



Daffodil International University
Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Spring 2026
Course Code: CSE228 , Course Title: Theory of Computation
Level: 2 Term: 2 Batch: 67

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.]

1.	a)	Consider the following CFG: $S \rightarrow S - S \mid S \mid (S) \mid ID \mid \$ + \$$ $ID \rightarrow a \mid b \mid c \mid ID2 \mid ID3$ Given string $(a2 - b3) / (c + a23)$ i. Perform (LMD and RMD) for the given string. ii. Construct the parse tree for the string. iii. Determine whether the grammar is ambiguous or not.	[2+2+1]	CO3
	b)	A company stores logs where: i. Every login (L) must have a matching logout (O) Any number of error messages (E) may appear in between Construct CFG and Show derivation of: LLEEOO ii. Derive the following regular expression into CFG: $10(10 + 1)^*(0 + 11)^*$	[3+2]	
2.		Consider the following CFG: $S \rightarrow Aba \mid bB \mid \epsilon$ $A \rightarrow aA \mid BC \mid CD$ $B \rightarrow bB \mid \epsilon \mid b$ $C \rightarrow D \mid Ab \mid \epsilon$ $D \rightarrow d \mid S$ Perform the following steps: i) Eliminate null productions(ϵ) 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]	CO3
3.	a)	Suppose You are designing a syntax checker for a programming language. The language allows expressions of the form: $id^n \$ \$ id^n$ Where: id = identifier (a,b) $\$$ = separator *Number of identifiers before and after $\$$ must be equal Illustrate the Pushdown Automata for this language	[5]	CO4
	b)	Transition Function (δ): 1. $\delta(q_0, a, Z_0) = (q_0, AZ_0)$ 2. $\delta(q_0, a, A) = (q_0, AA)$ 3. $\delta(q_0, b, A) = (q_1, \epsilon)$ 4. $\delta(q_1, b, A) = (q_1, \epsilon)$ 5. $\delta(q_1, b, Z_0) = (q_2, BZ_0)$ 6. $\delta(q_2, b, B) = (q_2, BB)$ 7. $\delta(q_2, c, B) = (q_3, \epsilon)$ 8. $\delta(q_3, c, B) = (q_3, \epsilon)$ 9. $\delta(q_3, \epsilon, Z_0) = (q_f, Z_0)$	[2+3]	

		i) Analyze the language accepted by the PDA. ii) Verify whether the following string is accepted or rejected. Show all steps using Instantaneous Descriptions (ID): ($w = aaabbbbcc, aaabbbccc$)		
4.	a)	Use Pumping Lemma for CFL to prove: $L = \{ a^i b^j c^k \mid i < j < k \}$ is not a CFL.	[5]	CO4
	b)	Illustrate Turing machine to recognize the language, $L = \{ 0^n 1^{3n} 2^{3n}, n \geq 1 \}$.	[5]	