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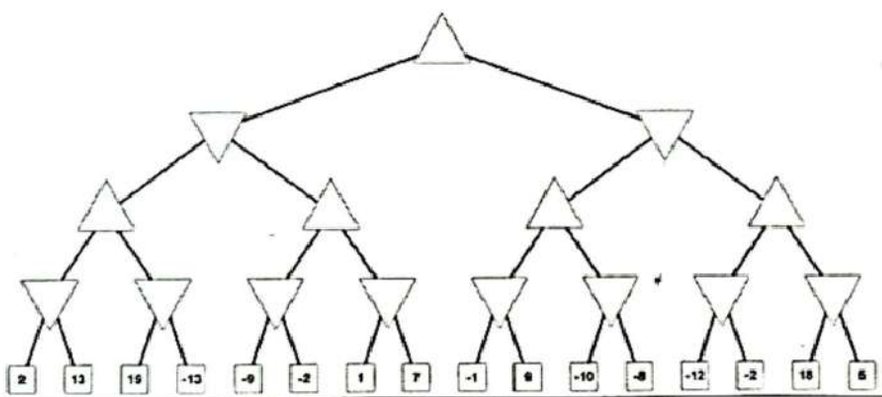
Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Final Examination, Fall 2025
Course Code: CSE 316, Course Title: Artificial Intelligence
Level:03 Term:02 Batch: 64

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)	**Explain** briefly how to generate a game-playing search algorithm by using the basic elements of a game. Let's Consider 1(b) Game Tree and Explain the Minimax algorithm and how it determines the optimal move for the MAX player.	05	CO3
	b)	**Apply** the alpha -Beta Pruning Algorithm in following Graph. 	05	
2.	a)	A fruit-processing factory uses an automated apple-sorting machine to separate apples into **"Fresh"** and **"Defective"** categories. The factory wants to ensure only fresh apples are packed for sale, so the sorting machine uses a high-resolution camera and image-processing software to detect defects. Based on historical data about 10% of all apples are defective, meaning they are bruised, rotten, or otherwise unsuitable for sale. The sorting machine is fairly accurate and correctly identifies a defective apple 85% of the time. However, sometimes the machine makes mistakes. It wrongly flags a fresh apple as defective 5% of the time. The factory manager wants to know: how reliable is this detection? **Determine** the probability that the apple is truly defective given that the machine flagged it? Please use as P(D) for defective and P(F) for fresh.	05	CO2
	b)	At a tech university, students are enrolled in four programs: AI (40), ML (35), Cybersecurity (25), and IoT (20). Some students take multiple programs: 10 students are enrolled in both AI and ML, and 3 students are enrolled in both AI and IoT. The total number of students is 120.	05	

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		I. **Determine** the probability that a randomly selected student is enrolled in AI or ML? II. **Calculate** the probability that a student is enrolled in ML or IoT, but not AI?		
3.	*a)*	Consider the following Knowledge Base (KB): (A→B)∧(B∨C)∧(¬C∨A) And α=(A∧¬C), **Determine** whether: KB⊨α.	05	CO2
	b)	**Explain** the components of a formal CFG and convert to the CNF of given CFG. S → NP VP NP → Det N | N VP → V NP Det → the | a N → dog | cat V → sees	05	
4.	*a)*	The DIU IoT Lab has deployed a "Smart Farming" system in a greenhouse to automate irrigation. This system uses a Perceptron-based decision model, utilizing environmental data, to determine when to activate the water sprinklers. The system accepts three normalized inputs from sensors: 1. x_1: Soil Dryness Level (0 to 1, where 1 is completely dry). 2. x_2: Temperature (0 to 1, normalized based on max daily heat). 3. x_3: Rain Forecast Probability (0 to 1, where 1 is 100% chance of rain). The AI engineer has assigned the following associated weights to these inputs to prioritize soil conditions over the forecast: $W = (W_1, W_2, W_3) = (0.6, 0.3, -0.4)$ (Note: The rain forecast has a negative weight because high rain probability should discourage watering.) The system activates the sprinklers (Output = 1) if the weighted sum is greater than or equal to a threshold value $(\theta) = 0.5$. Otherwise, the sprinklers remain off (Output = 0). At 2:00 PM, the sensors record the following data: • Soil Dryness = 0.7 • Temperature = 0.8 • Rain Forecast = 0.2 **Examine** the weighted sum using the perceptron formula and determine if the Smart Farming system will turn on the sprinklers. Show your steps clearly.	05	CO4
	b)	**Analyze** the limitation of using a Single Layer Perceptron (SLP) for this specific decision-making process. Specifically, explain what would happen if the relationship between the inputs required a non-linear decision boundary (e.g., the "XOR problem") and suggest which AI architecture should replace the SLP to solve that issue.	05	

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