

Mid Semester Examination

Course Name: Artificial Intelligence
Full Marks-30

Code: CS561/CS571
Time: 2 hours

Answer ALL the questions

Make reasonable assumptions as and whenever necessary. You can answer the questions in any sequence. However, the answers to all the parts of any particular question should appear together.

(Q1). Fuzzy subset hood and fuzzy implication are defined as follows by (1) and (2) respectively:

$$\begin{aligned} \text{Sub}(B, A) &= 1 - \text{Sup}(B, A) \\ &= 1 - \frac{\sum_{x_i \in U} \max(0, \mu_B(x_i) - \mu_A(x_i))}{\sum_{x_i \in U} \mu_B(x_i)} \quad \text{where } U = \{x_1, x_2, \dots, x_n\} \end{aligned} \quad (1)$$

$$t(\mu_B(x_i) \rightarrow \mu_A(x_i)) = \min(1, 1 - t(\mu_B(x_i)) + t(\mu_A(x_i))) \quad (2)$$

where U is the universe, A and B are fuzzy sets, $\mu_S(x)$ is membership value $([0,1])$ of element x in S . (2) is also called the Lukasiewicz operation, where t indicates the amount of truth $([0,1])$.

Since logic and set theory are interdependent and consistent with each other, (1) and (2) also have to be mutually consistent. Establish this. **12 marks**

(Q2). Define monotonicity with respect to A^* search. Prove that if A^* has picked a node for expansion, the optimal path to that node has been found and its parent pointer will not have to be changed in future, provided the heuristic function is monotonic. **8 marks**

(Q3) (a). "Simulated Annealing could be an alternative solution to address all the problems that a Hill climbing search encounters"- Justify in favour or against this claim with proper explanations. **2 marks**

(b). Consider a Multinomial Naïve Bayes classifier for document classification. With respect to this, explain with appropriate examples the (i). importance of conditional independence assumption in modelling the problem; (ii). problems that (i) encounters; (iii). possible remedial measures of (ii); and (iv). the necessity of considering the number of occurrences of terms (or words) for classification. **8 marks**