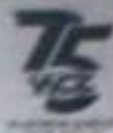


WALCHAND COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Vishrambag, Sangli - 416415

Second Year B.Tech. Computer Science and Engineering
Re-Exam, Odd and Even Semester AY 2023-24
Formal Language and Automata Theory (6CS221)



Re-Exam

PRN: _____

Day & Date: Monday, 08/07/2024 Time : 02.00 pm to 05.00 pm

Max Marks: **100**

IMP: Verify that you have received question papers with correct course code, branch etc.

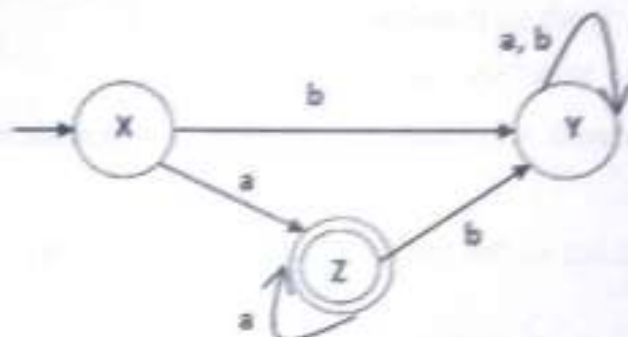
- Instructions
- All questions are compulsory.
 - Writing question number on answer book is compulsory otherwise answers may not be assessed.
 - Assume suitable data wherever necessary.
 - Figures to the right of question text indicate full marks.
 - Mobile phones, smart gadgets and programmable calculators are strictly prohibited.
 - Except PRN anything else writing on question paper is not allowed.
 - Exchange/Sharing of stationery, calculator etc. not allowed.

Text on the right of marks indicates course outcomes (Only for faculty use)

Marks

- Q1 A) What are the closure properties of Regular Language? Consider following DFA accepting a regular language L over an alphabet $\Sigma = (a, b)$, design a DFA which accepts complement of L .

CO3



6

- B) Define regular expression, write down the regular expression 'r' for the language which defines following set of strings

CO2

1. $L(r) = \{aaa, aab, aba, abb, baa, bab, bba, bbb\}$

7

2. $L(r) = \{ \epsilon, 1, 10, 11, 101, 110, 1010, \dots \}$

3. $L(r) = \{a, c, ab, cb, abb, cbb, abbb, \dots\}$

- C) Define Pumping Lemma for Regular Languages and Explain with suitable example

5

CO1

- Q2 A) State and explain Kleen's theorem part-I

6

CO1

- B) Define NFA with ϵ -transition, convert the following NFA to its equivalent DFA

$Q \backslash \Sigma$	a	b
p	q,r	q
q	r	q,r
r	a	p
a	-	p

- C) Differentiate between NFA and DFA

- D) What is Finite State Machine? consider following two regular languages

$$L = \{Aa, Bb, Cc, Dd\} \quad D = \{Aa, Ff, Kk, Dd\} \quad \text{Find out}$$

$$1. L \cup (L \cap D) \quad 2. L \cap (L \cup D) \quad 3. LD$$

- Q3 A) What is Context Free Grammar (CFG)? Write a CFG for the language represented by following Regular Expression

$$(a+b)^* a (a+b)^* a (a+b)^*$$

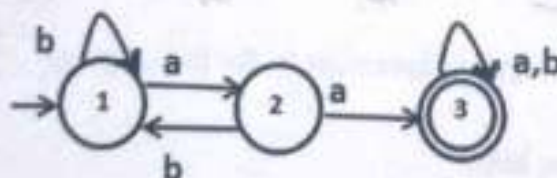
- B) What is Derivation Tree? Draw a Derivation Tree for the string 'aabbbaa' considering following grammar

$$G = (\{S, A\}, \{a, b\}, P, S) \text{ where } P \text{ consists of}$$

$$S \rightarrow aAS \mid a \quad A \rightarrow SbA \mid SS \mid ba$$

- C) What is ambiguous Context Free Grammar? Explain with suitable example

- Q4 A) Define PDA and construct a PDA recognizing the language accepted by the DFA given below



- B) Demonstrate Top-down and Bottom-up parsing techniques with suitable example
- C) Differentiate between PDA and FA

- Q5 A) What is Nullable Non-terminal? Explain the procedure to eliminate Nullable Non-terminal with suitable example

- B) Explain Backus Normal Form (BNF) and Greibach Normal Form (GNF) with suitable example

C) Convert following CFG into Chomsky Normal Form

$S \rightarrow bA \mid aB$

$A \rightarrow bAA \mid aS \mid a$

$B \rightarrow aBB \mid bS \mid b$

4 CO3

Q6 A) What is Composite TM? Explain Nondeterministic Turing Machine with suitable example and explain the conditions for ACCEPT and REJECT scenario in case of non-deterministic Turing Machine

7 CO1

B) Consider the following transition table for a Turing machine functionality. Simulate/Analyze the working of the given Turing machine considering the input string '11110111'. Comment on the functionality of the Turing machine

CO3

Here $I = \{0, 1, ;\}$

$S = \{q_0, q_1, q_2, q_3, q_4, q_5 = \text{halt}\}$

$D = \{L, R, N\}$

S \ I	0	1	;
q_0	R	q_1R	q_2
q_1	q_1R	q_2	q_2
q_2	q_2R	q_3	q_4
q_3	.	q_4R	.
q_4	.	q_5	.
q_5	.	.	.

6

C) Explain 1) Basic construction of Turing machine 2) Universal Turing machine

4 CO1

.....End of question paper