



COMSATS UNIVERSITY ISLAMABAD
DEPARTMENT OF COMPUTER SCIENCE
Terminal Examination, Spring 2022

Class/Section: - BSCS – 6A & 6B
 Subject: - Theory of Automata
 Instructor: - Taimur Shahzad

Marks: - 50
 Time: - 03 HRS
 Dated: - 29th June 2022

Question No.01: Let δ denotes the transition function and $\hat{\delta}$ denote the extended transition function of the ϵ NFA whose transition table is given below. Construct an NFA in Graphical form from the given NFA tables.

[CLO - 1] (02 x 10 Marks)

i.

δ	ϵ	a	b
$\rightarrow q_0$	$\{q_2\}$	$\{q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_2\}$	$\{q_3\}$
q_2	$\{q_0\}$	ϕ	ϕ
$*q_3$	ϕ	ϕ	$\{q_2\}$

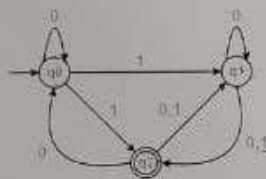
ii.

δ	a	b	ϵ
$\rightarrow q_0$	$\{q_0\}$	$\{q_1\}$	$\{q_3\}$
q_1	$\{q_2\}$	$\{q_3\}$	$\{q_3\}$
q_2	$\{q_3\}$	ϕ	ϕ
$*q_3$	ϕ	ϕ	$\{q_0\}$

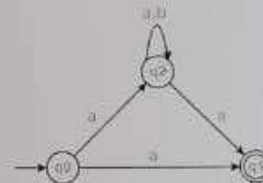
Question No.02: Convert the following Non-Deterministic Finite Automata's (NFAs) to Deterministic Finite Automata (DFA) and mention all the steps involved in conversion (Statements, Tables, Graphs etc.): -

[CLO - 2] (02 x 5 = 10 Marks)

i.



ii.



Question No.03: Construct a Turing Machine for language $L = \{0^n 1^2 n \mid n \geq 1\}$. Represent the Turing machine in both Forms i.e., Graphical Form as well as in Tap Form.

[CLO - 2] (10 Marks)

Question No.04: Design a Finite Automata and Language of given Regular Expressions.

[CLO - 3] (02 x 05 = 10 Marks)

i. $E_1 = a(a+b)^*$

ii. $E_2 = (a(a+b)^*b) + (b(a+b)^*a)$

iii. $E_3 = (a(a+b)^*a) + (b(a+b)^*b) + a + b + \epsilon$

iv. $E_4 = (a+b)^*a(a+b)^*$

v. $E_5 = (a+b)^*a$

Question No.05: Let $T = \{ 0, 1, (,), \cup, *, \emptyset, \epsilon \}$. We may think of T as the set of symbols used by regular expressions over the alphabet $\{0, 1\}$; the only difference is that we use ϵ for symbol ε , to avoid potential confusion in what follows.

[CLO - 4] (05 x 02 = 10 Marks)

- i. Your task is to design a CFG G with set of terminals T that generates exactly the regular expressions with alphabet $\{0, 1\}$.
- ii. Using your CFG G , give a derivation and the corresponding parse tree for the string $(0 \cup (10)^*1)^*$.
- iii. Your task is to design a CFG G with set of terminals T that generates exactly the regular expressions with alphabet $\{0, 1\}$.

Good Luck