



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: D1 + TD1

Programme Name & Branch : B. Tech. (BBS)
Course Code and Course Name : Formal Languages and Automata Theory (CBS2002)
Faculty Name(s) : Debi Prasanna Acharjya
Class Number(s) : VL2024250107119
Date of Examination : 16/10/2024
Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyse, 5 - Evaluate, 6 - Create)
- CO 1: Demonstrate the knowledge of mathematical models of computation and describe how they relate to formal languages
CO 2: Derive an appropriate model of computation for a given language and vice versa
CO 3: Infer the equivalence of languages described using different automata or grammars

Q. No	Question	M	CO	BL
1.	(a) Show that the following language is not regular. Use pumping lemma to support your answer. $L = \{a^n \mid n \geq 1, n \in \mathbb{N}\}$	5	1	3
	(b) Obtain a context free grammar to generate the following language. $L = \{01(1100)^n 110(10)^n \mid n \geq 1, n \in \mathbb{N}\}$	5		
2.	(a) Show that the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow aB \mid bA$, $A \rightarrow aS \mid bAA \mid a$, and $B \rightarrow bS \mid aBB \mid b$ is ambiguous.	5	3	3
	(b) Eliminate the useless symbols from the context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow aA \mid bB$, $A \rightarrow aA \mid a$, $B \rightarrow bB \mid d$, $D \rightarrow ab \mid Ea$ and $E \rightarrow aC \mid d$.	5		
3.	(a) Obtain an equivalent context free grammar by eliminating the null productions of the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow aSa \mid bSb \mid B$, $A \rightarrow aBb \mid bBa$, and $B \rightarrow aB \mid bB \mid \Lambda$.	5	3	4
	(b) Obtain an equivalent context free grammar in Chomsky Normal form for the following context free grammar $G = (V_N, T, P, S)$ having productions $S \rightarrow 0AAA \mid 1B10$, $A \rightarrow 0AB \mid 1S \mid 1$, and $B \rightarrow 1BB \mid 0S \mid 0$.	5		
4.	Construct a pushdown automaton that accepts the following language by final state. Illustrate the construction by considering even and odd strings. $L = \{a^{2n}b^n \mid n \geq 1, n \in \mathbb{N}\}$	10	2	3
5.	Prove or disprove that the string $w = baabaa$ belongs to the language generated by the following context free grammar $G(V_N, T, P, S)$ having productions $S \rightarrow AB \mid BC$, $A \rightarrow BA \mid a$, $B \rightarrow CC \mid b$, $C \rightarrow AB \mid a$. Use CYK algorithm to support your answer.	10	2	4