In [153]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler
from pandas.plotting import scatter_matrix
from sklearn.metrics import classification_report
```

In [154]:

```
df=pd.read_csv("C:\\Users\\USER\\Downloads\\pathway data set1111.csv")
```

In [155]:

```
df.head()
```

Out[155]:

	path	c1	c2	c3	c4	c5	c6	c7	c8	c9	Outcome	Unnamed: 11	Unnamed: 12	Unnamed: 13
0	AKT	5.5	1.5	1.5	1.5	2.5	1.5	3.5	1.5	1.5	no	NaN	NaN	NaN
1	AKT	5.5	4.5	4.5	5.5	7.5	10.5	3.5	2.5	1.5	yes	NaN	NaN	NaN
2	AKT	3.5	1.5	1.5	1.5	2.5	2.5	3.5	1.5	1.5	no	NaN	NaN	NaN
3	AKT	6.5	8.5	8.5	1.5	3.5	4.5	3.5	7.5	1.5	yes	NaN	NaN	NaN
4	AKT	4.5	1.5	1.5	3.5	2.5	1.5	3.5	1.5	1.5	no	NaN	NaN	NaN

In [156]:

```
df=df.drop(["Unnamed: 11"],axis=1)
```

In [157]:

```
df=df.drop(["Unnamed: 12"],axis=1)
```

In [158]:

```
df=df.drop(["Unnamed: 13"],axis=1)
```

In [159]:

