

**Model Answer**  
**Department of CSIT**

MSc (Computer Science) Semester: III Year:2013 Paper Title: Artificial Intelligence and Expert Systems  
Max Marks: 60

Please refer to lecture notes where ever mentioned by link (LN in short)

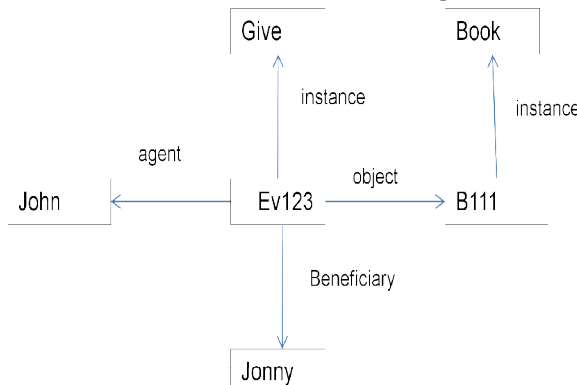
<http://ggu.ac.in/download/Class-Note13/Artificial%20Intelligence%20and%20Expert%20System24.10.13.pdf>

**Section A: (All 10 questions are compulsory)**

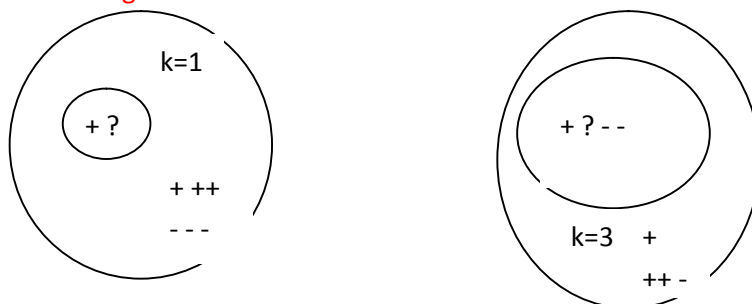
**10X2=20**

Very Short Answer Questions: Write very short answers to following questions. Please attempt questions of Section A, together and write proper question number for each answer.

1. Write the names of any four types of environments.  
Accessible, discrete, Episodic, Deterministic, Static, and/or their counter parts
2. What are simple reflex agents?  
Agents which respond immediately on reaction after perception of some action e.g applying brake after seeing brake lights on the car going ahead
3. Draw a breadth first search tree for two levels for any problem (e.g. water jug problem).  
pl. see Page 27 of LN
4. Draw a truth table for the disjunction of propositions P and Q.  
(T,T)->T; (T,F)->T; (F,T)->T;(F,F)->F
5. Convert into predicate logic: (a) No mortal lives more than 150 years (b) If someone dies then he is dead at all later times.  
(a)  $\forall x: \forall t1: \forall t2: mortal(x) \wedge born(x,t1) \wedge gt(t2-t1,150) \rightarrow dead(x,t2)$   
(b)  $\forall x: \forall t1: \forall t2: died(x,t1) \wedge gt(t2,t1) \rightarrow dead(x,t2)$
6. Draw a semantic net for the sentence ' John gave the book to Mary'.



7. Draw k-nn figure with values of k=1 and 3.



where '+' and '-' are two classes, and ? is the class of unknown pattern

**8. Write the names of any four applications of pattern recognition.**

Basically PR is applied for human recognition systems such as face recognition, thumb impression, character recognition, speech recognition,

**9. What is an expert system?**

An expert system is a complex AI program which is used to solve problems which are solved by human expert. E.g. what an expert physician doctor does, same purpose must be achieved by an expert system.

**10. Write any four applications of expert systems.**

Medical diagnosis, education, agriculture, weather forecasting, games, counseling etc.

**Section B: (Attempt any 4 questions out of 7 questions)**

**4X10=40**

**Descriptive Questions: (only main points are presented to be elaborated)**

**1. Discuss the term artificial intelligence as defined by various scientists and researchers. How it is useful in computer science, explain.**

Pl. refer LN pages 4-9 for first part.

