



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 ignore illegible script or have the script re-typed at 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	1800433
2	Title of Examination Paper	Machine Learning and AI
3	Module Code	ACC A6011
4	Date and Time of Examination	08/07/2024 9:00 AM
5	Examination Venue	IA 310
6	Seat Number	601
7	Number of Answer Books handed in	1

(Gweler yr ochr arall am y fersiwn Cymraeg)

List the numbers of the questions you have attempted	1	2	4
Office Use	23/25	17.5/25	10/25
Total	50.5		

Complete, fold and seal
(see note 2 below)

SURNAME: Dylic

FORENAME(S): Iwan

50.5
75
= 67%
Agood

50.5
75
= 67%

75

Question 1:

Win | 4/15

Loss | 6/15

- a) Your Skill = Medium | 4/9
 Opponents Skill = High | 2/9
 Opponents Ranking = Normal | 6/9
 Your Ranking = High | 3/9

$$\frac{20}{20}$$

$$\text{Win} = \left(\frac{4}{9} \times \frac{2}{9} \times \frac{6}{9} \times \frac{3}{9} \right) \times \frac{9}{15}$$

$$\left(\frac{16}{729} \right) \times \frac{9}{15} = \frac{16}{1215} = \underline{\underline{0.0132}}$$

$$\frac{20}{20}$$

$$\text{Loss} = \left(\frac{16}{729} \right) \times \frac{6}{15} = \frac{32}{3645} = 0.009$$

It is more likely that a Win would occur

Question 1

13) Naïve Bayes relies on all features being mutually exclusive. A crude method of removing small probability values would be to multiply each probability by a factor of 10, whether that be 10 or 100. This would have to be done on all outputs otherwise it would screw the results.

$$\frac{3}{5}$$

$$\frac{23}{25}$$

3/5
of
doubt
each
output.

$$\frac{23}{25}$$

Question 2

a) Hill climbing is a search method which involves iterating over an algorithm to find the most efficient method. It does this by iterating doing small adjustments one per iteration. This can be a long process and can run ~~interminably~~ indefinitely. To stop this a termination condition can be used. If the algorithm runs indefinitely it will eventually reach a plateau. As seen in Figure 1.

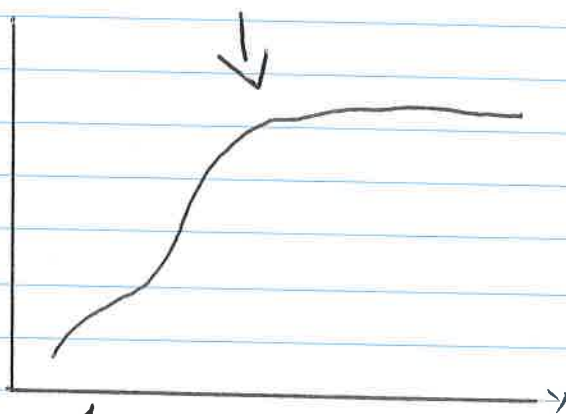


Figure 1.

After this point no more optimisable adjustments can be made. Depending on the data set used to run this search will depend on how long each iteration takes. Using a smaller test data set can speed up the process but may not provide the best solution. Hill climbing also ~~uses~~ uses a tree format based on its single change rule. A potential drawback is the solution it lands on at the end might not be the best overall. This is shown in Figure 2.

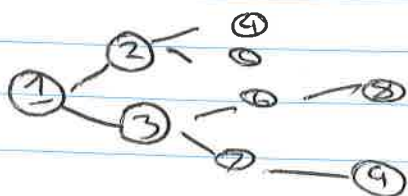


Figure 2.

Solution 4 might be the best option but if the algorithm decides to adjust solution ③ it may not reach the same conclusion.

Question 2:

b) Potential pseudocode for a genetic learning algorithm is as follows:

~~*/~~ = Comment

Generate Random list of algorithms

Initialise Ag Seed (42)

Initialise Run Counter = 0

Once a list of algorithms has been generated

begin a loop

While Terminate < 1 Continue

Select the top fitness rated algorithms
For Crossover

~~Select Ag~~

Loop Start

Select Top 2 Ag Where Max (Fitness)

Apply a Crossover of the two selected

Crossover Ag 1 + Ag 2 output = Ag 3

Once a new algorithm based on the two

* Chosen is selected mutate

Mutate Ag 3

This creates a new algorithm based
on the two with the highest fitness
ratings. This then replaces the least highest
in the list.

