

科目：人工智慧 A

日期：108 年 1 月 18 日 第 1 頁 共 1 頁

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* 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. (18 pts total) Concisely and precisely describe “repeated random sampling”, “stratified k-fold CV” and “LOOCV” for accuracy estimation, and briefly describe their pros and cons, respectively.
2. (3 pts each, 18 pts total) Consider a binary-class classification problem, where there are equal numbers of positive and negative examples in the data set. Also suppose that the class label (i.e. +/-) is totally randomly assigned to these examples. Now for the following two classification models, estimate their test accuracies based on different estimation methods.
 - (i) A perfect decision tree model trained from the training data without pruning.
 - (a) Repeated random subsampling method, in which 2/3 of data for training, the rest for testing.
Test Accuracy = ?
 - (b) Stratified 10-fold CV.
Test Accuracy = ?
 - (c) LOOCV.
Test Accuracy = ?
 - (ii) A majority predictor model trained from the training data that always predicts the majority class in training data.
 - (a) Repeated random subsampling method, in which 2/3 of data for training, the rest for testing.
Test Accuracy = ?
 - (b) Stratified 10-fold CV.
Test Accuracy = ?
 - (c) LOOCV.
Test Accuracy = ?
3. (14 pts total) Explain the need for “inductive bias” for inductive learning, and give two examples of inductive bias.

◎請用深黑色鋼筆或原子筆出題

命題老師簽名：

科目：人工智慧 B

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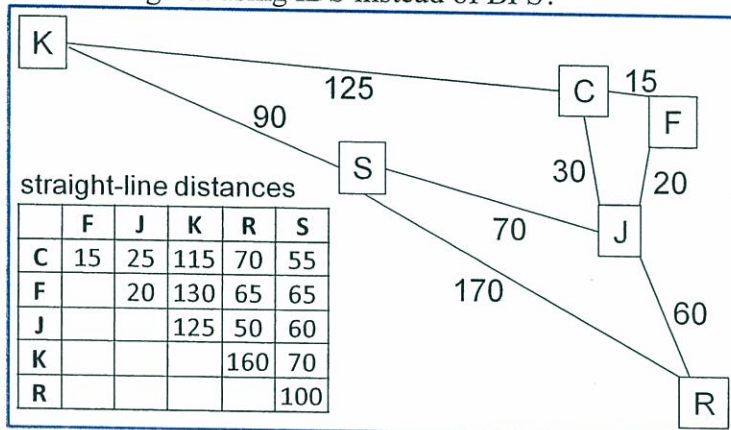
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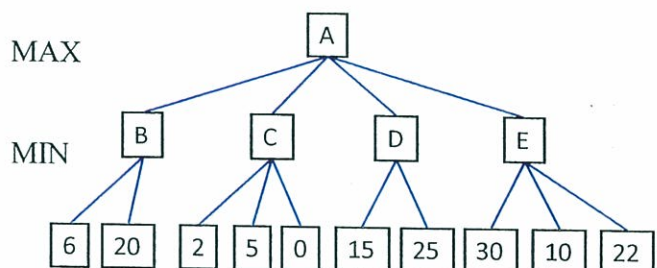
1. [15%] Given the map below, we want to find a path from K to R. Consider only graph search, i.e., each state is visited at most once in the search process. For equally preferred nodes, generate and expand them in alphabetical order.

- (a) [4%] List the states expanded, in the correct order, if we use breadth-first search (BFS). What is the solution path?
- (b) [4%] List the states expanded, in the correct order, if we use uniform-cost search. What is the solution path?
- (c) [4%] Show the process of A* search with the straight-line distance as heuristic. What is the solution path?
- (d) [3%] Does iterative-deepening search (IDS) yields the same path as BFS? If yes, then what is the advantage of using IDS instead of BFS?



2. [10%] Here is a 2-ply game tree with values of the evaluation function shown for the leaf nodes. It is now the turn of MAX to make a move.

- (a) Give the minimax values of all the non-leaf nodes in this game tree.
- (b) According to (a), which action should MAX take?
- (c) When α - β pruning is used, determine which of the nodes won't be checked. (The order of node checking is left to right.)



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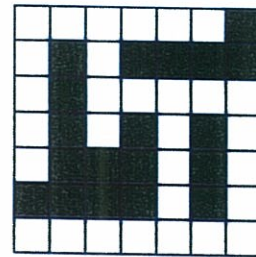
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3. [10%] Crossword puzzle is a very popular word game.

A player has to fill in the blanks so that the letters in each set of vertically or horizontally consecutive blanks form an English word. Usually hints are provided for the words, but we will ignore hints in this problem. An example crossword puzzle is shown below together with a possible solution (note: Solution is not unique without hints).



S	L	E	I	G	H				
A		O							
N		N	O	R	T	H			
T		S		O		O			
A				U		L			
				N		L			
H	O	L	I	D	A	Y			

Consider the following two options for formulating a crossword puzzle as a constraint satisfaction problem (CSP):

Option 1: Treat each blank as a variable (resulting in 30 variables in the example).

Option 2: Treat each set of vertically or horizontally consecutive blanks as a variable (resulting in 7 variables in the example).

Now, answer the questions below:

- [3%] For Option 1, clearly specify the domain of the variables and the constraints. You need to state the constraints using your variables, not just the general game rule.
- [3%] Repeat (a) for Option 2.
- [2%] Name a common heuristic used when solving CSPs with search, and give an example of how it can be applied to the problem here (use either options above).
- [2%] Provide a brief discussion on which formulation might be better for finding a solution computationally. You only need to be reasonable.

4. [15%] Consider the snapshot (shown to the right) of a (4x4) minesweeper game. Let A, B, C, D and E be propositional symbols representing whether mines exist at their locations.

- [5%] Write down the propositional logic sentences according to the game rule, that is, a number at a location indicates the count of mines among its 8 neighboring locations.
- [5%] Convert the sentences to conjunctive normal form.
- [5%] Try to determine their truth values by repeatedly applying the resolution inference rule.

1	A	B	C
2	2	2	1
D	1		
E	1		