



Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your legible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

1	Student Number	2304723
2	Title of Examination Paper	Artificial Intelligence
3	Module Code	ACC A7026
4	Date and Time of Examination	05/08/2024 09:00 ~ 11:00
5	Examination Venue	1Q 310
6	Seat Number	22
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
Question 2	17.5
Question 3	20
Question 4	32.5
Total	70

87.5% ✓

87.5%

Section A

Question 2:

2.1.

A* algorithm is suitable for finding the shortest path with known cost.

~~For factor i~~

Considering factor i, "Connect Four Game" has large branching factor, and the space complexity of A* is $O(b^d)$, so A* algorithm will need more memory space to store data.

Considering factor ii, A* algorithm can not obstruct potentially winning lines because it just ~~explores~~ explores the current smallest cost path.

Considering factor iii, "Connect Four Game" has incomplete information while A* algorithm selects nodes by calculating known costs of path.

Considering factor iv, because the dynamic nature of the game, after nodes selected by A* algorithm, the cost of path may will be changed, and this will make it difficult to choose next node. *free heuristic*

2.2.

MCTS is suitable for changing environment and dynamic obstacles because it can adapt and learn from simulation and exploration.

Considering factor i, MCTS makes choices by statistics but not complete information, so large branching factor and complex game state will not impact the efficiency of MCTS. *free expansion, simulated, backprop*

Considering factor ii, MCTS will simulate and explore next state, so MCTS just fits to the requirement of strategy.

Considering factor iii, MCTS will simulate the movements by opponents, and backpropagate this information to make movements. *Probabilistic simulation*

Considering factor iv, MCTS is ideal for solving

problems in dynamic environment because it can adapt and learn from simulation and exploration.

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Section A Question 3.

3.1. The UCB is used for MCTS node selection during the traversal phase.

So choose Formula: $UCB(s_i) = v_i + C \sqrt{\frac{\ln N}{n_i}}$

$$\text{So } UCB = 0.8 + 1.5 \times \sqrt{\frac{\ln 80}{15}} \\ = 0.8 + 0.81 = 1.61$$

3.2.

3.2.1

i) supervised learning

ii) There must be datas with labels of unauthorized and authorized. So it's more suitable for supervised learning.

3.2.2.

i) Unsupervised learning labels

ii) There are not identified ~~labels~~, and it is a clustering task. So it's more suitable for unsupervised learning

3.2.3.

i) Unsupervised learning

ii) It's a clustering and association task. So it's more suitable for unsupervised learning.

3.2.4.

i) Reinforcement learning

ii) Optimizing is more suitable for reward based algorithm. If it meets customer demand, then gives positive reward.

Question 4.

4.1

Stage 1: Data Preparation: handling the missing values and splitting dataset into training and testing.

Stage 2: Define network of architecture: define number of layers and neurons. Define activation function.

Stage 3: Initialize and compile model: create model instance, compile model by loss function and optimizer. Initiate random weights and bias.

Stage 4: Train Model: fit model on training data, set number of epochs and batch size. Ensure the process of training is covering and not overfitting.

Stage 5: Model Evaluation: use metrics such as accuracy, precision, recall and F1 score to evaluate the trained model on test data.

Stage 6: Fine-tune: adjust hyperparameters for the best performance.

Stage 7: Predict and Deployed: predict the chance of admission.

4.2

4.2.1

The dimension of data is 7, and the dimension of ~~feature~~ input feature is 6, and the dimension of ~~label~~ label is 1.

4.2.2.

Number of columns with missing values is 0.

4.2.3.

i) The missing values do not impact significantly on the analysis.

ii) The missing values are distributed a very small percentage of the dataset.

4.3.

The objective of predicting student admissions can be considered as a binary classification problem. Because you only need to predict whether the applicant is accepted or rejected, which will be represented by '1' and '0'.

Chance of Admission: (0 or 1) is the class.

Features of this task are: GRE Score, TOEFL Score, University Rating, SOP, LOR, CGPA and Research.

4.4.

Because it is a binary classification problem, the best output activation function will be Sigmoid Function. After hidden layers, the Sigmoid Function will control the output being '0' or '1', which represent rejected or accepted.

4.5.

Overfitting means that proposed ANN model only performs well in training data but poorly in test data.

Proposed model only accurately predict the chance of admission on training data, but has low precision on real-world data.

4.6.

4.6.1.

		Predict	
		Accepted	Rejected
Actual	Accepted	TP	FN
	Rejected	FP	TN

TP = 150

FN = 15

FP = 30

TN = 5

4.6.2.

$$\text{Precision} = \frac{TP}{TP+FP} = \frac{150}{150+30} = \frac{5}{6} = 0.83333$$

$$\text{Recall} = \frac{TP}{TP+TN} = \frac{150}{150+5} = \frac{30}{31} = 0.96774$$

$$\text{F1-Score} = \frac{2 \cdot \text{Precision} \cdot \text{Recall}}{\text{Precision} + \text{Recall}} = \frac{2 \times \frac{5}{6} \times \frac{30}{31}}{\frac{5}{6} + \frac{30}{31}} = \frac{60}{67} = 0.89552$$

$$\begin{array}{r} 245325 \\ \hline 40 \end{array}$$

Agree.