國立交通大學試題紙

一百零八學年度第一學期
博士班資格考

科目：人工智慧 A　　日期： 109 年 1 月 14 日　第 1 頁 共 2 頁

請 "✓" 明　✓不可看書　可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (20pts total, 4pts each) In a world of only objects X, Y and Z, a logical language is defined with constant symbols A, B and C, a function symbol f, and predicate symbols p, q and r.
   Given the following interpretation I,
   I(X)=A, I(Y)=A, I(Z)=B
   I(f)={(A,B),(B,C),(C,C)} Note. in (i,j), i is an argument, j is a value
   I(p)={A,B}
   I(q)={C}
   I(r)={<B,A>,<C,B>,<C,C>}
   For each of the following sentences, indicate whether it is true or false in the given interpretation I.
   a. r(X,Y)　　Ans:_____
   b. q(f(Z))　　Ans:_____
   c. ∃w, f(w)=Y　　Ans:_____
   d. ∀w, r(f(w),w)　　Ans:_____
   e. ∀u,v, r(u,v)⇒(∀w, r(u,w)⇒v=w)　　Ans:_____

2. (15pts) Given the following sentences,
   ∀x,[(∀y,S(y)∧V(x,y))⇒((∃z,¬T(x,z))∧V(x,x))],
   ∀x,y, S(y)⇒T(x,y)∧V(x,y),
   and the sentence to be proved is:
   ∃w, ¬S(w)
   Show the set of clauses that will be needed to do a resolution refutation proof.

3. (5pts total) Consider the eight-puzzle problem. There are various ways of representing the puzzle.
   (1) (3 pts) Now, one is to consider a move as the change from one board

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configuration to another. How many operators do we need?
Ans:_____

(2) (2 pts) Instead, if we consider a move as moving a blank in a given direction, then how many operators do we have?
Ans:_____

4. (10pts total)Consider relation ρ on variables A, B, C, and D, $\rho(A,B,C,D)=\{(a,a,a,a),(a,b,b,b),(b,b,a,c)\}$.
If we take a projection on variables A, B, and C from $\rho(A,B,C,D)$, is the projection $\Pi_{ABC}(\rho)$ representable by a binary constraint network and Why? (5pts) Is ρ decomposable and Why?(5pts)

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1. [10 points] Consider the following planning problem: The environment has three locations: A, B, and C. John is ***at*** A initially. An object P is ***at*** C initially. The task of John is to move P to B and return to A. The allowed actions include: ***Go*** (from one location to another), ***PickUp*** (an object), and ***PutDown*** (an object). John ***has*** object P after picking it up and does not have P after putting it down.

(a) [3 points] Write down the initial state description.

(b) [7 points] Write down the action schemas.

2. [20 points] Consider the regression problem of fitting a function, $y=a_1f_1(x)+ a_1f_1(x)+\ldots+ a_pf_p(x)$, to a set of points, $\{(x_i, y_i), 1\le i\le n\}$.

(a) [7 points] Derive the min-squared-error solution (i.e., minimizing the L2 loss) of the coefficients.

(b) [7 points] Derive the update equation for obtaining the solution via gradient descent.

(c) [2 points] Describe the basic idea of regularization, a common technique to prevent overfitting.

(d) [4 points] Give expression of the regularization term for both L1 and L2 regularization. Which one is more likely to give sparse results?

3. [20 points] Answer the following questions concisely (4 points each).

(a) Describe the idea of Ockham's Razor and how it is related to model selection in learning.

(b) What is the difference between the available feedbacks for supervised and reinforcement learning?

(c) What is the difference between feedforward and recurrent artificial neural networks?

(d) What is the Bayes Rule in probabilistic reasoning?

(e) Describe the concept of boosting in ensemble learning from samples. No equations required.

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