JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATION-2025

M.Tech-2nd Semester (ECE)

COURSE CODE (CREDITS): 21M11EC212 (3) MAX. MARKS: 35

COURSE NAME: Artificial Intelligence and Expert Systems

COURSE INSTRUCTORS: Dr. Naveen Jaglan 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	Questions	CO	Marks
Q1	Solve the following 8-puzzle problem using steepest hill climbing problem. State the heuristic used. What are the limitations of hill climbing algorithms? Initial State: 2 8 3 / 1 5 4 / 7 6 _ Final State: 1 2 3 / 8 _ 4 / 7 6 5	2	5
Q2	Consider the problem of finding the shortest route through several cities, such that each city is visited only once and in the end return to the starting city (the Travelling Salesman problem). Suppose that in order to solve this problem we use a genetic algorithm, in which genes represent links between pairs of cities. For example, a link between London and Paris is represented by a single gene 'LP'. Let also assume that the direction in which we travel is not important, so that LP = PL. (a) How many genes will be used in a chromosome of each individual if the number of cities is 10? (b) How many genes will be in the alphabet of the algorithm?	3	5
Q3	Consider the following travelling salesman problem which uses following distance matrix and starting city A:	4	5

		A	B	C	D	E	F	G	H	
	A	0	1	4	2	9	8	3	2	
	B	1	0	5	3	7	2	5	1	
	C	2	5	0	6	1	4	7	7	
	D	4	3	6	0	5	2	1	6	
	E	9	7	1	5	0	9	1	1	
	F	8	2	4	2	9	0	3	5	
	G	3	5	7	1	1	3	0	2	
	H	2	1	7	6	1	5	2	0	
	Generate initial population and select parents for first iteration using Roulette wheel method (Take population size as 4)?									
Q4	Prove each of the following statements, or give a counter example: (a) Breadth-first search is a special case of uniform-cost search. (b) Depth-first search is a special case of best-first tree search. (c) Uniform-cost search is a special case of A* search.									2 5
Q5	Use logistic regression to predict whether a customer will subscribe to a term deposit based on personal and financial features. Create a sample dataset with features like age, job, marital status, education, default, balance, housing loan, and target y. Preprocess the data, train the model, and evaluate it using accuracy, confusion matrix, and ROC AUC score.									3 5
Q6	What is the role of one-hot encoding in machine learning? Under what circumstances is it required, and can it introduce multicollinearity in linear regression models? If so, how can this issue be resolved? Illustrate your explanation with a Python example.									3 5
Q7	A budget airline company operates 3 plains and employs 5 cabin crews. Only one crew can operate on any plain on a single day, and each crew cannot work for more than two days in a row. The company uses all planes every day. A Genetic Algorithm is used to work out the best combination of crews on any particular day. (a) Suggest what chromosome could represent an individual in this algorithm? (b) Suggest what could be the alphabet of this algorithm? What is its size? (c) Suggest a fitness function for this problem. (d) How many solutions are in this problem? Is it necessary to use Genetic Algorithms for solving it? What if the company operated more plains and employed more crews?									4 5