

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Supplementary Examination- 2026

B.Tech-VII Semester (CSE/IT)

COURSE CODE(CREDITS):18B1WCI742 (3)

MAX. MARKS: 75

COURSE NAME: Artificial Intelligence

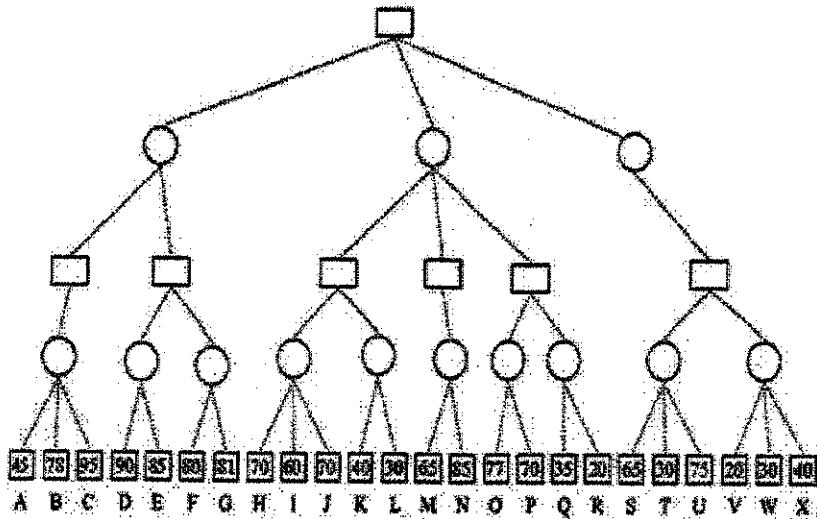
COURSE INSTRUCTORS:HRI/KTS/SRJ

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	Explain how the concept of state space search forms the foundation for both domain-independent deterministic search algorithms and heuristic search methods. In your answer, analyze how DFS, BFS, and Iterative Deepening DFS explore the state space differently	1	8
Q2	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	8
Q3	(a) Write the A* heuristic search algorithm. (b) What characteristics should the heuristic function satisfy so that A* always finds the optimal (least-cost) path? Explain this in terms of admissibility and whether the heuristic underestimates or overestimates the distance from a node N to the goal.	3	5+5
Q4	In the context of Ant Colony Optimization (ACO), explain the following, clearly defining all symbols used. (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.	4	5+5
Q5.	In the game tree given in the following image, the leaves are labelled with the values from the evaluation function. The letter labels [A... X] below the leaves are names of the leaves. Show the order in which algorithm Minimax and Alpha-Beta pruning will inspect the nodes, explaining all the decisions made, along with diagrams where appropriate. What is the minimax value of the game?	2	8



Q6	Explain the assumptions of the Naïve Bayes classifier and describe the rules applied when multiple pieces of evidence are available.	5	8
Q7	<p>(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?</p> <p>(b) Consider a Genetic Algorithm where chromosomes are represented as binary strings of length 6.</p> <p>The fitness function is defined as $f(x) = \text{Number of 1s in the chromosome}$</p> <p>The initial population is given as</p> $x_1 = 101011; \quad x_2 = 110001; \quad x_3 = 011010; \quad x_4 = 100111$ <p>i) Calculate the fitness of each chromosome. ii) Identify the two fittest chromosomes. iii) Perform one-point crossover at position 3 on the two fittest chromosomes and write the resulting offspring.</p>	3	4+6
Q8	Explain the different inference rules used in logic.	5	5
Q9	Explain the concepts of bias and variance in machine learning. How do bias and variance lead to underfitting and overfitting in a model? Illustrate how an appropriate balance between bias and variance helps in building a generalized model.	5	8