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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Midterm Examination, Fall 2026
Course Code: CSE316, Course Title: Artificial Intelligence
Level: 4 Term: 1 Batch: 66

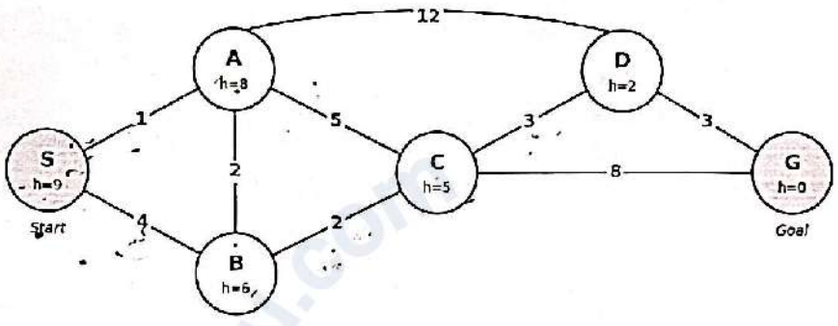
Time: 01:30 Hrs **Marks: 25**

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 university wants to develop an intelligent autonomous delivery robot to deliver books, documents, and other items across its campus. The robot receives delivery requests, identifies pickup and destination locations, monitors traffic congestion and weather conditions, checks its battery level, and avoids obstacles while moving. It must deliver packages to the correct destinations on time while minimizing travel distance, energy consumption, and delivery costs. Sometimes, the robot must choose between a shorter but congested route and a longer but faster route.		CO1
	a)	Identify and explain the four major components of the intelligent campus delivery agent, and discuss how the concept of a rational agent applies to this scenario.	3	
	b)	Illustrate the working architecture of a utility-based agent for this scenario and explain how it evaluates alternative actions and selects the most appropriate action to achieve its objectives.	3	
2.		Consider the nodes "A–R" and construct a search tree where the branching factor at Level 0 is 3, Level 1 is 2 and the branching factor at all subsequent levels is 1. Assume that the goal node is "L" and all node expansions follow a left-to-right order. Apply Breadth-First Search (BFS), Depth-First Search (DFS), Depth-Limited Search (DLS, limit = 2), and Iterative Deepening Search (IDS) to find the goal node L, showing the node traversal order for each algorithm.	4	CO1
3.		A bank wants to develop an intelligent loan advisory system that evaluates applicants' income, employment history, credit records, existing debts, and banking policies. Using predefined expert rules and financial knowledge, the system analyzes each application, determines whether the applicant meets the eligibility criteria, and provides a recommendation with an explanation. Draw and label the complete working architecture of an Expert System, showing its major components and the flow of information between them with brief explanation.	4	CO2

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4.		Consider the undirected weighted graph shown below, where S is the start node and G is the goal node. The number on each edge is its step cost, and h is the heuristic value of each node.  		CO2
	a)	Apply A* search from S to G. Show g(n), h(n) and f(n)=g(n)+h(n) for the nodes in the open list at each step, and write the order of node expansion and the optimal path found with its total cost.	4	
	b)	Determine whether the given heuristic is admissible, and state whether Greedy Best-First Search would find the same path.	2	
5.		Solve the 8-queens problem using a genetic algorithm. Each state is an 8-digit string where the i-th digit is the row of the queen in the i-th column. Fitness = number of non-attacking pairs of queens (a solution has fitness 28). The initial population is: P1 = 32743215 (fitness 18); P2 = 25314728 (fitness 24); P3 = 41357268 (fitness 26); P4 = 63825147 (fitness 25).		CO2
	a)	Calculate the selection probability of each individual using fitness-proportional selection, and determine the offspring generated by single-point crossover after the 3rd digit for the pair (P1, P2) and after the 5th digit for the pair (P3, P4). Lastly apply mutation to the 5th digit of the first offspring by changing it to 2.	5	