Replace ~~Ag~~ min(Ag) with Ag 3

Question 2

- b) * once this is done we check against
 * the termination condition. In our case
 * we have used number of runs.

Run Counter + 1

IF Run Counter = 6

Then go to end

Else

go to Loop Start

End

Terminate

c) Parent 1: 1 4 3 8 5 4 1 9
 Parent 2: 3 7 4 1 9 6 3 2

Child 1: 1 7 4 1 9 4 1 9

Child 2: 3 4 3 8 5 6 3 2 ✓

- d) Fitness Function = ~~$f(x) = (a+b) - (c-e+d) - g + f + h$~~
 $F(x) = (a+b) - (c-e+d) - g + f + h$

	a	b	c	d	e	f	g	h
Child 1	1	7	4	1	9	4	1	9
Child 2	3	4	3	8	5	6	3	2

Child 1:

$$(1+7) - (4-9+1) - 1 + 4 + 9 = 24$$

Child 2:

$$(3+4) - (3-5+8) - 3 + 6 + 2 = 6$$

Child 1 has the highest fitness score.

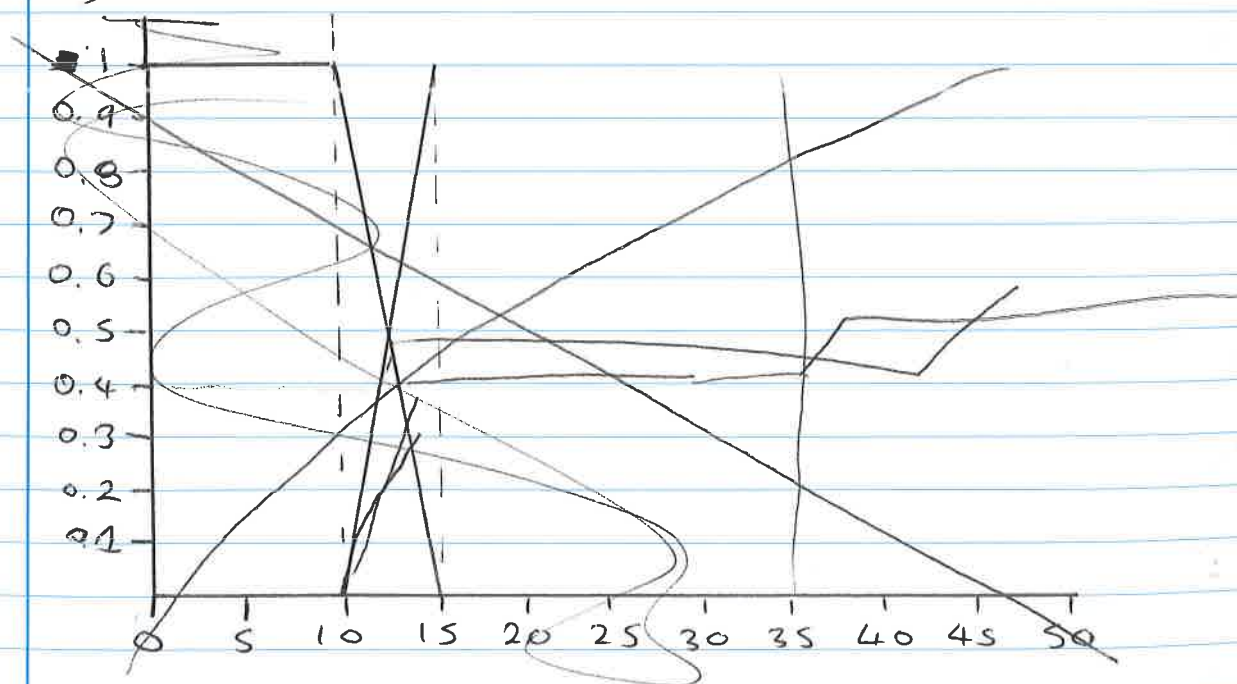
$$F_2 = \frac{17.5}{25}$$

Question 4

a) A Fuzzy logic system maps out the predicted values based on degrees of membership and confidence scores. It finds the overlapping scores and then provides a confidence score.

b) one method of defuzzification is Centroid defuzzification. Another method would be clustering using k-means. Clustering data together based on values. I would choose centroid fuzzification as it provides the most accurate results. It may be a longer process but in the example of diagnosing patients accuracy over efficiency is warranted.

