



Daffodil International University
Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Spring 2025
Course Code: CSE228, Course Title: Theory of Computation
Level: L2 Term: T2 Batch: 65

Time: 02:00 Hrs

Marks:40

Answer ALL Questions

*[The figures in the right margin indicate the full marks and corresponding course outcomes.
All portions of each question must be answered sequentially.]*

Q1	a)	Apply the concept of Pushdown Automata (PDA) to discover a PDA that accepts the language $L = \{0^n 1^{2n} \mid n \geq 1\}$ and Analyze that the string 000111111 is accepted	[6]	CO3
	b)	Consider the following PDA: $P = (\{q_0, q_1, q_2, q_3, q_4, f\}, \{a, b\}, \{Z_0, A, B\}, \delta, q_0, Z_0, \{f\})$. The transition functions are given below: 1. $\delta(q_0, a, Z_0) = (q_1, AAZ_0)$ 7. $\delta(q_2, b, B) = (q_2, BB)$ 2. $\delta(q_1, a, A) = (q_1, AAA)$ 8. $\delta(q_3, \epsilon, Z_0) = (q_1, AZ_0)$ 3. $\delta(q_2, a, B) = (q_3, \epsilon)$ 9. $\delta(q_0, \epsilon, Z_0) = (f, \epsilon)$ 4. $\delta(q_3, \epsilon, B) = (q_2, \epsilon)$ 10. $\delta(q_1, \epsilon, Z_0) = (q_0, Z_0)$ 5. $\delta(q_0, b, Z_0) = (q_2, BZ_0)$ 11. $\delta(q_2, \epsilon, Z_0) = (q_0, Z_0)$ 6. $\delta(q_1, b, A) = (q_1, \epsilon)$ 12. $\delta(q_3, b, Z_0) = (q_2, BZ_0)$ Analyze the execution of the given PDA and provide the sequence of Instantaneous Descriptions (IDs) to demonstrate that the strings " bab " and " abb " are accepted by $L(P)$.	[4]	
Q2	a)	Consider the following CFG: $E \rightarrow I \mid E+E \mid E^*E \mid (E), I \rightarrow a \mid b \mid Ia \mid Ib \mid IO \mid II$ Analyze the given CFG for the string (b+a11)*(b0+a00) by performing Leftmost Derivation, Rightmost Derivation. Also, infer whether the above-mentioned CFG is ambiguous or not for the above strings.	[5]	CO3
	b)	Convert the given regular expression (a+b)*bab* into CFG Using the generated CFG, determine whether the following strings are accepted: abbabb, and babbb	[5]	
Q3		Consider the following grammar: $S \rightarrow AX \mid B \mid \epsilon$ $A \rightarrow aS \mid \epsilon$ $B \rightarrow bA \mid C$ $C \rightarrow cB \mid \epsilon$ $X \rightarrow aB \mid b$ Determine the following steps: i) Eliminate epsilon (ϵ)-productions from the grammar. ii) Remove unit productions from the grammar. iii) Eliminate useless symbols from the grammar. iv) Convert the resulting grammar into Chomsky Normal Form (CNF) .	[10]	CO4
Q4	a)	Determine that the language $L = \{0^{2n} 1^{4n}, n \geq 1\}$ is not regular by using pumping lemma	[5]	CO4
	b)	Design a Turing Machine which recognizes the language $L = \{a^n b^n c^n \mid n \geq 1\}$	[5]	