

國立交通大學 101 學年度第 1 學期 博士班資格考筆試考試試題

土木工程學系 資訊組(己) 科目：人工智慧在土木工程之應用 選考學生數：1 考試時間：60 min

共 1 頁，第 1 頁

注意：請選其中三題作答！

1. You are given a set of rules: Should we buy a house or not?
R1: IF *inflation is low*
THEN *interest rates are low* (CF=0.82)
ELSE *interest rates are high* (CF =0.9)
R2: IF *interest rates are high*
THEN *housing prices are high* (CF= 0.75)
R3: IF *housing prices are high*
THEN *do not buy a house* (CF=0.68)
ELSE *buy it* (CF =0.85)
 - a. Run a backward chaining with a *high inflation rate* as given.
 - b. Run a forward chaining with a *low inflation rate* as given.
 - c. Prepare an inference tree for the backward chaining case.
 - d. Calculate the corresponding certainty factor (CF) of your answer.
2. 知識表示法(knowledge representation approaches)為知識庫系統(knowledge-based system)或知識管理(knowledge management, KM)系統中重要的關鍵技術。試舉四種知識表示法，並說明其優缺點。
3. In artificial neural networks (ANN) domains, error back-propagation (BP) is one of important learning models.
 - (a) Please present the flowchart of error back-propagation (BP) learning algorithm.
 - (b) What is the main function for momentum term in conventional BP algorithm?
 - (c) Can we normalize the outputs in the interval of [0, 1] as the sigmoid function $1/(1+e^{-x})$ is utilized? Why?
 - (d) Please derive the $\Delta w_{kj} = -\mu \frac{\partial E(W)}{\partial w_{kj}}$ for weights between output layer and hidden layer. Here, system error is defined as
$$E = \frac{1}{2P} \sum_{p=1}^P (d_p - o_p)^2$$
where P is number of training instances. d_p and o_p are the desired and computed output for the p th training instance.
4. Please use “4R” diagram or relations to describe case-based reasoning (CBR) model and also compare with CBR with other AI system (e.g. production system) for advantages vs. disadvantages.
5. What is competitive learning? Derive the competitive learning algorithm.

國立交通大學 101 學年度第 2 學期 博士班資格考筆試考試試題

土木工程學系 資訊組(己) 科目：演算法 選考學生數：1 考試時間：60 min

共 1 頁，第 1 頁

- Use the master method to give tight asymptotic bounds for the following recurrences.
 - $T(n)=4T(n/2)+n$.
 - $T(n)=4T(n/2)+n^2$.
 - $T(n)=4T(n/2)+n^3$.
- Illustrate the operation of BUILD-MAX-HEAP on the array $A=\langle 15, 32, 7, 1, 8, 9, 26, 2, 99 \rangle$.
- Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$.
- Find a feasible solution or determine that no feasible solution exists for the following system of difference constraints:
 $x_1 - x_2 \leq 4$
 $x_1 - x_5 \leq 5$
 $x_2 - x_4 \leq -6$
 $x_3 - x_2 \leq 1$
 $x_4 - x_1 \leq 3$
 $x_4 - x_3 \leq 5$
 $x_4 - x_5 \leq 10$
 $x_5 - x_3 \leq -4$
 $x_5 - x_4 \leq -8$
- Prove that the vertex cover problem is NP-complete.