



Prifysgol Cymru
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Examiner Only

Examination Answer Books

12 Pages

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1	Student Number	2101242
2	Title of Examination Paper	Artificial Intelligence & Machine Learning
3	Module Code	ACC6011
4	Date and Time of Examination	From 9:15 8/1/2024
5	Examination Venue	IQ 310
6	Seat Number	10
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

1

$$\begin{aligned}
 a) \quad & P(\text{Win} \cap \text{Your skill medium}) = 4/9 \\
 & P(\text{Win} \cap \text{Opponent's skill high}) = 2/9 \\
 & P(\text{Win} \cap \text{Opponent's rank normal}) = 6/9 \\
 & P(\text{Win} \cap \text{Your rank high}) = 3/9 \\
 & P(\text{Win}) = 9/15
 \end{aligned}$$

$$\begin{aligned}
 \text{Prior Probability of winning with best values} &= 4/9 \times 2/9 \times 6/9 \times 3/9 \times 9/15 \\
 &= 0.012345679 \dots
 \end{aligned}$$

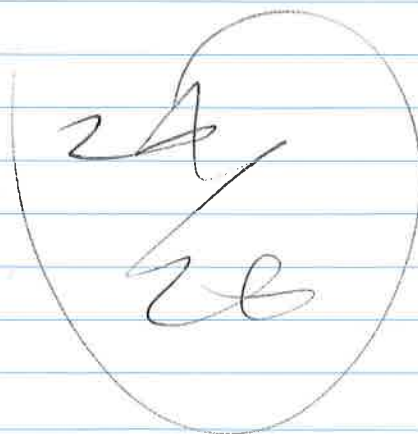
$$\begin{aligned}
 & P(\text{Loss} \cap \text{Your skill medium}) = 1/6 \\
 & P(\text{Loss} \cap \text{Opponent's skill high}) = 2/6 \\
 & P(\text{Loss} \cap \text{Opponent's rank normal}) = 2/6 \\
 & P(\text{Loss} \cap \text{Your rank high}) = 4/6 \\
 & P(\text{Loss}) = 6/15
 \end{aligned}$$

$$\begin{aligned}
 \text{Probability of Losing with best results} &= 1/6 \times 2/6 \times 2/6 \times 4/6 \times 6/15 \\
 &= 0.00493827 \dots
 \end{aligned}$$

Since the probability to win is greater than the probability to lose with given best values, more likely to win.

b) A method to decrease numerical errors due to the results of naive Bayes being very small is by using logarithmic terms, as the number gets smaller the power just gets more negative.

$$Q1 = \frac{24}{25}$$



2.

- a) A local search is a ^{dependent} ~~and~~ algorithm that runs repeatedly changing the initial values, comparing each new result to find the best until ~~the~~ the algorithm reaches one; or more of its termination protocols. An example of ~~this is~~ a local search is a hill climbing algorithm, ~~where as where as~~ where as the algorithm checks around an initial point ~~a~~ which, the distance is set ~~prior~~ often called the step value where it looks for the ~~greatest~~ highest point it can find in that step as it repeats this until it can no longer go any higher. This is then repeated with a different starting location until the highest point is reached. Problems with hill climbing local search is that the distance moved each step must be ~~decided~~ decided prior so that it's not too small where the algorithm takes a long time to get a result but also not too large as to overshoot any ~~minclines~~ ~~minclines~~. A way to mitigate this is by doing prior test and determine the best value for your algorithm.

4 1/2
74 1/2
7

- b) Firstly the two genotypes must be stored into an ~~array~~ array so that each digit can be change separately. Then a variable for the crossover point (or points if multiple) must be declared as a integer then a loop carried out between the crossover point until the end of the genotype or until the second cross over point. ~~where~~ Where in the loop the respected genes are swapped ~~between~~ between the two parent genotypes. ~~Afterwards~~ Afterwards for the mutation a random point in the genotype is selected where it is ~~changed~~ replaced with a new variable, which is also random.

1 1/2
4

12

7

2.

c) Parent 1: 14385419
Parent 2: 37419632

Child 1: ~~17419419~~ 17419419
Child 2: 34385632

d) $F(x) = (a+b) - (c-e+d) - g + f + h$
 $F(\text{child 1}) = (1+7) - (4-9+1) - 1 + 4 + 9$
 $= 8 + 6 - 1 + 4 + 9 = 26$
 $F(\text{child 2}) = (3+4) - (3-5+8) - 3 + 6 + 2$
 $= 7 - 6 - 3 + 6 + 2 = 6$

Therefore Child 1 is the more optimized genotype as its fitness value is higher. I am assuming that my answer in part 'c' is correct.

