師大資工三 人工智慧 期中考(2021-04-22) Ch1~4

請將答案一律寫入另一張「答案紙」中，**請依序做答**。考畢交回「答案紙」即可。

一、(2 分) 以下那一個敘述最接近 strong AI 的定義？_____ (單選題)

(a) A computer program that produces the strongest possible rational for a decision.

(b) A computer program that models human cognitive reasoning.

(c) A computer program that can outperform a human on the Turing test.

(d) A computer program that can speak Chinese.

二、(2 分) 選擇題：Strong AI

(a) Claims that animals can think. (b) Claims that humans cannot think.

(c) Claims that we can create minds. (d) Claims that humans are machines.

三、(2 分) 選擇題：Deep Blue was the first program to beat a world chess champion. Who did Deep Blue beat in 1997?

(a) Lee Sedol (b) Aja Huang (c) Ke Jie (d) Garry Kasparov

四、(2 分) 選擇題：AlphaGo was the first program to beat a world Go champion. Who did AlphaGo beat in 2016?

(a) Lee Sedol (b) Aja Huang (c) Ke Jie (d) Garry Kasparov

五、(4 分) What is the difference between systems that think rationally and systems that act rationally?

六、(2 分) Thinking Humanly is a view of Artificial Intelligence, where the system

(a) behaves like a human.

(b) thinks in the best possible way.

(c) uses same cognitive processes as a human.

(d) must protect humans from any danger.

七、(3 分)以下敘述是否正確？請說明理由：The Turing test evaluates a computer system's ability to act rationally.

八、(3 分)書上有提到比"Turing test"更進一步的"total Turing test"。請你說明"total Turing test"進一步的要求為何？(提示：Turing's test avoided direct physical interaction between the interrogator and the computer.)

九、(2 分) Which event is considered the "birth" of Artificial Intelligence? _____ (單選題)

(a) The formulation of the Turing test by Alan Turing in 1950.

(b) A workshop in the summer of 1956 at Dartmouth.

(c) The development of the Lisp programming language in 1958.

(d) The victory of the Deep Blue computer system over the chess world champion in 1997.

十、(2 分) The problem of how to express all the knowledge that an AI system needs may be solved in many applications by learning methods rather than hand-coded knowledge engineering, provided the learning algorithms have enough data to go on. Reporters have written that "AI Winter" may be yielding to a new Spring. What is AI Winter?

(a) the time of year when AI researchers meet at a major conference (AAAI).

(b) the period in last century when funding to AI in companies went down.

(c) a winter competition of AI systems.

(d) All Inclusive offer at hotels during winter time.

十一、(2 分) Control theory is

(a) a theory how to control humans.

(b) a theory how to control companies.

(c) a research area about automatic control of artifacts.

(d) a part of economy about running (controlling) companies effectively.

十二、 (12 分) 右圖是一個類神經網路 neuron 的示意圖。

(甲)請問這個 f()一般稱呼為何(請用英文回答)？

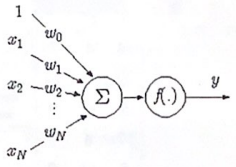
(乙)Sigmoid 是常用的 f()，請繪出函數的形狀。

(丙)請寫出 y 的計算公式。

(丁)請問圖中 w_0 的左邊輸入固定的 1，其目的為何？

(戊)何謂 learning rate？

(己)何謂 mean square error？



十三、 (10 分) 以下是一個 python 的程式：

```
from numpy import *
inp = array([[1, 3, 2]])
weights = array([[4], [2], [-5]])
print(dot(inp, weights))
out = 1 / (1 + exp(-(dot(inp, weights))))
print(out)
```

(a) 請問第一行的 import 它的用途為何？

(b) 請問第四行的 dot 是做甚麼計算？

(c) 請問第四行會輸出的值為何？

(d) 請問第六行會輸出的值為何？

(e) 這個程式有處理 bias 嗎？

十四、(3 分)請說明 episodic task environments 和 sequential task environments 最主要的差異為何。

十五、(5 分)下表中問第二欄中有五個空格，請填空。

	Solitaire (接龍)	Backgammom (西洋雙陸棋戲)	Internet shopping	Taxi
Observable??	FULL		PARTIAL	PARTIAL
Deterministic??	YES		YES	NO
Episodic??	NO		NO	NO
Static??	YES		SEMI	NO
Discrete??	YES		YES	NO

十六、(3 分)考慮一個簡單的自動調溫器，當溫度低於所設定的值三度時，它就會啟動暖氣，一直加熱，直到高於所設定的值三度時，它就會關閉暖氣。接著要等到溫度低於所設定的值三度時，它才會再次啟動暖氣。請問這個自動調溫器是不是一種 model-based reflex agent？請說明你的理由。

十七、(4 分) 試列出網際網路購物代理人的 PEAS。(請至少各寫出一項)

Performance：

Environment：

Actuators：

Sensors：

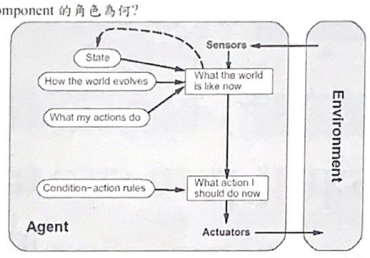
十八、(2 分) If the state at the next instant in time depends *only* on the state at the current time, the task environment is said to be _____?(單選題)

(a) episodic (b) stochastic (c) static (d) deterministic (e) dynamic

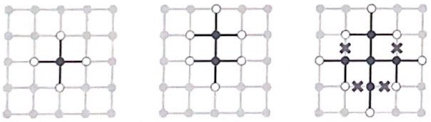
十九、(3 分) 一個 learning agent 包含以下 4 個 components: learning element, performance element, critic, problem generator. 請問其中 critic component 的角色為何?

