JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech- VII Semester (CSE/IT)

COURSE CODE (CREDITS): 18B1WCI742 (3)   MAX. MARKS: 35
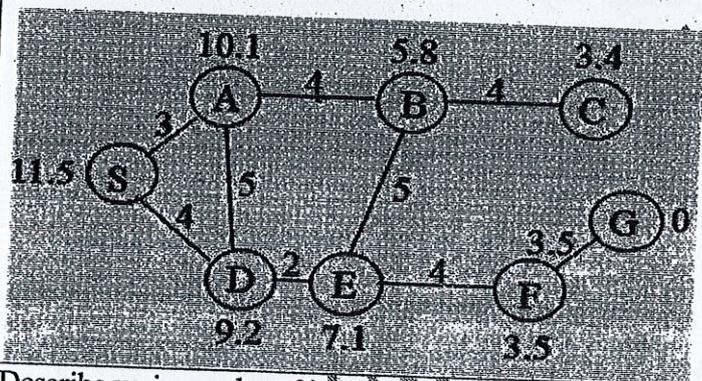
COURSE NAME: Artificial Intelligence

COURSE INSTRUCTORS: Meghna Dhalaria   MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	CO	Marks
Q1	(a) Explain the role of selection, crossover, and mutation in a Genetic Algorithm. How do these operators help in improving the quality of solutions across generations? (b) Consider a Genetic Algorithm where chromosomes are represented as binary strings of length 6. The fitness function is defined as: $f(x)$=Number of 1s in the chromosome The initial population is given as: $x_1 = 101011$ $x_2 = 110001$ $x_3 = 011010$ $x_4 = 100111$ (a) Calculate the fitness of each chromosome. (b) Identify the two fittest chromosomes. (c) Perform one-point crossover at position 3 on the two fittest chromosomes and write the resulting offspring.	3	[7]
Q2	Consider the following statements are true in a given knowledge base in Propositional Logic. Bob likes programming and he likes mathematics. If he likes programming and he likes data structures, then he will become a software engineer. If he likes data structures and likes algorithms, he will clear technical interviews. He does not like mathematics or he likes algorithms. He does not like operating systems and databases. Is the statement true/false: "Bob will become a software engineer"? Prove.	3	[6]
Q3	In the context of Ant Colony Optimization (ACO), explain the following, clearly defining all symbols used:	4	[5]

	(a) The probability of the *k*th ant moving from city *i* to city *j*. (b) If the pheromone value on an edge is $\tau = 0.5$, heuristic value $\eta = 4$, $\alpha = 1$, $\beta = 2$, and the sum of probabilities is 10, calculate the probability of selecting that edge.			
Q4	Prove that the A* search algorithm is cost-optimal when using an admissible heuristic. Your proof must be by contradiction. Clearly state the assumptions made about the heuristic and action costs, define the relevant cost functions g(n), h(n), and f(n), and show how assuming that A* returns a suboptimal solution leads to a contradiction.	2	[4]
Q5	Consider a water jug problem with three jugs of capacities 8 liters, 5 liters, and 3 liters. Initially, all jugs are empty. Using an appropriate state space search approach, explain how exactly 4 liters of water can be measured. Show the sequence of states involved.	2	[5]
Q6	Find the optimal path using A* algorithm	2	[4]
Q7	Describe various rules of inference in Logic.	3	[4]