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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Mid Examination, Summer 2025

Course Code: CSE115 Course Title: Introduction to Biology and Chemistry for Computation

Level: 1 Term: 1 Batch: 69

Time: 01:30 Hrs **Marks: 25**

Answer ALL Questions [Optional]

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

1.	After joining the CSE department, Arif visited his old school to meet his favourite science teachers. When he met his biology and chemistry teachers, they were excited to hear he was studying computer science. His chemistry teacher said, "Have you heard of computational chemistry? With your programming skills, you could help simulate complex chemical reactions." His biology teacher added, "With bioinformatics, we can study genes and learn more about diseases." Smiling, Arif replied, "If we combine your deep knowledge in science with my coding skills, we can really make a difference in the world!"		[5]	CO2
	a)	Using your knowledge on computational chemistry, **Describe** some of the applications of computational chemistry.		
	b)	"Bioinformatics is the interdisciplinary field where computer science, mathematics, and biology are merged" **Analyze** this quote as per your understanding with the necessary diagrams.	[3]	
2.	Ifrat was working on a research project in his computational biology course when his professor gave him an interesting problem to solve. "Imagine a highly complex biological process where a long molecular chain makes an identical copy of itself before a cell divides," the professor explained. Ifrat was surprised. "So, this process ensures that each new cell gets the exact same genetic information?" he asked. "Exactly!" the professor replied. "It follows a step-by-step mechanism involving unwinding, matching up building blocks, and assembling a new chain using the original as a template. Specialized enzymes help in this process, ensuring accuracy, though occasional errors can occur, leading to mutations."		[5]	CO1
	a)	Identify and **Demonstrate** the process the professor was referring to with appropriate diagrams.		
3.	AgroSynth Solutions is developing a new herbicide to combat a resistant weed strain affecting global crops. The research is challenging due to complex interactions between herbicide molecules and plant enzymes. To overcome this, your team is using computational chemistry tools. The manufacturing plant uses a Distributed Control System (DCS) for precise, safe production.		[5]	CO2
	a)	**Examine** the efficiency and reliability of DCS over a centralized system.		

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4.	A researcher is analyzing DNA sequences to identify conserved functional regions. Due to potential sequence variations like insertions, deletions, or mutations, selecting a suitable alignment method is crucial to identify the most similar subsequences. Given: Sequence 1: AGTACG Sequence 2: GACTAG Scoring: Match = +1, Mismatch = 0, Gap penalty = -2		[7]	CO3
	a)	**Apply** a suitable sequence alignment algorithm to find the best possible alignment that reads both the sequences as a whole. Find the alignment score matrix and calculate the optimal similarity score based on the given scoring scheme.		