二十、(2 分) 請問右圖是哪一種 agent 的示意圖?(單選題)

(a) Table-driven-agent
(b) Simple reflex agent
(c) Model-based reflex agent
(d) Goal-based agent
(e) Utility-based agent
(f) Learning agent



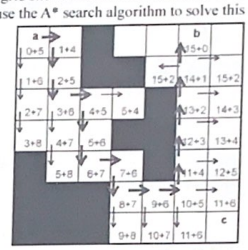
廿一、(7 分)考慮以下 5*5 的 2D grid。其中起點是中間的(3, 3)位置，而 goal state 為右上角位置(1, 5)。此題我們均使用 graph version，也就是已拜訪過的位置不會重覆走入。首先使用 breadth-first search。而節點及每個節點的相鄰的邊的拜訪次序均為 row-major ordering，也就是往上、往左、往右、往下排序。如下所示為前幾個回合的示意圖。打x表示不走那個邊。



Depth=1 Depth=2 Depth=2

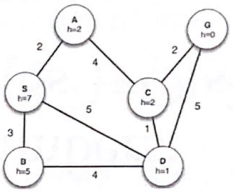
(a) 請問圖中黑色的節點集合可稱為甚麼(請用英文做答)?
(b) 請問圖中白色的節點集合可稱為甚麼(請用英文做答)?
(c) 請問圖中灰色的節點集合可稱為甚麼(請用英文做答)?
(d) 請問branching factor b值是多少?
(e) 請繪出Depth=3的圖。(白色、黑色節點及粗黑邊、x都要標示出來)
(f) 請繪出Depth=4的圖。(白色、黑色節點及粗黑邊、x都要標示出來)
(g) breadth-first search最後找到的solution path如何走?

廿二、(7 分) Consider the path finding problem of the regular 2D grid shown below. The start state "a" is at the origin, (0,0), and the goal state "b" is at (x, y)=(0, 5). We can use the A* search algorithm to solve this problem.



(a) What is the branching factor b in this state space? _____
(b) Is $h_1 = |u - x| + |v - y|$ an admissible heuristic for a state at (u, v)?
(c) Is $h_1 = |u - x| + |v - y|$ a consistent heuristic for a state at (u, v)?
(d) $h_1 = |u - x| + |v - y|$ is called the M_____ distance heuristic for a state at (u, v)? (請填入英文字，首字母是 M)
(e) What is the h_1 value for the state "c" in the right figure?
(f) Is $h_2 = |u - x|$ an admissible heuristic for a state at (u, v)?
(g) Does h_2 dominate h_1?

廿三、(8 分)給定下圖，共有 6 個節點，每個節點的 heuristic function 值以 h=?表示。每個節點的 successors 用 undirected edges(無向邊)表示，其中數字為其 cost。我們想利用 A* search using the heuristic function h 展開此圖，以找出從 S 到 G 的最短路徑之解。我們已將前兩個步驟的結果顯示在下面右方。其中 Open list，由左往右為其優先順序。假設使用 graph search 版本，也就是重覆的節點不會重覆走進去或展開。

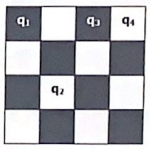


step	Node expanded	g	h	f	parent	Open list
1	S	0	7	7		
2	A	2	2	4	S	A
	B	3	5	8	S	A B
	D	5	1	6	S	A D B

(甲)請將接下來的 step 3、step 4、...等結果接填續入表格下方，一直到找到答案為止。(6 分)
(乙) 請問此例子最後找到的 solution 為何？(2 分)

廿四、(10 分)請利用 IDA* search 展開第廿三題的圖，以找出從 S 到 G 的最短路徑之解。請依節點產生的次序逐步用繪圖的方式表示每一回合的 search tree，並顯示所產生的節點的 f()、g()、h()、及 f-limit scores。

廿五、(6 分) Apply the hill-climbing search to solve the 4-queens problem. Start with the configuration shown right. The heuristic cost function is the number of pairs of queens that are attacking each other. Please trace the hill-climbing search step by step. You can choose randomly among the set of best neighbors. 註：neighbor function 是 queen 可垂直移動。上下移動一隻 queen 就是一個 neighbor。



廿六、(6 分) Simulated Annealing Search是模擬冷卻晶體的算法。If $\Delta E < 0$, it has a probability $e^{\Delta E / T}$ to move to a worse state. 請問其中e、ΔE、T各代表甚麼？

廿七、(2 分) 在 local beam search algorithm 中，如果 k 值設定為∞，則會變成那一種演算法?

廿八、(4 分)假設你使用 genetic algorithm 來解 8-queens problem.

(甲)請執行圖中的 crossover operation on these pairs of chromosomes at the indicated points.請寫出執行後下面兩行的空格內容。

(乙)請問圖中<3, 2, 7, 5, 2, 4, 1, 1>表示的盤面為何？請繪圖表示之。