國 立 交 通 大 學 試 題 紙

九十六學年度第一次
博士班資格考

科目：人工智慧（A）　　日期： 97 年 1 月 24 日　第 1 頁 共 1 頁

請" ✓" 明　　✓不可看書　　可看書

* 請將答案依題號順序寫入答冊

1. Consider the following set of training examples:

Example	Class	A1	A2
1	1	T	T
2	2	T	T
3	1	T	F
4	3	F	F
5	3	F	T
6	2	F	T

(a) (2 pts) Is it possible to give a decision tree that perfectly describes the training examples? _____ (Yes/No)
(b) (5 pts) Briefly explain your answer to (a). No more than two sentences, please.
(c) (8 pts) Focused on A1 only, what is its information gain relative to all these training examples? (Note that no need to calculate the value. Just write down the complete equation, and try to be as clear as possible.)

2. (10 pts) You are working for a data mining company as a ML (machine Learning) algorithm developer. One of your clients, who is a big chain-drugstore owner, ask you to design a data mining tool based on ML to profile the customer purchase history, so that he can better predict the behavior of the prospective customers. Note that the owner is only interested accurate prediction of the probability for a prospective customer's future purchase, but his life-time companion, his wife, is more interested in the reasons for a customer's purchase. Suppose you have only Decision Tree and ANN available. Explain which approach you'd propose to the owner, and which to his wife. (Hint: Try to focus on the advantages and disadvantages of Decision Tree and ANN. No more than two paragraphs.)

3. (13 pts total) A, B and C are Boolean attributes, where True=+1, False=-1. A has higher priority than B, and B has higher priority than C, i.e., for trees, you should draw A first, then B, and finally C if necessary. Draw your decision trees and perceptrons for the following functions. (a) (5 pts) $A \wedge \neg B$ (b) (8 pts) exactly 2-of-3 concept. (Note. An exactly 2-of-3 concept means exactly 2 out of 3 Boolean attributes are true. If the learner is incapable of describing the functions, just say 'No'.)

4. (12 pts) Suppose you are a medical doctor who has AI background. According to the records, 99% of the Lab test for those real cancer patients came out positive, and 97% of the Lab test for normal people came out negative. This indicates the Lab test is quite accurate. Now one of your patients just had a Lab test that came out 'positive', and he is extremely worried. As a doctor, you are also aware of the fact that for any person, the chance to actually have the cancer is 0.000001. How will you comfort this patient based on your AI knowledge?

◎請用深黑色鋼筆或原子筆出題

命題老師簽名：

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1. True or False (2 points per question, total 18 points)

a. IDA* (iterative deepening A*) is subject to the potentially exponential increase in complexity associated with searching on graph

b. IDA* is unable to check for repeated states generated by alterative paths.

c. All uninformed search algorithms have worst-case exponential time complexity.

d. SMA* (simplified memory bounded A*) algorithm is complete if its all memory M <= depth d.

e. SMA* performs well on the problems with highly connected state spaces and real-valued heuristics.

f. The set of states expanded by algorithm A* is subset of those examined by breadth-first search.

g. The total number of nodes at depth k is bk for uniform search space of uniform branching factor b.

h. Iterative min-conflicts is usually effective in practice for constraint satisfaction problem

i. The space involved with depth-first search is linear.

2. (12 points) Consider the problem of moving k knights from k starting squares s1, s2, . . . , sk to k goal squares g1, g2, . . . , gk, on an unbounded chessboard, in the smallest number of actions. Each action consists of moving up to k knights simultaneously, subject to the rule that no two knights can land on the same square at the same time. The legal moves of a knight are marked in Figure 1.

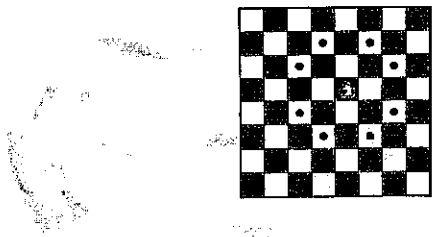

Figure 1: Legal moves of a knight on the chess board.

(a) (4 Points) Define the maximum branching factor b in this state space as a function of k.

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(b) (4 Points) Suppose hi is an admissible heuristic for the problem of moving knight i to goal gi by itself. Is the following heuristic function admissible? Please justify your answer briefly.

$$\sum_{i=1}^{k} h_i$$

(c) (4 Points) Which of the following is a better heuristic function? Please justify your answer.

- min{h1, h2, . . . , hk}
- max{h1, h2, . . . , hk}

3. (10 points) Given the following predicates and functions:

Boy(x): x is a boy.

Girl(x): x is a girl.

Happy(x): x is happy.

Loves(x,y): x loves y

Mother(x):= the mother of x

Father(x)= the father of x

Translate the following sentences into first order logic:

(a) (2 Points) Every boy's father's father loves him.

(b) (2 Points) Every girl whose mother loves her father is happy.

(c) (2 points) Everyone is who loves someone and is loved by that one is happy

(d) (4 Points) Find the most general unifier for the following pair of FOL sentences.

∀xLoves(Kate,x)

∀xLoves(x,Mother(x))

4. (10 points) Consider a KB consisting of the following set of sentences in propositional calculus.

(P⇔¬Q) ⇒ R

¬ ¬P ∨ ¬P

¬ (P ∧ S)

P ∧ Q ⇒ S

(a) (2 Points) How many models satisfy the first sentence?

(b) (2 Points) Is the KB Horn? Why or why not?

(c) (6 Points) Use resolution to prove that R is true. Justify your answer