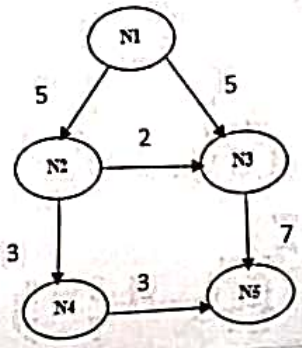
NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
THEORY EXAMINATION
Question Paper

Total no. of pages used: 2

Month and year: May 2025 | Semester: IV
Program: B.Tech.-COE/IT/MC | Course code: CSPC-204/ITPC-204
Subject: Artificial Intelligence & Soft Computing | Time allowed: 03 Hours | Number of
Maximum Marks: 50 | Total No of Questions: 5
Questions to be attempted: 5

Note 1: *There are five questions in the paper& each has two parts. Every question is compulsory.*

Q-1.	(a). Given a network with 5 nodes; N1, N2, N3, N4, N5, with the actual distance between the nodes written on the sides of the edges. N1 is the starting node and N5 is goal node. The heuristic value of each node is given in a table shown below. Use A* algorithm to find the path from N1 to N5 explaining all the steps. Write the merit and demerit of A* algorithm. Also discuss the complexity estimation.	5

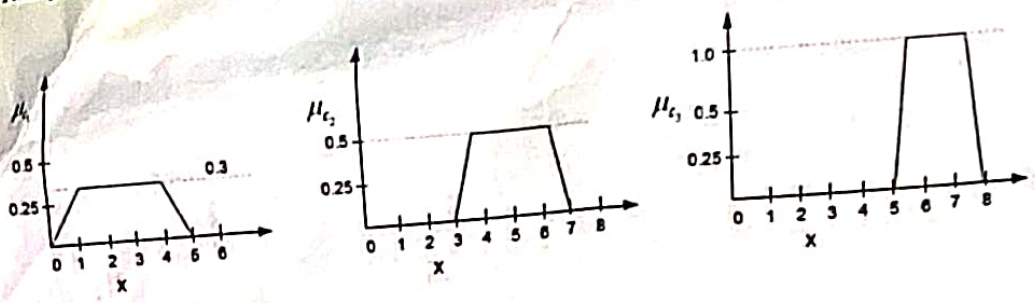


Node	H(Node)
N1	9
N2	5
N3	3
N4	1
N5	0

	(b). Explain constraint satisfaction problem in details. Assign values to three variables X,Y&Z using CSP such that: • X∈{1,2,3} • Y∈{1,2,3,4} • Z∈{2,4,6} **Constraints:** 1. X+Y= Z 2. X<Y	5
Q-2.	(a) Explain the mathematical model of hill climbing algorithm and its pseudo-code along with merits and demerits.	5
	(b) Consider the following sentence: [(Food ⇒ Party) ∨ (Drinks ⇒ Party)] ⇒ [(Food ∧ Drinks) ⇒ Party] i) Determine whether this sentence is valid, satisfiable (but not valid), or unsatisfiable. ii) Convert the left-hand ([(Food ⇒ Party) ∨ (Drinks ⇒ Party)]) and right-hand sides of the main implication ((Food ∧ Drinks) ⇒ Party) into CNF, showing each step. Assuming KB as: [(Food ⇒ Party) ∨ (Drinks ⇒ Party)], Prove the right side of main implication that is [(Food ∧ Drinks) ⇒ Party] using resolution technique.	5
Q-3.	(a) Consider the following sentences. **S1:** Everyone who loves all animals is loved by someone, **S2:** Anyone who kills an animal is loved by no one, **S3:** Jack loves all animals, **S4:** Either Jack or Jim killed a cat, named Tuna, **S5:** All the cats are animals. Convert above sentences to first order logic sentences.	5

(b) Define first-order logic in detail. Also defineUniversal instantiation, Universal generalization, Existential instantiation, and Existential generalization. 5

Q-4. (a) Explain different defuzzification methods. Also find crisp value given three output fuzzy plot using center of sums method of defuzzification. 5



(b) Define the basic terminology Support, Normality, Core & Crossover point of fuzzy logic. Also find algebraic difference, bounded sum & bounded difference of A(x) & B(x). A= {0.2/1 + 0.3/2 + 0.5/3 + 0.1/4}, B= {0.5/1 + 0.2/2 + 0.1/3+ 0.6/4}. 5

Q-5. (a) What is evolutionary algorithm? Explain the Particle Swarm algorithm in detail with mathematical model. 5

(b) What is genetic algorithm? Maximize the function, $f(x)= x^2 x\in[0,31]$. 5

Use a Genetic Algorithm with:

- Binary encoding (5 bits, since $2^5=32$)
- Population size = 4
- Selection: Roulette Wheel
- Crossover: Single point
- Number of generations = 1