**CAP4630 Introduction to Artificial Intelligence**

**Homework 7 (5 pts, Due Dec 5 2022)**

[Homework solutions must be submitted through Canvas. No email submission is accepted. Only pdf, word, and txt files are allowed. If you have multiple pictures, please include all pictures in one Word/pdf file. You can always update your submissions before due date, but only the latest version will be graded.]

**Question 1 [1 pt]:** Given the following knowledge base of Horn clauses, please draw the corresponding AND-OR graph [0.5 pt]. Please using PL-FC-ENTAIL?(KB, q) to check whether KB╞Q is true or not (show your solutions [0.5 pt])

S1 ⇒ S2; IS true iff S1 is false or S2 is true

S1 ⇒ S2; IS false iff S1 is true and S2 is false

C∧P⇒Q;

B∧L∧M⇒ P;

A∧L⇒M;

A∧B⇒L;

A; B; C;

Please see image below for Solution proving Q is True.

Diagram

Description automatically generated with medium confidence

**Question 3 [2 pts]:** In database showing in Table 1,

* Please calculate the Entropy of the whole dataset (0.5 pt).

Please see the image below the table for my work.

* Use information gain to determine which attribute has the highest Information Gain (1 pt) (List major steps)

The Outlook attribute has the highest information gain. Please see the image below the table for my work.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Outlook | Temperature | Humidity | Wind | Class |
| 1 | Sunny | Hot | High | Weak | No |
| 2 | Sunny | Hot | High | Strong | No |
| 3 | Overcast | Hot | High | Weak | Yes |
| 4 | Rain | Mild | High | Weak | Yes |
| 5 | Rain | Cool | Normal | Weak | Yes |
| 6 | Rain | Cool | Normal | Strong | No |
| 7 | Overcast | Cool | Normal | Strong | Yes |
| 8 | Sunny | Mild | High | Weak | No |
| 9 | Sunny | Cool | Normal | Weak | Yes |
| 10 | Rain | Mild | Normal | Weak | Yes |
| 11 | Sunny | Mild | Normal | Strong | Yes |
| 12 | Overcast | Mild | High | Strong | Yes |
| 13 | Overcast | Mild | Normal | Weak | No |
| 14 | Rain | Hot | High | Strong | Yes |
| 15 | Rain | Mild | High | Strong | No |

**Text

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**Question 4 [2 pts]:** In the dataset showing in Table 1,

* please use Gini Index to calculate the Gini index split score of each of the four attributes (outlook, temperature, humidity, wind), respectively (List major steps) [1.5 pt] (this score also denotes correlation each attribute to the class label).

Please see the image below the table for my work.

* Please rank and select the most important attribute to build the root node of the decision tree [0.5 pt].

Outlook will be the root node, followed by Humidity, Temperature, and then Wind.

Please see the image below the table for my work.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Outlook | Temperature | Humidity | Wind | Class |
| 1 | Sunny | Hot | High | Weak | No |
| 2 | Sunny | Hot | High | Strong | No |
| 3 | Overcast | Hot | High | Weak | Yes |
| 4 | Rain | Mild | High | Weak | Yes |
| 5 | Rain | Cool | Normal | Weak | Yes |
| 6 | Rain | Cool | Normal | Strong | No |
| 7 | Overcast | Cool | Normal | Strong | Yes |
| 8 | Sunny | Mild | High | Weak | No |
| 9 | Sunny | Cool | Normal | Weak | Yes |
| 10 | Rain | Mild | Normal | Weak | Yes |
| 11 | Sunny | Mild | Normal | Strong | Yes |
| 12 | Overcast | Mild | High | Strong | Yes |
| 13 | Overcast | Mild | Normal | Weak | No |
| 14 | Rain | Hot | High | Strong | Yes |
| 15 | Rain | Mild | High | Strong | No |

**Table 1**

**A picture containing text, receipt

Description automatically generated**