CS IT 2015

(Set-1)

M.Tech - 2nd(ICT)

Artificial Intelligence & Machine Learning

Full Marks : 70

Time : 3 hours

Q. No. 1 which is compulsory and answer any **five** questions from the rest

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2 × 10

(*i*) What is machine learning ?

(*ii*) Describe a search process formally.

(*iii*) Describe the criteria for evaluating a search algorithm.

(*iv*) Describe a state space in which iterative deepening search performs much worse than depth-first search.

(*v*) Provide a scenario under which hill climbing algorithm can perform at par or even better than genetic algorithm (analyse your example with respect to time complexity).

(*vi*) How ridges and plateau can be avoided in hill climbing algorithm ?

(*vii*) Differentiate between supervised and unsupervised learning.

(*viii*) What is a constraint satisfaction problem ?

(*ix*) Describe with an example the limitations of McCulloh Pitts neuron.

(*x*) Differentiate between probability and membership value of a fuzzy set. Explain with an example.

2. "Missionaries and Cannibals" is a problem in which 3 missionaries and 3 cannibals want to cross from the left bank of a river to the right bank of the river. There is a boat on the left bank, but it can carry at most two objects at a time (and can never cross with zero objects). If cannibals ever out number the missionaries on any bank, the cannibals eat the missionaries. How do they cross the river without the missionaries risking being eaten ?

(*i*) Describe how you would represent the state space, including the states, successor function, and goal test. 5

(*ii*) Which search algorithm would be optimal for solving the problem and why ? Also find out the optimal cost for the solution. 5

3. Represent the following sentences with predicate calculus, using a consistent vocabulary : $2\frac{1}{2} \times 4$

(*i*) There is a woman who likes all men who are not vegetarian.

(*ii*) There is a barber who shaves all men in town who do not shave themselves.

(*iii*) No person likes a professor unless the professor is smart.

(*iv*) Politicians can fool some of the people all the time, and they can fool all the people some time ; but they cannot fool all of the people all of the time.

4. (*i*) Discuss on fuzziness measure of a fuzzy set. 5

(*ii*) Consider the following two fuzzy sets :

$A = \{ 0{\cdot}1/a, 0{\cdot}6/b, 1/c, 0{\cdot}6/d, 0{\cdot}1/e \}$

$B = \{ 0/a, 0{\cdot}2/b, 1/c, 0{\cdot}2/d, 0{\cdot}1/e \}$

Draw the membership functions of A and B. Then, calculate the following :

Support and Core for the fuzzy set B ; and Cardinality and Complement for the fuzzy set A. 5

5. (*i*) Explain the working principle of Bayes' classifier. 5

(*ii*) Consider the dataset shown in the table below : 5

Record	*A*	*B*	Class
1	−1	−1	+
3	−1	0	−
4	−1	1	−
5	0	0	+
7	1	−1	−
8	1	0	−
9	1	1	+

(*a*) Estimate the conditional probabilities for $P(A_1|+), P(B_2|+), P(A|-), P(B_2|-)$.

(*b*) Predict the class using Bayes' decision theory for ($A = 0, B = 1$|Class = ?).

6. (*i*) Write down the cross-over and mutation operators used in genetic algorithms. 5

(*ii*) A thief enters a museum and wants to steal artefacts from there. Every artefact has a weight and a value associated with it. The thief carries a knapsack (bag) which has certain capacity (with respect to weight). The problem is to find the combination of artefacts the thief takes so that he gets the maximum value and the weight of all the selected artefacts is less than the capacity of his bag. The thief cannot take any artefact partially. Either he takes it or leaves it. What is the way he can maximize his profit ?

Describe the genetic encoding, fitness function, and cross-over operators for the above problem. 5

7. Write short notes on any *two* : 5 + 5

(*i*) Alpha-beta pruning algorithm

(*ii*) Reactive systems

(*iii*) Conceptual Dependency.

8. (*a*) Use resolution to answer the question, "what course would steve like ?", by assuming the following facts : 5

(*i*) Steve only likes easy courses.

(*ii*) Science courses are hard.

(*iii*) All the courses in the basket weaving department are easy.

(*iv*) BK301 is a basket weaving course.

(*b*) Implement the backpropagation learning algorithm for a fully connected three layer network, with $\eta = 0.35$ and $\alpha = 0.9$. Test your implementation on the following data : 5

Input Vector	Target Output Vector
(0·0, 0·0)	(0.1)
(0·0, 1·0)	(0·9)
(1·0, 0·0)	(0·9)
(1·0, 1·0)	(0·9)