```
df
```

Out[159]:

	path	c1	c2	c3	c4	c5	c6	c7	c8	c9	Outcome
0	AKT	5.5	1.5	1.5	1.5	2.5	1.5	3.5	1.5	1.5	no
1	AKT	5.5	4.5	4.5	5.5	7.5	10.5	3.5	2.5	1.5	yes
2	AKT	3.5	1.5	1.5	1.5	2.5	2.5	3.5	1.5	1.5	no
3	AKT	6.5	8.5	8.5	1.5	3.5	4.5	3.5	7.5	1.5	yes
4	AKT	4.5	1.5	1.5	3.5	2.5	1.5	3.5	1.5	1.5	no
5	AKT	8.5	10.5	10.5	8.5	7.5	10.5	9.5	7.5	1.5	yes
6	AKT	1.5	1.5	1.5	1.5	2.5	10.5	3.5	1.5	1.5	yes
7	AKT	2.5	1.5	2.5	1.5	2.5	1.5	3.5	1.5	1.5	no
8	AKT	2.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	5.5	no
9	AKT	4.5	2.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
10	AKT	1.5	1.5	1.5	1.5	1.5	1.5	3.5	1.5	1.5	no
11	AKT	2.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
12	AKT	5.5	3.5	3.5	3.5	2.5	3.5	4.5	4.5	1.5	no
13	AKT	1.5	1.5	1.5	1.5	2.5	3.5	3.5	1.5	1.5	no
14	AKT	8.5	7.5	5.5	10.5	7.5	9.5	5.5	5.5	4.5	yes
15	AKT	7.5	4.5	6.5	4.5	6.5	1.5	4.5	3.5	1.5	yes
16	AKT	4.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
17	AKT	4.5	1.5	1.5	1.5	2.5	1.5	3.5	1.5	1.5	no
18	AKT	10.5	7.5	7.5	6.5	4.5	10.5	4.5	1.5	2.5	yes
19	AKT	6.5	1.5	1.5	1.5	2.5	1.5	3.5	1.5	1.5	no
20	AKT	7.5	3.5	2.5	10.5	5.5	10.5	5.5	4.5	4.5	yes
21	AKT	10.5	5.5	5.5	3.5	6.5	7.5	7.5	10.5	1.5	yes
22	AKT	3.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
23	AKT	8.5	4.5	5.5	1.5	2.5	0.5	7.5	3.5	1.5	yes
24	AKT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	no
25	AKT	5.5	2.5	3.5	4.5	2.5	7.5	3.5	6.5	1.5	yes
26	AKT	3.5	2.5	1.5	1.5	1.5	1.5	2.5	1.5	1.5	no
27	AKT	5.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
28	AKT	2.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
29	AKT	1.5	1.5	3.5	1.5	2.5	1.5	1.5	1.5	1.5	no
...	...	...	...	...	...	...	...	...	...	...	...
570	MTOR	8.5	10.5	4.5	4.5	8.5	10.5	8.5	2.5	1.5	yes
571	MTOR	7.5	6.5	10.5	5.5	3.5	10.5	9.5	10.5	2.5	yes
572	MTOR	3.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no

	path	c1	c2	c3	c4	c5	c6	c7	c8	c9	Outcome
573	MTOR	1.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
574	MTOR	10.5	9.5	7.5	3.5	4.5	2.5	7.5	7.5	1.5	yes
575	MTOR	5.5	1.5	2.5	1.5	2.5	1.5	3.5	1.5	1.5	yes
576	MTOR	5.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	yes
577	MTOR	1.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
578	MTOR	1.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
579	MTOR	1.5	1.5	1.5	1.5	2.5	1.5	3.5	1.5	1.5	no
580	MTOR	5.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	1.5	yes
581	MTOR	5.5	7.5	10.5	6.5	5.5	10.5	7.5	5.5	1.5	yes
582	MTOR	6.5	10.5	5.5	5.5	4.5	10.5	6.5	10.5	1.5	yes
583	MTOR	3.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	1.5	no
584	MTOR	5.5	1.5	1.5	6.5	3.5	1.5	1.5	1.5	1.5	yes
585	MTOR	1.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	1.5	no
586	MTOR	8.5	10.5	10.5	10.5	6.5	10.5	10.5	10.5	1.5	yes
587	MTOR	5.5	1.5	1.5	1.5	2.5	1.5	2.5	2.5	1.5	yes
588	MTOR	9.5	8.5	8.5	9.5	6.5	3.5	4.5	1.5	1.5	yes
589	MTOR	5.5	1.5	1.5	1.5	2.5	1.5	1.5	1.5	1.5	yes
590	MTOR	4.5	10.5	8.5	5.5	4.5	1.5	10.5	1.5	1.5	yes
591	MTOR	2.5	5.5	7.5	6.5	4.5	10.5	7.5	6.5	1.5	yes
592	MTOR	10.5	3.5	4.5	5.5	3.5	10.5	4.5	1.5	1.5	yes
593	MTOR	5.5	1.5	2.5	1.5	2.5	1.5	1.5	1.5	1.5	yes
594	MTOR	4.5	8.5	6.5	3.5	4.5	10.5	7.5	1.5	1.5	yes
595	MTOR	5.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	yes
596	MTOR	4.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	1.5	no
597	MTOR	5.5	1.5	3.5	1.5	2.5	1.5	3.5	1.5	1.5	yes
598	MTOR	3.5	1.5	1.5	1.5	2.5	1.5	2.5	1.5	1.5	no
599	MTOR	5.5	2.5	4.5	1.5	1.5	1.5	1.5	1.5	1.5	yes

600 rows × 11 columns

In [160]:

```
df.path[df.path =="AKT"] =1
df.path[df.path =="FASL"] =2
df.path[df.path =="MAPK"] =3
df.path[df.path =="NOTCH"] =4
df.path[df.path =="SHH"]=5
df.path[df.path =="TNF"] =6
df.path[df.path =="WNT"] =7
df.path[df.path =="MTOR"] =8
print(df)
```

