IT Extra

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May-June 2024
(B.Tech) Program: Information Technology Scheme I/II/IIB/III: IIB
Regular Examination: SY Semester: IV
Course Code: ITC404 and Course Name: Automata Theory
Date of Exam: 21-05-2024 Duration: 2.5 Hours Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

		Max. Marks	CO	BTL
Qu-1	Solve any **SIX** questions out of **EIGHT.**	**12**		
i)	What is a language? Define concatenation of languages L_1 and L_2.	**2**	CO1	**2**
ii)	Give the formal definition of Deterministic Finite Automaton (DFA).	**2**	CO2	**2**
iii)	What are derivation trees?	**2**	CO3	**2**
iv)	What are the kinds of moves that can be made while accepting strings with an NPDA?	**2**	CO4	**2**
v)	Why is halting problem useful?	**2**	CO5	**2**
vi)	List the Phases of Compiler.	**2**	CO6	**1**
vii)	Give an example of a grammar with useless production.	**2**	CO3	**2**
viii)	List the application of Turing machine and explain any one in detail.	**2**	CO5	**2**
Qu-2	Solve any **FOUR** questions out of **SIX**.	**16**		
i)	What is the motivation behind writing regular expressions? What do the following regular expressions represent? (1) (a + b) . (b + c) (2) (0 + 1)*	**4**	CO1	**3**
ii)	Draw NFA for the Regular Expression $(ab \cup a)^*$.	**4**	CO2	**4**
iii)	Give CFG for set of odd length strings in {0, 1}* with middle symbol '1'.	**4**	CO3	**5**
iv)	Design a PDA to accept strings of type a^nb^n.	**4**	CO4	**5**
v)	Design a Turing Machine to accept strings of type a^nb^{2n}.	**4**	CO5	**5**
vi)	List and explain the differences between compiler and interpreter.	**4**	CO6	**2**
Qu-3	Solve any **TWO** questions out of **THREE**.	**16**		
i)	What is Regular Grammar? Write a grammar (RL and LL) that generate the language: L = {w∈{a, b}*| length(w) is EVEN}	**8**	CO1	**5**

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May-June 2024
(B.Tech) Program: Information Technology Scheme I/II/IIB/III: IIB
Regular Examination: SY Semester: IV
Course Code: ITC404 and Course Name: Automata Theory
Date of Exam: 21-05-2024 Duration: 2.5 Hours Max. Marks: 60

ii)	Convert the NFA to DFA. The transition table for the NFA is: $Q\|\Sigma$ | a | b $\rightarrow q_0$ | q_0 | q_0, q_1 q_1 | -- | q_2 ((q_2)) | -- | --	**8**	CO2	**3**
iii)	For the grammar given below: $S \rightarrow A1B,\ A \rightarrow 0A \mid \varepsilon,\ B \rightarrow 0B \mid 1B \mid \varepsilon$ Give parse tree for leftmost and rightmost derivation of the string '1001' and '00101'.	**8**	CO3	**3**
Qu-4	Solve any **TWO** questions out of **THREE**.	**16**		
i)	Let the language *SimplePal*= $\{xcx^r \mid x \in \{a, b\}^*\}$ and the transition table in **Table-1** is modified in that the letters on the stack are uppercase and the PDA accepts by empty stack. Give a CFG from a PDA accepting the language *SimplePal*= $\{xcx^r \mid x \in \{a, b\}^*\}$.	**8**	CO4	**5**
ii)	Design a Turing machine which recognizes the language $L= \{WCW^R \mid W \in \{0, 1\}^* W^R$ – reverse of W$\}$	**8**	CO5	**5**
iii)	Design a PDA that will recognizes the language $L= \{WCW^R \mid W \in \{a, b\}^* W^R$ – reverse of W$\}$	**8**	CO4	**5**

Table-1: A PDA Accepting *SimplePal* by Empty Stack

Move Number	State	Input	Stack Symbol	Move(s)
1	q_0	a	Z_0	(q_0, AZ_0)
2	q_0	b	Z_0	(q_0, BZ_0)
3	q_0	a	A	(q_0, AA)
4	q_0	b	A	(q_0, BA)
5	q_0	a	B	(q_0, AB)
6	q_0	b	B	(q_0, BB)
7	q_0	c	Z_0	(q_1, Z_0)
8	q_0	c	A	(q_1, A)
9	q_0	c	B	(q_1, B)
10	q_1	a	A	(q_1, Λ)
11	q_1	b	B	(q_1, Λ)
12	q_1	Λ	Z_0	(q_1, Λ)
(all other combinations)				none

****