Artificial Intelligence Technologies and Commercial Applications

midterm examination 2018

1. Please answer the following questions about search.
2. Use the problem of 3x3 puzzle to illustrate the basic factors for defining a state space search. (15)
3. Illustrate briefly algorithm A and algorithm A\*. (10)
4. If there are two heuristics h1(n) and h2(n) for A\* search and h1(n) ≦ h2(n) for any state n. How do the two heuristics influence the search? (5)
5. Suppose we have a set of data, {(xi, yi)} where xi‘s and yi‘s are all real numbers. Illustrate how a nonlinear regression problem could be formulated as a linear regression problem with variable transformation for the following families of regression functions, respectively.

(a) . (10)

(b) (10)

1. Please explain the meaning of each term (in *italic*) and its usage in the algorithm.
2. *Temperature* in simulated annealing. (8)
3. *Perceptron* in artificial neural network. (8)
4. *Pheromone* in ant colony optimization. (8)
5. *Gradient Descent* for optimization. (8)
6. *Schema* for genetic algorithm. (8)
7. The joint distribution for two random variables, X and Y, is shown as below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Y=A | Y=B | Y=C |
| X=1 | 0.06 | 0.12 | 0.30 |
| X=2 | 0.09 | 0.25 | 0.18 |

a) Please compute the conditional probability P(X=1|Y=A) (5)

b) Are the two variables statistically independent? Why? (5)

c) Assume we observe a fact that Y is impossible to be C. What could we make decision for X (X=1 or X=2) under this condition? What decision should we make if no obsertation is available? (10)

1. Please answer the questions about search on game tree.
2. Please illustrate the how min-max algorithm is performed for the following game tree. (10)
3. Please describe the detailed process (e.g. alpha-pruning, beta-pruning) when alpha-beta pruning is applied to the min-max. (10)
4. Please encircle those nodes that are visited in (b). (5)

4 6 9 3 5 2 3 4 7 1 8 3

MAX

MIN

MAX

MIN

1. Please answer the questions.
2. What are the criteria for determining optimal question when spanning each node in the inductive learning algorithm of decision tree? (5)
3. What are the limitations of classification and regression tree when applied to classification problems? (5)
4. How many parameters are there in a Gaussian mixture model of 10 mixtures have for 39 dimensional points? (assuming its covariance matrixes are all diagonal) (5)
5. Assume there are 4 red balls, 2 white balls and 1 blue ball and 1 green ball in a basket. Please find the entropy for the distribution of the balls. (10)
6. Given two vectors X1=[0 1 1 0 1 0 0 1 0 1] and X2=[1 0 1 1 0 0 1 1 0 0], please compute the simple matching coefficient, the Jaccard coefficient and the Rao’s coefficient. (10)
7. Please describe the process of agglomerative clustering algorithm, including how the dendrogram is generated and how the clusters are determined. (20)