LAB – 04 - EXECUTION

3 DATASETS:-

Weather.csv

sky	air temp	humidity	wind	water	forecast	enjoy sport
sunny	warm	normal	strong	warm	same	yes
sunny	warm	high	strong	warm	same	yes
rainy	cold	high	strong	warm	change	no
sunny	warm	high	strong	cool	change	yes

Book-citation.csv

citations	size	inLibrary	price	editions	buy
some	small	no	affordable	many	no
many	big	no	expensive	one	yes
some	big	always	expensive	few	no
many	medium	no	expensive	many	yes
many	small	no	affordable	many	yes

Health.csv

nose	cough	skin	class
running nose	coughing	red skin	yes
running nose	coughing	normal	yes
running nose	normal	red skin	no
normal	coughing	red skin	no
normal	normal	red skin	no
normal	normal	normal	no

1. **FIND-S ALGORITHM**

```
# imports

import pandas as pd
import numpy as np
```

```
# getting the data from the csv file
data = pd.read_csv("health.csv")
print(data)
print("\n-----------------------------------------------------\n")

#getting the attributes outside
attr = np.array(data)[:,:-1]
print("The attributes are: \n",attr)
print("\n-----------------------------------------------------\n")

#segragating the target that has positive and negative examples
target = np.array(data)[:,-1]
print("The target is: \n",target)
print("\n-----------------------------------------------------\n")
```

```
#training function to implement find-s algorithm
def train(attr,target):
    for i, val in enumerate(target):
        if val == "yes":
            specific_hypothesis = attr[i].copy()
            break

    for i, val in enumerate(attr):
        if target[i] == "yes":
            for x in range(len(specific_hypothesis)):
                if val[x] != specific_hypothesis[x]:
                    specific_hypothesis[x] = '?'
                else:
                    pass

    return specific_hypothesis
```

```
#obtaining the final hypothesis
print("n The final hypothesis is:",train(attr,target))
```

Output:-

Weather.csv:-

```
     sky air temp humidity    wind water forecast enjoy sport
0  sunny     warm   normal  strong  warm     same         yes
1  sunny     warm     high  strong  warm     same         yes
2  rainy     cold     high  strong  warm   change          no
3  sunny     warm     high  strong  cool   change         yes

---------------------------------------------------------

The attributes are:
 [['sunny' 'warm' 'normal' 'strong' 'warm' 'same']
 ['sunny' 'warm' 'high' 'strong' 'warm' 'same']
 ['rainy' 'cold' 'high' 'strong' 'warm' 'change']
 ['sunny' 'warm' 'high' 'strong' 'cool' 'change']]

---------------------------------------------------------

The target is:
 ['yes' 'yes' 'no' 'yes']

---------------------------------------------------------
```

```
The final hypothesis is: ['sunny' 'warm' '?' 'strong' '?' '?']
```

Book-citation.csv

```
  citations    size inLibrary       price editions  buy
0      some   small        no  affordable     many   no
1      many     big        no   expensive      one  yes
2      some     big    always   expensive      few   no
3      many  medium        no   expensive     many  yes
4      many   small        no  affordable     many  yes

-------------------------------------------------------

The attributes are:
 [['some' 'small' 'no' 'affordable' 'many']
 ['many' 'big' 'no' 'expensive' 'one']
 ['some' 'big' 'always' 'expensive' 'few']
 ['many' 'medium' 'no' 'expensive' 'many']
 ['many' 'small' 'no' 'affordable' 'many']]

-------------------------------------------------------

The target is:
 ['no' 'yes' 'no' 'yes' 'yes']

-------------------------------------------------------
```

```
The final hypothesis is: ['many' '?' 'no' '?' '?']
```

Health.csv

```
          nose     cough      skin class
0  running nose  coughing  red skin   yes
1  running nose  coughing    normal   yes
2  running nose    normal  red skin    no
3        normal  coughing  red skin    no
4        normal    normal  red skin    no
5        normal    normal    normal    no

-------------------------------------------------------

The attributes are:
 [['running nose' 'coughing' 'red skin']
 ['running nose' 'coughing' 'normal']
 ['running nose' 'normal' 'red skin']
 ['normal' 'coughing' 'red skin']
 ['normal' 'normal' 'red skin']
 ['normal' 'normal' 'normal']]

-------------------------------------------------------

The target is:
 ['yes' 'yes' 'no' 'no' 'no' 'no']

-------------------------------------------------------
```

```
The final hypothesis is: ['running nose' 'coughing' '?']
```