```
    path    c1    c2    c3    c4   c5    c6    c7    c8   c9 Outcome
0      1   5.5   1.5   1.5   1.5  2.5   1.5   3.5   1.5  1.5      no
1      1   5.5   4.5   4.5   5.5  7.5  10.5   3.5   2.5  1.5     yes
2      1   3.5   1.5   1.5   1.5  2.5   2.5   3.5   1.5  1.5      no
3      1   6.5   8.5   8.5   1.5  3.5   4.5   3.5   7.5  1.5     yes
4      1   4.5   1.5   1.5   3.5  2.5   1.5   3.5   1.5  1.5      no
5      1   8.5  10.5  10.5   8.5  7.5  10.5   9.5   7.5  1.5     yes
6      1   1.5   1.5   1.5   1.5  2.5  10.5   3.5   1.5  1.5     yes
7      1   2.5   1.5   2.5   1.5  2.5   1.5   3.5   1.5  1.5      no
8      1   2.5   1.5   1.5   1.5  2.5   1.5   1.5   1.5  5.5      no
9      1   4.5   2.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
10     1   1.5   1.5   1.5   1.5  1.5   1.5   3.5   1.5  1.5      no
11     1   2.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
12     1   5.5   3.5   3.5   3.5  2.5   3.5   4.5   4.5  1.5      no
13     1   1.5   1.5   1.5   1.5  2.5   3.5   3.5   1.5  1.5      no
14     1   8.5   7.5   5.5  10.5  7.5   9.5   5.5   5.5  4.5     yes
15     1   7.5   4.5   6.5   4.5  6.5   1.5   4.5   3.5  1.5     yes
16     1   4.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
17     1   4.5   1.5   1.5   1.5  2.5   1.5   3.5   1.5  1.5      no
18     1  10.5   7.5   7.5   6.5  4.5  10.5   4.5   1.5  2.5     yes
19     1   6.5   1.5   1.5   1.5  2.5   1.5   3.5   1.5  1.5      no
20     1   7.5   3.5   2.5  10.5  5.5  10.5   5.5   4.5  4.5     yes
21     1  10.5   5.5   5.5   3.5  6.5   7.5   7.5  10.5  1.5     yes
22     1   3.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
23     1   8.5   4.5   5.5   1.5  2.5   0.5   7.5   3.5  1.5     yes
24     1   1.5   1.5   1.5   1.5  1.5   1.5   1.5   1.5  1.5      no
25     1   5.5   2.5   3.5   4.5  2.5   7.5   3.5   6.5  1.5     yes
26     1   3.5   2.5   1.5   1.5  1.5   1.5   2.5   1.5  1.5      no
27     1   5.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
28     1   2.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
29     1   1.5   1.5   3.5   1.5  2.5   1.5   1.5   1.5  1.5      no
..   ...   ...   ...   ...   ...  ...   ...   ...   ...  ...     ...
570    8   8.5  10.5   4.5   4.5  8.5  10.5   8.5   2.5  1.5     yes
571    8   7.5   6.5  10.5   5.5  3.5  10.5   9.5  10.5  2.5     yes
572    8   3.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
573    8   1.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
574    8  10.5   9.5   7.5   3.5  4.5   2.5   7.5   7.5  1.5     yes
575    8   5.5   1.5   2.5   1.5  2.5   1.5   3.5   1.5  1.5     yes
576    8   5.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5     yes
577    8   1.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
578    8   1.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
579    8   1.5   1.5   1.5   1.5  2.5   1.5   3.5   1.5  1.5      no
580    8   5.5   1.5   2.5   1.5  2.5   1.5   2.5   1.5  1.5     yes
581    8   5.5   7.5  10.5   6.5  5.5  10.5   7.5   5.5  1.5     yes
582    8   6.5  10.5   5.5   5.5  4.5  10.5   6.5  10.5  1.5     yes
583    8   3.5   1.5   1.5   1.5  2.5   1.5   1.5   1.5  1.5      no
584    8   5.5   1.5   1.5   6.5  3.5   1.5   1.5   1.5  1.5     yes
585    8   1.5   1.5   1.5   1.5  2.5   1.5   1.5   1.5  1.5      no
```

