CS534 - HW 1

Keith Chester

Due date: June 12 2022

Problem 1

Problem 2

In this problem we are exploring a first-order logical knowledge base and writing out logical expressions utilizing it. The knowledge base is represented as:

- CopyOf(d, a) - Predicate - Disk d is a copy of album a
- Owns(p, d) - Predicate - Person p owns disk d
- Sings(p, s, a) - Predicate - Album a inludes a recording of song s sung by person p
- Wrote(p, s) - Person p wrote song s

We are also injecting the following constants:

- $McCartney$ - a person
- $Gershwin$ - a person
- $BHoliday$ - a person
- Joe - a person
- $EleanorRigby$ - a song
- $TheManILove$ - a song
- $Revolver$ - an album

Within this, we express the following statements using first-order logic:

(a) Wrote$(Gershwin, TheManILove)$

(b) $\neg$ Wrote$(Gershwin, EleanorRigby)$

(c) Wrote$(Gershwin, TheManILove) \wedge$ Wrote$(McCartney, TheManILove)$

(d) $\exists s$ Wrote(Joe, s)

(e) Owns$(Joe, d) \wedge$ CopyOf$(d, Revolver)$

(f) $\forall s$ Sings$(McCartney, s, Revolver) \Rightarrow$ Wrote$(McCartney, s)$

(g) $\forall s$ Sings$(p, s, Revolver) \neg$ Wrote$(Gershwin, s)$

(h) $\forall s$ Wrote$(Gershwin, s) \Rightarrow$ Sings(p, s, a)

(i) $\exists a \forall s$ Wrote(Joe, s)

(j) Owns$(Joe, d) \wedge$ CopyOf$(d, a) \wedge$ Sings$(BHoliday, s, a)$

(k) $\exists d_i$ CopyOf$(d_i, a) \forall a$ Sings$(McCartney, a, s) \rightarrow \forall$ Owns(Joe, d)

(l) $\exists d$ CopyOf$(d, a) \forall a$ Sings$(BHoliday, s, a) \rightarrow$ Owns(Joe, d)

Problem 3

In this queston, we are looking at the following table of three binary input atributes, and a singular binary output:

Example	A_1	A_2	A_3	Output y
x_1	1	0	0	0
x_2	1	0	1	0
x_3	0	1	0	0
x_4	1	1	1	1
x_5	1	1	0	1

a.

Using the Gini Index, we aim to create a decision tree for this data.

b.

Now we utilize Information Gain to create a decision tree for this data.

Problem 4

In this section, we consider the following dta input with six inputs and a singular target output:

Example	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_10	A_11	A_12	A_13	A_14
x_1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
x_2	0	0	0	1	1	0	0	1	1	0	1	0	1	1
x_3	1	1	1	0	1	0	0	1	1	0	0	0	1	1
x_4	0	1	0	0	1	0	0	1	0	1	1	1	0	1
x_5	0	0	1	1	0	1	1	0	1	1	0	0	1	0
x_6	0	0	0	1	0	1	0	1	1	0	1	1	1	0
T	1	1	1	1	1	1	0	1	0	0	0	0	0	0