2. CANDIDATE ELIMINATION ALGORITHM

```
import numpy as np
import pandas as pd

concepts = []

data = pd.read_csv('health.csv')

concepts = np.array(data.iloc[:,0:-1])
print("\nInstances are:\n",concepts)

target = np.array(data.iloc[:,-1])
print("\nTarget Values are: ",target)
```

```
def learn(concepts, target):

    specific_h = concepts[0].copy()
    print("\nInitialization of specific_h and genearal_h")

    print("\nSpecific Boundary: ", specific_h)
    general_h = [["?" for i in range(len(specific_h))] for i in range(len(specific_h))]

    print("\nGeneric Boundary: ",general_h)

    for i, h in enumerate(concepts):
        print("\nInstance", i+1 , "is ", h)

        if target[i] == "yes":
            print("Instance is Positive ")
            for x in range(len(specific_h)):
                if h[x]!= specific_h[x]:
                    specific_h[x] ='?'
                    general_h[x][x] ='?'

        elif target[i] == "no":
            print("Instance is Negative ")
            for x in range(len(specific_h)):
                if h[x]!= specific_h[x]:
                    general_h[x][x] = specific_h[x]
                else:
                    general_h[x][x] = '?'

        print("Specific Bundary after ", i+1, "Instance is ", specific_h)
        print("Generic Boundary after ", i+1, "Instance is ", general_h)
        print("\n")

    indices = [i for i, val in enumerate(general_h) if val == ['?', '?', '?', '?', '?', '?']]
    for i in indices:
        general_h.remove(['?', '?', '?', '?', '?', '?'])
    return specific_h, general_h
```

```
s_final, g_final = learn(concepts, target)

print("Final Specific_h: ", s_final, sep="\n")
print("Final General_h: ", g_final, sep="\n")
```

Output:-

Weather.csv

```
Instances are:
 [['sunny' 'warm' 'normal' 'strong' 'warm' 'same']
 ['sunny' 'warm' 'high' 'strong' 'warm' 'same']
 ['rainy' 'cold' 'high' 'strong' 'warm' 'change']
 ['sunny' 'warm' 'high' 'strong' 'cool' 'change']]

Target Values are:  ['yes' 'yes' 'no' 'yes']
```

```
Initialization of specific_h and genearal_h

Specific Boundary:  ['sunny' 'warm' 'normal' 'strong' 'warm' 'same']

Generic Boundary:  [['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?',
'?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?']]

Instance 1 is  ['sunny' 'warm' 'normal' 'strong' 'warm' 'same']
Instance is Positive
Specific Bundary after  1 Instance is  ['sunny' 'warm' 'normal' 'strong' 'warm' 'same']
Generic Boundary after  1 Instance is  [['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?',
'?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?']]



Instance 2 is  ['sunny' 'warm' 'high' 'strong' 'warm' 'same']
Instance is Positive
Specific Bundary after  2 Instance is  ['sunny' 'warm' '?' 'strong' 'warm' 'same']
Generic Boundary after  2 Instance is  [['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?',
'?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?']]



Instance 3 is  ['rainy' 'cold' 'high' 'strong' 'warm' 'change']
Instance is Negative
Specific Bundary after  3 Instance is  ['sunny' 'warm' '?' 'strong' 'warm' 'same']
Generic Boundary after  3 Instance is  [['sunny', '?', '?', '?', '?', '?'], ['?', 'warm', '?', '?', '?', '?'], ['?', '?', '?',
'?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', 'same']]



Instance 4 is  ['sunny' 'warm' 'high' 'strong' 'cool' 'change']
Instance is Positive
Specific Bundary after  4 Instance is  ['sunny' 'warm' '?' 'strong' '?' '?']
Generic Boundary after  4 Instance is  [['sunny', '?', '?', '?', '?', '?'], ['?', 'warm', '?', '?', '?', '?'], ['?', '?', '?',
'?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?']]


Final Specific_h:
['sunny' 'warm' '?' 'strong' '?' '?']
Final General_h:
[['sunny', '?', '?', '?', '?', '?'], ['?', 'warm', '?', '?', '?', '?']]
```

