JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATION- 2024

M.Tech-II Semester (ECE-IoT)

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

COURSE NAME: Artificial Intelligence and Expert Systems

COURSE INSTRUCTOR: Dr. Naveen Jaglan　　　　　　　　　MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b)Marks are indicated against each question in square brackets.

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

1. What is pivoting? Name any two functions in pandas that supports pivoting? [CO-1; 5 marks]

2. Consider the following travelling salesman problem which uses following distance matrix and starting city A:

	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)?　　　　　　　　　　　　　[CO-2; 5 marks]

3. 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?

　　　　　　　　　　　　　　　　　　　　　　　　　　　[CO-3; 5 marks]

4. 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?

[CO-4; 2+3=5 marks]

5. Solve the following 8-puzzle problem using steepest hill climbing problem. State the heuristic used. What are the limitations of hill climbing algorithms?
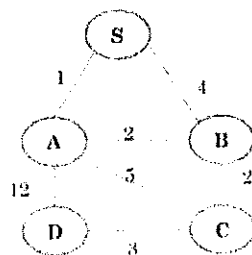
2	8	3
1	5	4
7	6	

Initial State

1	2	3
8		4
7	6	5

Final State

[CO-3; 5 marks]

6. For the search space shown below, find the optimal path from S to D using the heuristic values defined in table.

Node	Heuristic Value
S	7
A	6
B	2
C	1
D	0

[CO-4; 5 marks]

7. What is the purpose of one-hot encoding, and when is it necessary? Can one-hot encoding lead to multicollinearity issues in linear regression models? If so, how do you address them? Explain with the help of a python program. [CO-4; 5 Marks]