c)



Question 4

c) Rule 1

IF breathlessness is frequent
or wheeziness is severe

Then Confidence is high

Rule 2

IF breathlessness is moderate

AND Wheeziness is mild

THEN Confidence is medium

Rule 3

IF breathlessness is infrequent

THEN Confidence is low

Moderate Breathless :

$$\begin{cases}
 0 & x \leq 10 \\
 \frac{12-10}{15} = \underline{\underline{0.4}} & 10 < x \leq 15 \\
 1 & 15 \leq x \leq 25 \\
 \frac{30-12}{5} = 3.6 & 25 < x \leq 30
 \end{cases}$$

Infrequent Breathless :

$$1 \quad x \leq 10$$

$$\frac{15-12}{5} = \underline{\underline{0.6}} \quad 10 < x \leq 15$$

$$0 \quad x > 15$$

Question 4

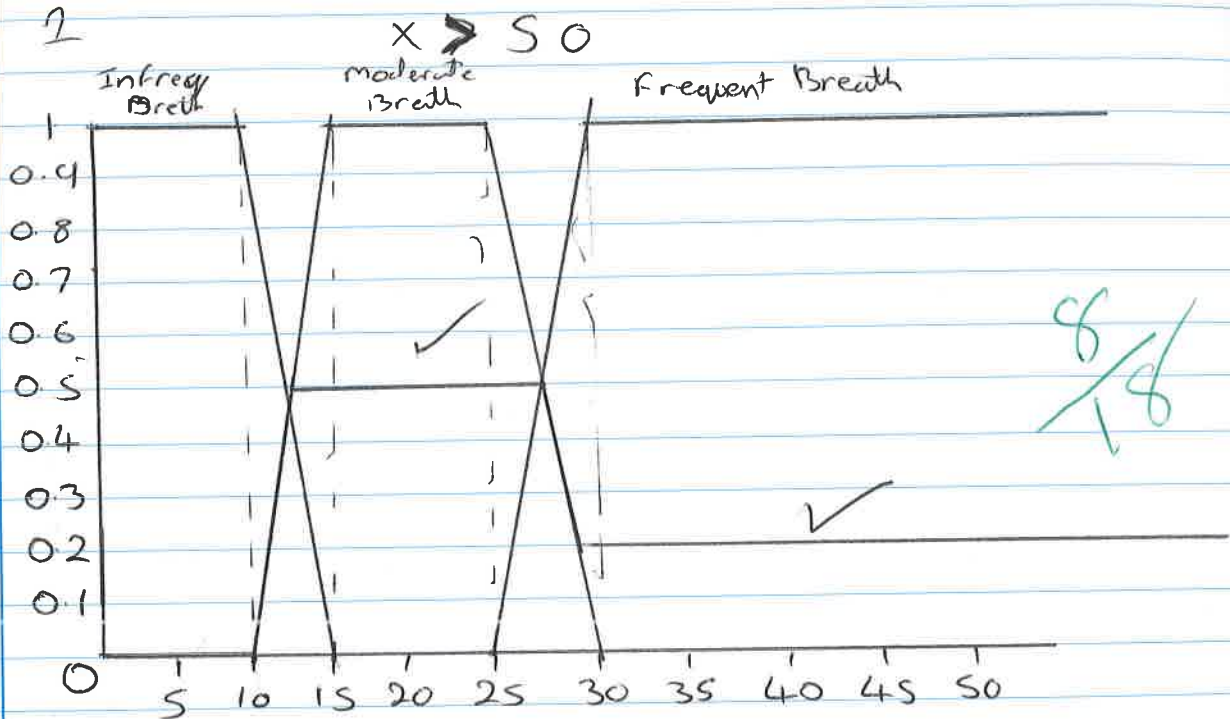
c)

Frequent breathless

$$0 \quad x \leq 25$$

$$\left\{ \frac{12 - 25}{25} = 0.52 \quad 25 < x \leq 50 \right.$$

2



Mild Wheeze

$$\left\{ \begin{array}{ll} 1 & x \leq 5 \\ \frac{7 - 6}{2} = 0.5 & 5 < x \leq 7 \\ 0 & x > 7 \end{array} \right.$$

Severe Wheeze

$$\left\{ \begin{array}{ll} 1 & x > 10 \\ \frac{6 - 5}{5} = 0.2 & 5 < x \leq 10 \\ 0 & x \leq 5 \end{array} \right.$$

10/25