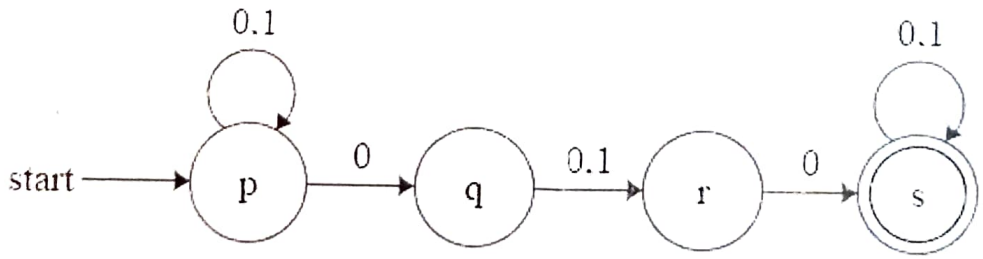
OR

(ii) Construct PDA for language $L = \{ w \in \{0, 1\}^* \mid w = w^R \}$ CO3

Section C

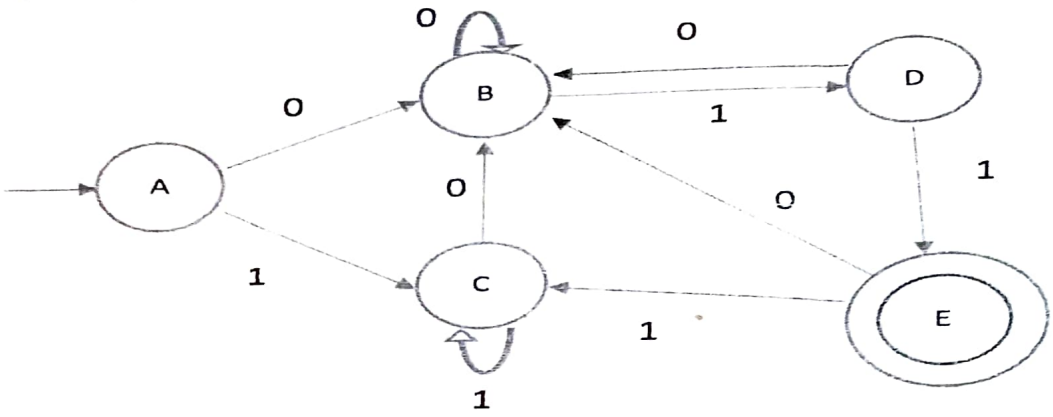
Q3. Attempt all questions: **(10X5 = 50 Marks)**

a i) Express the following NFA into DFA CO2



OR

ii) Express the given automaton into minimal automaton to get the minimum number of states. CO2



b i) Construct a PDA equivalent to the following grammar CO3

S→aAA

A→aS/bS/a

OR

ii) Prove that the following grammar of arithmetic expressions is ambiguous. CO3

E→E+E / E*E / (E) / a

Also, convert the given grammar into non-ambiguous grammar.

c i) Consider the grammar ({S,A,B), {a,b}, P, S) that has the productions CO3

S→bA/aB

A→bAA/aS/a

B→aBB/bS/b

Produce an equivalent grammar in CNF.

OR

ii) Consider the grammar ({S,X,A,B), {a,b}, P, S) that has the productions CO3

S→XB/AA

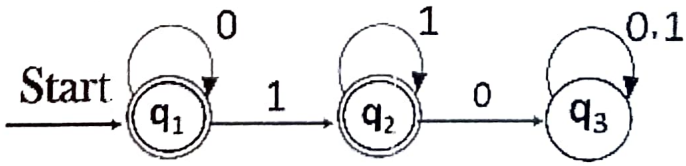
A→a/SA

B→b

X→a

Produce an equivalent grammar in GNF.

d i) Construct regular expression for the following DFA using Arden`s Theorem. CO3



OR

ii) Prove that the language L={a^n| n is a prime number} is not context free. CO3

e i) Show that, If L1 is recursive and L2 is recursive then L1 ∪ L2 and L1 ∩ L2 are also recursive. CO2

OR

ii) Show, whether the lists CO2

M = (abb, aa, aaa) and N = (bba, aaa, aa)

have a Post Correspondence Solution?