M.TECH. COMPUTER TECHNOLOGY SECOND YEAR FIRST SEMESTER – 2024

Subject: Artificial Intelligence **Time:** 3 hours **Full Marks:** 100

Answer any five questions

1. a. What are the differences between symbolic and sub-symbolic approaches in AI? 4
   b. What are the major components of Knowledge base system? 3
   c. What are the short term and long term goal of AI? 3
   d. Realize the EX-NOR gate function using McCulloch Pitts neuron with appropriate diagrams. 10

2. a. Represent the following sentences by predicate calculus wffs 3x4
   - Everyone who loves all animals is loved by someone.
   - Anyone who kills an animal is loved by no one.
   - Jack loves all animals
   - Either Jack or Jony killed the cat,who is named Luci
     Did Jony kill the cat?

   b Convert the following wffs into clausal form. 8
   $[(\forall x)\ Q(x)] \Rightarrow (\forall x)(\forall y)\ [(\exists z)\ [P(x \Rightarrow (\forall u)\ R(x,y,u,z)]$

3. a. Anyone passing the Artificial Intelligence exam and winning the lottery is happy. But anyone who studies or is lucky can pass all their exams. Ali did not study be he is lucky. Anyone who is lucky wins the lottery. Is Ali happy? Use the resolution refutation system to answer the question.. 15
   b. Find the *mgu* of the set 5

$$\{P(A, x, f(g(y))),\ P(z, f(z), f(u))\}$$

4. a. Describe the relationship between Horn clause and Prolog language. 5
   b. All people who are wealthy and smart are happy. Those people who can read are smart. John can read and is wealthy. Happy people have exciting lives. Use resolution system to answer the question, "can anyone be found with an exciting life"? 15

5. a. What is uncertainty in Expert system? What are the source of uncertain knowledge in expert system? 2+4
   b. What is prior probability? Give an example of the rule representation in the expert system based on Bayesian reasoning? 2+4
   c. Why is the certainty factor theory considered as a practical alternative to Bayesian reasoning? What are the measure of belief and the measure of disbelief? Define a certainty factor. 8

6. a. Why Fuzzy systems are popularly used to build expert system compared to rule based AI system? 3

   b. Define fuzzy set "near 5" based on the following information 3
   - S = [0:1:10];
   - G = [0.0 0.1 0.3 0.5 0.8 1 0.8 0.5 0.3 0.1 0];

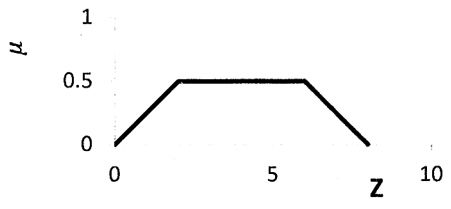
   c. Two fuzzy relations are given by 6

R =		y1	y2
	x1	0.6	0.3
	x2	0.2	0.9

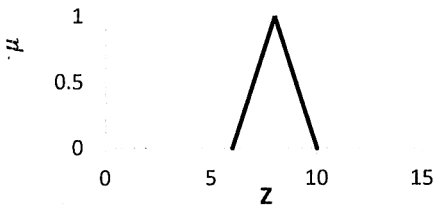
S=		Z1	Z2	Z3
	Y1	1	0.5	0.3
	Y2	0.8	0.4	0.7

Obtain fuzzy relations $R \circ S$ as Max-Product composition and Max –Min composition between these two fuzzy relations.

   d. Two fuzzy outputs are given by 3+3+2



(a)



(b)

Find the centroid using i) Center of Sums Method (COS) ii) Center of gravity (COG) and iii) Weighted Average Method

7. a. What are pros and cons of tournament selection of genetic algorithm? 4

   b. When will you use n point crossover against single point crossover? 3

   c. What do you mean by elitism selection properties? 3

   d. In GA, why crossover probability is set to a high value and mutation probability to a low value? 5

   e. Can GA guarantee the optimum solution? —support your viewpoint with proper justification. 5

8. a. How do you use predicate calculus to address NLP related problem? 6

   b. What is the difference between Information Extraction and Information Retrieval? 4

   c. What are the properties need to follow to develop an Intelligent agent 6

   d. Draw the block diagram of the architecture of Goal-Based Agent 4