```
import pandas as pd
import itertools
```

FIND-S

```
df=pd.read_csv(r'/content/ENJOYSPORT.csv',header=None)
df.drop(0,axis=0,inplace=True)
df.head()
```

	0	1	2	3	4	5	6
1	Sunny	Warm	Normal	Strong	Warm	Same	1
2	Sunny	Warm	High	Strong	Warm	Same	1
3	Rainy	Cold	High	Strong	Warm	Change	0
4	Sunny	Warm	High	Strong	Cool	Change	1

```
row_len,col_len=df.shape
```

```
a=[]
flag=0
for index,row in df.iterrows():
    if(row[col_len-1]=='1' or row[col_len-1]==1):
        if(flag==0):
            flag=1
            a.extend(row[0:col_len-1])
        for i in range(col_len-1):
            if(row[i]==a[i]):
                a[i]==row[i]
            else:
                a[i]='?'
print(a)
```

```
['Sunny', 'Warm', '?', 'Strong', '?', '?']
```

list_then_eleminate

```
The LIST-THEN-ELIMINATE Algorithm
1. VersionSpace <- a list containing every hypothesis in H
2. For each training example, (x, c(x))
           remove from VersionSpace any hypothesis h for which h(x) != c(x)
3. Output the list of hypotheses in VersionSpace
```

getting the version_space

```
new_list=list()
for i in range(col_len-1):
    version_space=set()
    for index,row in df.iterrows():
        version_space.add(row[i])
        version_space.add('$')
        version_space.add('?')
    new_list.append(list(version_space))
new_list
```

```
[['$', 'Sunny', '?', 'Rainy'],
 ['$', 'Warm', '?', 'Cold'],
 ['Normal', '$', 'High', '?'],
 ['Strong', '$', '?'],
 ['$', 'Cool', 'Warm', '?'],
 ['$', 'Same', '?', 'Change']]
```

now let us use a trick of itertools

```
version_space=list(itertools.product(*new_list))
print('total no element in versionSpace',len(version_space))
version_space[:10]
```

```
total no element in versionSpace 3072
[('$', '$', 'Normal', 'Strong', '$', '$'),
 ('$', '$', 'Normal', 'Strong', '$', 'Same'),
 ('$', '$', 'Normal', 'Strong', '$', '?'),
 ('$', '$', 'Normal', 'Strong', '$', 'Change'),
 ('$', '$', 'Normal', 'Strong', 'Cool', '$'),
 ('$', '$', 'Normal', 'Strong', 'Cool', 'Same'),
 ('$', '$', 'Normal', 'Strong', 'Cool', '?'),
 ('$', '$', 'Normal', 'Strong', 'Cool', 'Change'),
 ('$', '$', 'Normal', 'Strong', 'Warm', '$'),
 ('$', '$', 'Normal', 'Strong', 'Warm', 'Same')]
```

```
def apply(key,df):
    for index,row in df.iterrows():
        flag=0
        for i in range(col_len-1):
            if(key[i]=='?' or key[i]==row[i]):
                flag+=1
            else:
                continue
        if(flag==col_len-1 and row[col_len-1]=='1') or (flag!=col_len-1 and row[col_len-1]=='0'):
            continue
        else:
            return 1
    return 0


for i in version_space:
    p=apply(i,df)
    if(p==0):
        print(i)
```

```
('Sunny', 'Warm', '?', 'Strong', '?', '?')
('Sunny', 'Warm', '?', '?', '?', '?')
('Sunny', '?', '?', 'Strong', '?', '?')
('Sunny', '?', '?', '?', '?', '?')
('?', 'Warm', '?', 'Strong', '?', '?')
('?', 'Warm', '?', '?', '?', '?')
```