```
586    8   8.5  10.5  10.5  10.5  6.5  10.5  10.5  10.5  1.5     yes
587    8   5.5   1.5   1.5   1.5  2.5   1.5   2.5   2.5  1.5     yes
588    8   9.5   8.5   8.5   9.5  6.5   3.5   4.5   1.5  1.5     yes
589    8   5.5   1.5   1.5   1.5  2.5   1.5   1.5   1.5  1.5     yes
590    8   4.5  10.5   8.5   5.5  4.5   1.5  10.5   1.5  1.5     yes
591    8   2.5   5.5   7.5   6.5  4.5  10.5   7.5   6.5  1.5     yes
592    8  10.5   3.5   4.5   5.5  3.5  10.5   4.5   1.5  1.5     yes
593    8   5.5   1.5   2.5   1.5  2.5   1.5   1.5   1.5  1.5     yes
594    8   4.5   8.5   6.5   3.5  4.5  10.5   7.5   1.5  1.5     yes
595    8   5.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5     yes
596    8   4.5   1.5   2.5   1.5  2.5   1.5   2.5   1.5  1.5      no
597    8   5.5   1.5   3.5   1.5  2.5   1.5   3.5   1.5  1.5     yes
598    8   3.5   1.5   1.5   1.5  2.5   1.5   2.5   1.5  1.5      no
599    8   5.5   2.5   4.5   1.5  1.5   1.5   1.5   1.5  1.5     yes

[600 rows x 11 columns]
```

```
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:1: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  """Entry point for launching an IPython kernel.
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:2: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)

C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:3: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  This is separate from the ipykernel package so we can avoid doing imports
 until
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:4: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  after removing the cwd from sys.path.
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:5: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  """
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:6: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)

C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:7: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  import sys
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:8: SettingW
ithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [161]:

```
df.Outcome[df.Outcome=="no"] =0
df.Outcome[df.Outcome =="yes"] =1
df
```

```
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:1: Settin
gWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy (http://pandas.pydata.or
g/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
  """Entry point for launching an IPython kernel.
C:\Users\USER\Anacondan3\lib\site-packages\ipykernel_launcher.py:2: Settin
gWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy (http://pandas.pydata.or
g/pandas-docs/stable/indexing.html#indexing-view-versus-copy)
```

In [162]:

```
#Lets seperste Data
X=df.iloc[:,:10].values
y=df.iloc[:,10].values
```

In [174]:

```
#standardize the data of X
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
X_scaler=scaler.fit_transform(X)
```

In [211]:

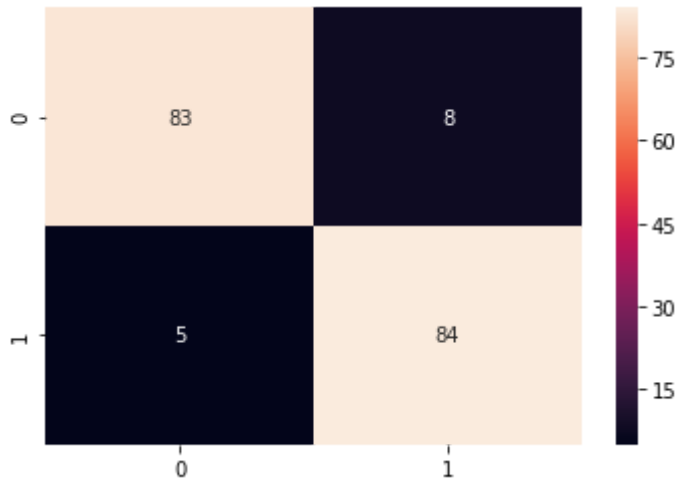
```
#Split Data into train and Test
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix
X_train,X_test,y_train,y_test=train_test_split(X_scaler,y,test_size=0.3,random_state=40)
y=y.astype('int')
```