AI is basically derived to help problems related to or to be solved by Computers. There are several applications of AI which are more suitable to CS field. Natural language Processing, Knowledge representation, games, modeling and other areas are closely fit to be used in CS than any other discipline. Even the intelligent agents use Ai as part of their functioning. Pattern recognition, neural networks, soft computing, computational intelligence, dimensionality reduction, data mining all use efficiently AI based approaches.

**2. Write a water jug problem, its production rules and solution.**

**State the problem, write all required production rules and application of rules to solve problem**

Pl. refer LN pages 20-22 and class exercises for rules.

**3. Discuss the A\* search with example, tree diagram and algorithm.**

Pl. refer LN pages 31- onward and class exercises for solutions. Thing to remember is that the Goal should be at SLD 0. Also all nodes leaving or coming to current node must be considered.

**4. Write in the context of predicate logic, the meaning of following terms with examples when you convert wff into clause form (a) Associative property (b) Distributive property (c) DeMorgans's laws (d) prenex norm form.**

(a) Associate Property  $a \vee (b \vee c) = (a \vee b) \vee c$

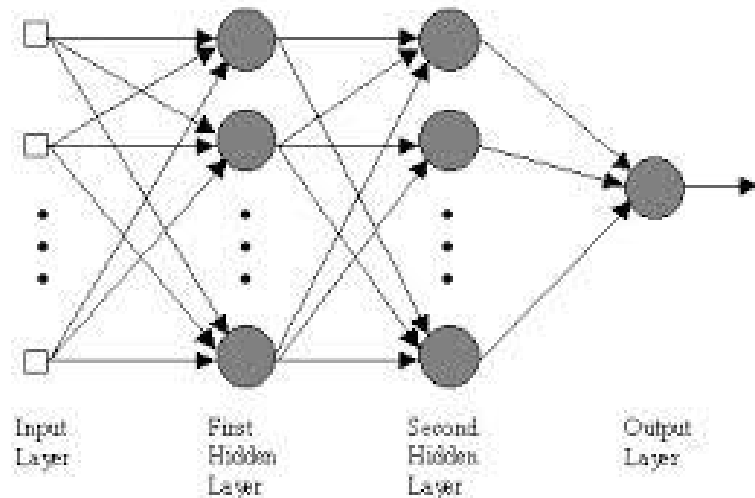
(b) Distributive property  $(a \wedge b) \vee c = (a \vee c) \wedge (b \vee c)$

(c) DeMorgans's laws  $\neg(a \wedge b) = \neg a \vee \neg b$ ;  $\neg(a \vee b) = \neg a \wedge \neg b$

(d) prenex norm form  $\forall x: \forall y: \forall z: [\neg \text{Roman}(x) \vee \neg \text{know}(x, \text{Marcus})] \vee [\text{hate}(x, \text{Caesar}) \vee (\neg \text{hate}(y, z) \vee \text{thinkcrazy}(x, y))]$

This form is prenex normal form, a form in which we have prefix of quantifiers followed by a matrix (rectangular bracket, free of quantifiers ], refer to LN page 63-64

5. Describe a simple neural network with a simple diagram and its benefits.



benefits of an ANN include non linear function approximation, regression, prediction, fault tolerance, curve fitting, learning both supervised, unsupervised etc

6. What are supervised and unsupervised classifications, explain with example.

Pl. refer to LN page 81-86, brief about knn, kmeans with numerical short and simple example

7. Why an expert system must have the explanation capability, explain. What is a knowledge base?

The ES are developed to help a human to take the best possible advice of a human expert through a computer software enriched with some hardware (if required). How and why an advice has been provided by an ES, must be assessable to the human user. Sometimes, users want to know the complete rule base for a better understanding.

Knowledge base is a collection of knowledge used to decide rules in an ES. The KB may consist of rules, theories, concepts, laws. A knowledge engineer is the suitable person to make best use of the KB. The domain expert is obviously key to a KB as his/her expertise will be placed on the KB. The knowledge engineer can apply the rules to develop an ES and hand in to a software developer who can then typically code the rules to provide decision.