The maximum value of the fitness function is:

$F(\text{highest}) = (9+9) - (0-9+0) - 0 + 9 + 9$
 $= 18 + 9 + 9 + 9 = 45$

Genotype: 99009909

The reasoning for this answer is that this genotype maximizes the positive in the fitness function whilst also minimizing the negative values.

$Q2 = \frac{20}{25}$

$DL = \frac{26}{28}$

4.

- a) There are four main steps in a fuzzy logic expert system. The first is to ~~fuzzyfy~~ ^{fuzzyfy} the values which is you use the rules to ~~plot the values of the experiment on a graph~~ get the correlation which each rule using the example value. Next step is to put ~~the plot~~ ^{the} results of the graph to membership functions on the graph to ~~the~~ the maximum values. next is to apply the results of the rules to see how your ~~example~~ correlates to each membership function. Lastly is to defuzzyfy the by adding the weight of each point and ~~divide~~ ^{divide} by how many points are on each membership function. This will get the average result.

$$Q4b = \frac{0}{3}$$

$$\frac{0}{3}$$

c) Rule 1

IF ~~and~~ frequent breathlessness 0
 OR Severe wheeziness 0.2
 THEN high confidence 0.2

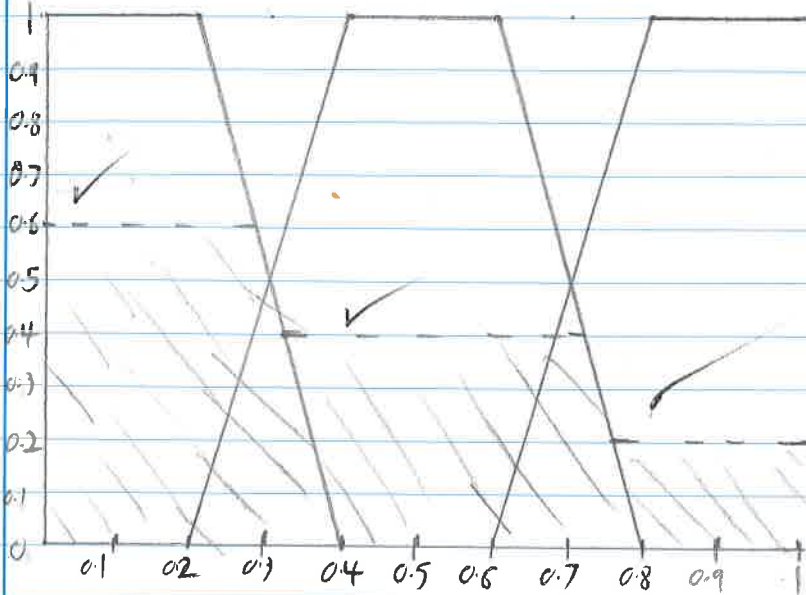
Rule 2

IF moderate breathlessness 0.4
 AND mild wheeziness 0.5
 Then medium confidence 0.4

Rule 3

IF infrequent breathlessness 0.6
 Then low confidence 0.6

4.
d)



$$\text{Level of Confidence} = \cancel{(0.1+0.2)0.6} + \cancel{(0.3)0.5} + \cancel{(0.4+0.5+0.6+0.7)}0.4 + \cancel{(0.8+0.9+1)0.2}$$

$$= (0+0.1+0.2)0.6 + (0.3)0.5 + (0.4+0.5+0.6+0.7)0.4 + (0.8+0.9+1)0.2$$

$$(3 \times 0.6) + (0.5) + (4 \times 0.4) + (3 \times 0.2)$$

$$= 0.18 + 0.15 + 0.88 + 0.54$$

$$1.8 + 0.5 + 1.6 + 0.6$$

$$\cancel{4.5} \text{ (Step)} = \frac{1.75}{4.5} = 0.38$$

$$\frac{16}{18}$$

$$\frac{16}{18}$$

$$Q4: \frac{18\frac{1}{2}}{25}$$

$$\frac{18\frac{1}{2}}{25}$$

Q4