In [212]:

```
from sklearn import linear_model
model=linear_model.LogisticRegression()
model.fit(X_train,y_train)
prediction=model.predict(X_test)
print("Accuracy = ",model.score(X_test,y_test)*100)
Matrix=confusion_matrix(prediction,y_test)
print("Confusion Matrix :")
print(Matrix)
sns.heatmap(Matrix,annot=True)
plt.show()
sensitivity=(Matrix[0,0]/(Matrix[0,0]+Matrix[0,1]))*100
specificity=(Matrix[1,1]/(Matrix[1,0]+Matrix[1,1]))*100
print("Sensitivity : ",sensitivity)
print("Specificity : ",specificity )
```

```
C:\Users\USER\Anacondan3\lib\site-packages\sklearn\linear_model\logistic.py:
432: FutureWarning: Default solver will be changed to 'lbfgs' in 0.22. Speci
fy a solver to silence this warning.
  FutureWarning)

Accuracy =  92.77777777777779
Confusion Matrix :
[[83  8]
 [ 5 84]]
```




```
Sensitivity :  91.20879120879121
Specificity :  94.3820224719101
```

In [213]:

```
prediction=model.predict(np.array([[1,10.5,5.5,5.5,3.5,6.5,7.5,7.5,10.5,1.5]]))
prediction
```

Out[213]:

```
array([1])
```

In [214]:

```
prediction=model.predict(np.array([[8,3.5,1.5,1.5,1.5,2.5,1.5,1.5,1.5,1.5]]))
prediction
```

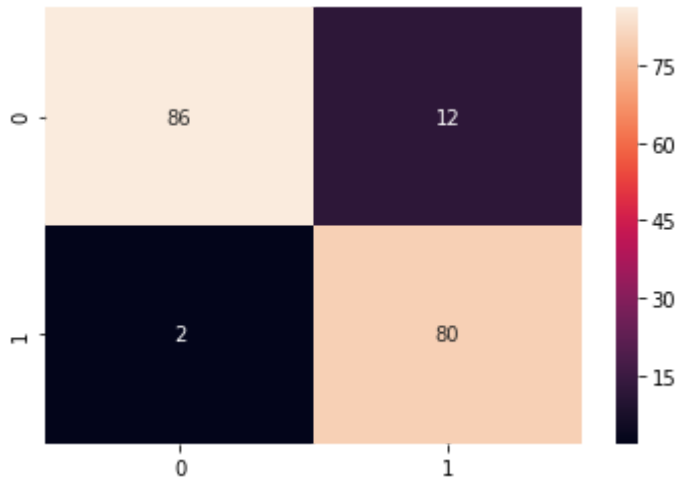
Out[214]:

```
array([1])
```

In [215]:

```
from sklearn.neighbors import KNeighborsClassifier
model=KNeighborsClassifier(n_neighbors=19,metric='minkowski',p=2)
model.fit(X_train,y_train)
pred=model.predict(X_test)
print("Accuracy : ",model.score(X_test,y_test)*100)
Matrix=confusion_matrix(pred,y_test)
print("Confusion MAtrix : ")
print(Matrix)
sns.heatmap(Matrix,annot=True)
plt.show()
sensitivity=(Matrix[0,0]/(Matrix[0,0]+Matrix[0,1]))*100
specificity=(Matrix[1,1]/(Matrix[1,0]+Matrix[1,1]))*100
print("Sensitivity : ",sensitivity)
print("Specificity : ",specificity )
```

```
Accuracy :  92.22222222222223
Confusion MAtrix :
[[86 12]
 [ 2 80]]
```




```
Sensitivity :  87.75510204081633
Specificity :  97.5609756097561
```

In [216]:

```
prediction=model.predict(np.array([[8,3.5,1.5,1.5,1.5,2.5,1.5,1.5,1.5,1.5]]))
prediction
```

Out[216]:

```
array([1])
```

In [217]:

```
prediction=model.predict(np.array([[1,10.5,5.5,5.5,3.5,6.5,7.5,7.5,10.5,1.5]]))
prediction
```

Out[217]:

```
array([1])
```

In [ ]:

```

```