Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science and Engineering

Final Examination, Spring-2026

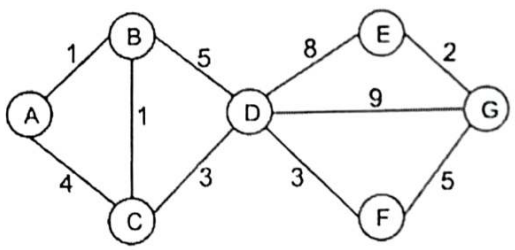
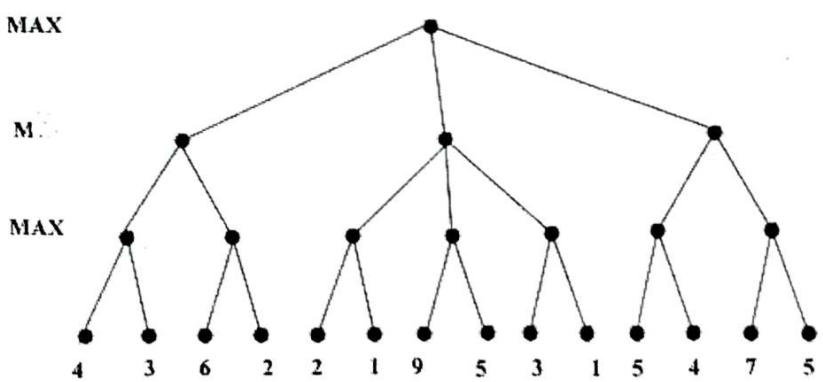
Course Code: CSE-316, Course Title: Artificial Intelligence

Level: 3 Term: 3 Batch: 65

Time: 02:00 Hours **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)***	**State** the equation used in A* search strategy. In the state space graph shown in Figure 1(a), 'A' is the start state and 'G' is the goal state. The costs for each edge are shown on the graph. Each edge can be traversed in both directions. Prove that the shortest path is $S = \{A \rightarrow B \rightarrow C \rightarrow D \rightarrow F \rightarrow G\}$, by applying A* search strategy. The corresponding heuristic table is presented in Table 1(a).	**5**	**CO3**
		Table 1(a): Heuristic value table		
		Nodes | Heuristics (h_1): A 9.5; B 9; C 8; D 7; E 1.5; F 4; G 0		
		 Figure 1(a): An example state space graph		
	(b)	**Define** Genetic Algorithm. Describe the pipeline (steps) of Genetic Algorithm strategy with an appropriate example.	**5**	
	(c)	For the adversarial search tree given in Figure 2(a), **identify** the optimal strategy from Max's perspective using Alpha-Beta pruning algorithm. Values of 'v' at each node should be mentioned clearly, also the branches that are pruned should be marked clearly.  Figure 2(a): Adversarial search tree example	**5**	

2.	*(a)*	Consider a sentence, $\phi = (\neg p \vee q) \wedge (q \rightarrow \neg r \wedge \neg p) \wedge (p \vee r)$. Apply first order logic to **identify** that ϕ is satisfiable.	5	CO4
	(b)	A doctor knows that tuberculosis causes a persistent cough in 80% of cases. The prior probability that a patient has tuberculosis is 2 out of 400 patient, and the probability that any patient has a cough is 10%. **Solve** the probability that a patient has tuberculosis given that they have a cough.	5	
	(c)	For the following primary dataset shown in Table 3(b), **apply** the Bag of Words (BoW) concept of Natural Language Processing to **prepare** a clean dataset for AI system training. Table 3(b): Primary dataset of emotion classification **Social Media post** / **Sentiment** This war is heartbreaking, so many innocents are affected. — Negative The situation is complicated, and both sides are suffering. — Neutral Diplomacy seems like the only real solution now. — Positive Some actions taken in this war are deeply concerning. — Negative	5	
3.	*(a)*	Consider a system with four inputs and a single output. Design a single-neuron architecture for this system, including the necessary mathematical formulation. **Clarify** the process of determining the initial weight matrix and explain two suitable activation functions, along with their appropriateness for the problem.	5	CO4
	(b)	For the above design (Q4(a)), consider the updated weight vector after some iteration is $W = [0.8 \quad -0.6 \quad 0 \quad 0.3]^T$. **Apply** and **analyze** the 3 (three) iterations of the Perceptron Learning rule for the designed system. Consider the following inputs, desired outputs, and learning rate as $\eta = 0.1$. Table 4(b): Inputs and desired outputs Iteration / Inputs / Desired outputs 1 — $x_1 = [1 \quad -2 \quad 0 \quad 1]^T$ — $d_1 = -1$ 2 — $x_2 = [0 \quad 1.5 \quad -0.5 \quad 1]^T$ — $d_1 = -1$ 3 — $x_3 = [-1 \quad 1 \quad 0.5 \quad 1]^T$ — $d_1 = 1$	5	