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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B.Tech-IV Semester (CSE/IT)

COURSE CODE (CREDITS): 24B11CI411 (3) MAX MARKS: 35

COURSE NAME: Artificial Intelligence (AI): Recent Trends and Applications

COURSE INSTRUCTOR: Dr. Harsh Srivastava (HST) 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

(c) Use of calculator is allowed

Q.No	Question	CO	Marks
Q1	Explain the concepts of Greedy Best-First Search and A* Search Algorithms in Artificial Intelligence. Compare both algorithms based on heuristic usage, path cost calculation, efficiency, and optimality. .	CO1	5
Q2	Consider a neural network with 2 input neurons, 4 hidden neurons, and 1 output neuron using linear activation. Inputs: $x_1=2$, $x_2=1$, target $t=10$, learning rate $\eta=0.1$. Initial weights: Input→Hidden = [[1,2,1,0.5],[2,1,1.5,1]], Hidden→Output = [1,1,2,1]. Loss function: $L = \frac{1}{2}(t-y)^2$. Compute the forward pass output, calculate the gradients for the output-layer weights, and perform one gradient descent update for the output-layer weights.	CO3	5
Q3	Consider the sentence: "**Machine learning improves intelligent systems rapidly**." Using the Skip-gram model of Word2Vec with context window size = 2 and target word = "learning": (a) Generate all input–output training pairs for the target word. (b) Explain briefly how the Skip-gram neural network learns word embeddings from these pairs.	CO4	2.5+2.5
Q4	Consider a Genetic Algorithm with 5-bit encoding to maximize $f(x) = x^3 - 4x$ for $x \in [0,31]$. Initial population: 01101(13), 11000(24), 01010(10), 10101(21). (a) Compute the fitness of each chromosome. (b) Perform roulette wheel selection to choose two parents. (c) Apply single-point crossover after bit position 3 and perform bit-flip mutation on offspring bits 2 and 5. (d) Calculate and compare the average fitness of the old and new populations.	CO5	1+1+2+1

Q5	(a) Write the mathematical formula for TF-IDF and explain the role of IDF in handling common words like "the", "is". (b) Using the following 4 documents, compute the TF-IDF value for all the terms in D1 and D3. D1: Machine learning is a branch of artificial intelligence. D2: Deep learning uses neural networks for learning patterns. D3: Artificial intelligence and machine learning are trending. D4: Learning new skills in AI requires practice. (Use natural logarithm for IDF. The word "AI" is treated the same as "artificial intelligence" for simplicity.)	CO4	2.5+2.5
Q6	Design a Mamdani Fuzzy Inference System for smart climate control with inputs Temperature, Humidity, Occupancy and output Fan Speed. Temperature: Very Cold(0,0,10), Cold(5,12,20), Comfortable(18,24,30), Warm(26,32,38), Hot(35,45,45) Humidity: Dry(0,0,40), Normal(30,50,70), Humid(60,100,100) Occupancy: Empty(0,0,10), Few People(5,20,35), Crowded(30,50,50) Fan Speed: Off(0,0,20), Low(10,25,40), Medium(35,50,65), High(60,75,90), Very High(85,100,100) Rules: 1. IF Temperature is Very Cold THEN Fan Speed is Off 2. IF Temperature is Cold AND Humidity is Dry THEN Fan Speed is Low 3. IF Temperature is Comfortable AND Humidity is Normal THEN Fan Speed is Medium 4. IF Temperature is Warm AND Humidity is Humid THEN Fan Speed is High 5. IF Temperature is Hot THEN Fan Speed is Very High 6. IF Temperature is Warm AND Occupancy is Crowded THEN Fan Speed is Very High 7. IF Temperature is Comfortable AND Occupancy is Few People THEN Fan Speed is Medium 8. IF Temperature is Hot AND Humidity is Humid THEN Fan Speed is Very High For Temperature = 30°C, Humidity = 70%, Occupancy = 35: (a) Find fuzzified memberships. (b) Compute firing strengths using min operator. (c) Aggregate output using max operator. (d) Find defuzzified Fan Speed using centroid method.	CO4	2.5+2.5+ 2.5+2.5