Book-citation.csv

```
Instances are:
 [['some' 'small' 'no' 'affordable' 'many']
 ['many' 'big' 'no' 'expensive' 'one']
 ['some' 'big' 'always' 'expensive' 'few']
 ['many' 'medium' 'no' 'expensive' 'many']
 ['many' 'small' 'no' 'affordable' 'many']]

Target Values are:  ['no' 'yes' 'no' 'yes' 'yes']
```

```
Initialization of specific_h and genearal_h

Specific Boundary:  ['some' 'small' 'no' 'affordable' 'many']

Generic Boundary:  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'],
['?', '?', '?', '?', '?']]

Instance 1 is  ['some' 'small' 'no' 'affordable' 'many']
Instance is Negative
Specific Bundary after  1 Instance is  ['some' 'small' 'no' 'affordable' 'many']
Generic Boundary after  1 Instance is  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?',
'?', '?', '?', '?'], ['?', '?', '?', '?', '?']]



Instance 2 is  ['many' 'big' 'no' 'expensive' 'one']
Instance is Positive
Specific Bundary after  2 Instance is  ['?' '?' 'no' '?' '?']
Generic Boundary after  2 Instance is  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?',
'?', '?', '?', '?'], ['?', '?', '?', '?', '?']]



Instance 3 is  ['some' 'big' 'always' 'expensive' 'few']
Instance is Negative
Specific Bundary after  3 Instance is  ['?' '?' 'no' '?' '?']
Generic Boundary after  3 Instance is  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', 'no', '?', '?'], ['?',
'?', '?', '?', '?'], ['?', '?', '?', '?', '?']]



Instance 4 is  ['many' 'medium' 'no' 'expensive' 'many']
Instance is Positive
Specific Bundary after  4 Instance is  ['?' '?' 'no' '?' '?']
Generic Boundary after  4 Instance is  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', 'no', '?', '?'], ['?',
'?', '?', '?', '?'], ['?', '?', '?', '?', '?']]



  Instance 5 is  ['many' 'small' 'no' 'affordable' 'many']
  Instance is Positive
  Specific Bundary after  5 Instance is  ['?' '?' 'no' '?' '?']
  Generic Boundary after  5 Instance is  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', 'no', '?', '?'], ['?',
  '?', '?', '?', '?'], ['?', '?', '?', '?', '?']]


  Final Specific_h:
  ['?' '?' 'no' '?' '?']
  Final General_h:
  [['?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', 'no', '?', '?'], ['?', '?', '?', '?', '?'], ['?', '?', '?',
  '?', '?']]
```

Health.csv

```
Instances are:
 [['running nose' 'coughing' 'red skin']
 ['running nose' 'coughing' 'normal']
 ['running nose' 'normal' 'red skin']
 ['normal' 'coughing' 'red skin']
 ['normal' 'normal' 'red skin']
 ['normal' 'normal' 'normal']]

Target Values are:  ['yes' 'yes' 'no' 'no' 'no' 'no']
```

```
Initialization of specific_h and genearal_h

Specific Boundary:  ['running nose' 'coughing' 'red skin']

Generic Boundary:  [['?', '?', '?'], ['?', '?', '?'], ['?', '?', '?']]

Instance 1 is  ['running nose' 'coughing' 'red skin']
Instance is Positive
Specific Bundary after  1 Instance is  ['running nose' 'coughing' 'red skin']
Generic Boundary after  1 Instance is  [['?', '?', '?'], ['?', '?', '?'], ['?', '?', '?']]



Instance 2 is  ['running nose' 'coughing' 'normal']
Instance is Positive
Specific Bundary after  2 Instance is  ['running nose' 'coughing' '?']
Generic Boundary after  2 Instance is  [['?', '?', '?'], ['?', '?', '?'], ['?', '?', '?']]



Instance 3 is  ['running nose' 'normal' 'red skin']
Instance is Negative
Specific Bundary after  3 Instance is  ['running nose' 'coughing' '?']
Generic Boundary after  3 Instance is  [['?', '?', '?'], ['?', 'coughing', '?'], ['?', '?', '?']]



Instance 4 is  ['normal' 'coughing' 'red skin']
Instance is Negative
Specific Bundary after  4 Instance is  ['running nose' 'coughing' '?']
Generic Boundary after  4 Instance is  [['running nose', '?', '?'], ['?', '?', '?'], ['?', '?', '?']]




   Instance 5 is  ['normal' 'normal' 'red skin']
   Instance is Negative
   Specific Bundary after  5 Instance is  ['running nose' 'coughing' '?']
   Generic Boundary after  5 Instance is  [['running nose', '?', '?'], ['?', 'coughing', '?'], ['?', '?', '?']]



   Instance 6 is  ['normal' 'normal' 'normal']
   Instance is Negative
   Specific Bundary after  6 Instance is  ['running nose' 'coughing' '?']
   Generic Boundary after  6 Instance is  [['running nose', '?', '?'], ['?', 'coughing', '?'], ['?', '?', '?']]


   Final Specific_h:
   ['running nose' 'coughing' '?']
   Final General_h:
   [['running nose', '?', '?'], ['?', 'coughing', '?'], ['?', '?', '?']]
```