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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→S−S|S/S|(S)|ID ID→a|b|c|ID2|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 → Aba | bB | ε A→aA | BC | CD B→bB | ε | b C → D | Ab | ε D →d | 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.δ(q0, a, Z0) = (q0, AZ0) 2.δ(q0, a, A) = (q0, AA) 3.δ(q0, b, A) = (q1, ε)) 4.δ(q1, b, A) = (q1, ε) 5.δ(q1, b, Z_0) = (q2, BZ0) 6.δ(q2, b, B) = (q2, BB) 7.δ(q2, c, B) = (q3, ε) 8.δ(q3, c, B) = (q3, ε) 9.δ(q3, ε, Z0) = (qf, Z0)	[2+3]	

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		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]	

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