

```

import numpy as np
import pandas as pd

data=pd.DataFrame(data=pd.read_csv('spory.csv'))
concepts = np.array(data.iloc[:,0:-1])
print("\nInstances are:\n",concepts)
target = np.array(data.iloc[:, -1])
print("\nTarget Values are: ",target)

```

OUTPUT:

```

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']

```

In [4]:

```

def learn(concepts, target):

    specific_h = concepts[0].copy()
    print("\nInitialization of specific_h and general_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] = '?'
```

```
if 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 Boundary 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")
```

Initialization of specific_h and general_h

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

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

Instance 1 is ['sunny' 'warm' 'normal' 'strong' 'warm' 'same']

Instance is Positive

```
Specific Bunday 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 Bunday 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 Boundary 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 Boundary 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', '?', '?', '?', '?']]