In [1]:

```
%matplotlib inline
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import roc_auc_score
from sklearn.model_selection import RandomizedSearchCV
from sklearn.model_selection import GridSearchCV
import joblib
from sklearn.metrics import classification_report
```

```
/home/sushil/anaconda3/lib/python3.7/site-packages/statsmodels/tools/_
testing.py:19: FutureWarning: pandas.util.testing is deprecated. Use t
he functions in the public API at pandas.testing instead.
  import pandas.util.testing as tm
```

In [2]:

```
X=joblib.load("tfidf-5000").toarray()
y=joblib.load("y_amazon_5000")
```

In [4]:

```
from sklearn.model_selection import cross_val_score
```

In [5]:

```
from sklearn.model_selection import cross_val_predict
```

In [6]:

```
from sklearn import datasets,metrics
from sklearn.metrics import accuracy_score
```

In [7]:

```
from sklearn.decomposition import TruncatedSVD
```

In [8]:

```
from scipy.sparse import random as sparse_random
```

In [9]:

```
from sklearn.random_projection import sparse_random_matrix
```

In [10]:

```
svd=TruncatedSVD(n_components=100,n_iter=7,random_state=42)
```

In [11]:

```
svd.fit(X)
```

Out[11]:

```
TruncatedSVD(algorithm='randomized', n_components=100, n_iter=7,
             random_state=42, tol=0.0)
```

In [12]:

```
x=svd.transform(X)
```

In [14]:

```
x.shape
```

Out[14]:

```
(4994, 100)
```

In [15]:

```
X.shape
```

Out[15]:

```
(4994, 3314)
```

In [27]:

```
X_train,x_test,Y_train,y_test=train_test_split(x,y,test_size=0.20,shuffle=False)
```

In [28]:

```
print(X_train.shape)
print(x_test.shape)
print(Y_train.shape)
print(y_test.shape)
```

```
(3995, 100)
(999, 100)
(3995,)
(999,)
```

In [29]:

```
x_train,x_cv,y_train,y_cv=train_test_split(X_train,Y_train,test_size=0.20,shuffle=F
```

In [30]:

```
print(x_train.shape)
print(x_cv.shape)
print(y_train.shape)
print(y_cv.shape)
```

```
(3196, 100)
(799, 100)
(3196,)
(799,)
```

In [18]:

```
import numpy as np
```

In [22]:

```
a=list(np.arange(1,50,2))
```

In [24]:

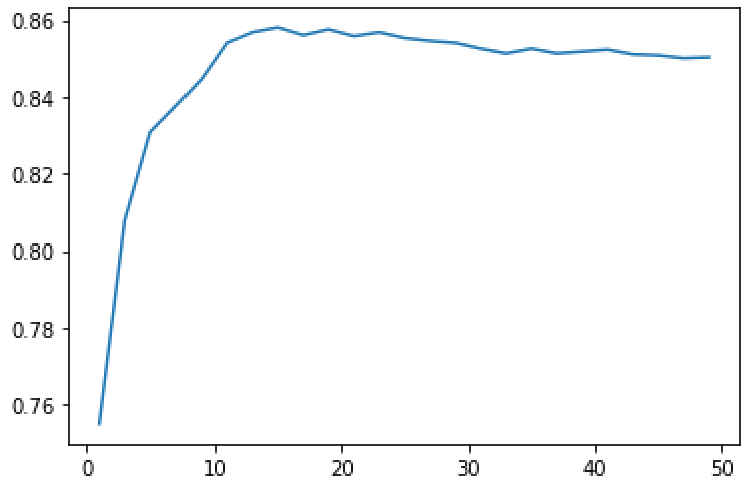
```
type(a)
print(a)
```

```
[1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 3
7, 39, 41, 43, 45, 47, 49]
```

In [36]:

```
%%time
cv_scores=[]
best_k=[]
for k in a:
    knn=KNeighborsClassifier(n_neighbors=k,algorithm="kd_tree")
    scores=cross_val_score(knn,X_train,Y_train,cv=4,scoring="accuracy")
    cv_scores.append(scores.mean())
    best_k.append(k)
accuracy=max(cv_scores)
optimal_k=best_k[cv_scores.index(max(cv_scores))]
plt.plot(best_k,cv_scores)
plt.show
print("the k={} with max accuracy={} is ".format(optimal_k,accuracy))
```

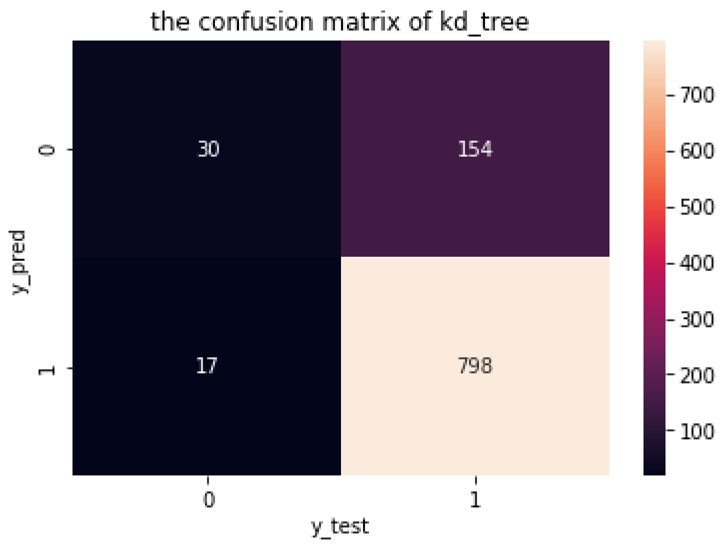
```
the k=15 with max accuracy=0.8580746854068498 is
CPU times: user 1min 14s, sys: 0 ns, total: 1min 14s
Wall time: 1min 14s
```



In [52]:

```
%%time
knn=KNeighborsClassifier(n_neighbors=optimal_k,algorithm="kd_tree")
knn.fit(X_train,Y_train)
y_pred=knn.predict(x_test)
y_pred_proba=knn.predict_proba(x_test)
#print("the accuracy of coorecy value is ",y_pred_proba)
classification_reports=classification_report(y_test,y_pred)
print("the classification reports:",classification_reports,sep='\n')
confusion_mat=confusion_matrix(y_test,y_pred,labels=[0,1])
print("the confusion matrix is : n",confusion_mat,sep='\n')
sns.heatmap(confusion_mat,annot=True,fmt='g')
plt.xlabel("y_test")
plt.ylabel("y_pred")
plt.title("the confusion matrix of kd_tree")
plt.show()
```

```
the classification reports:
              precision    recall  f1-score   support

           0       0.64      0.16      0.26       184
           1       0.84      0.98      0.90       815

    accuracy                           0.83       999
   macro avg       0.74      0.57      0.58       999
weighted avg       0.80      0.83      0.78       999

the confusion matrix is : n
[[ 30 154]
 [ 17 798]]
```



```
CPU times: user 2.62 s, sys: 112 ms, total: 2.73 s
Wall time: 2.5 s
```

In [63]:

```
def kd_tree(upper_limit_k,X_train,Y_train,x_test,y_test):
    a=list(np.arange(1,upper_limit_k,2))
    cv_scores=[]
    best_k=[]
    for k in a:
        n=KNeighborsClassifier(n_neighbors=k,algorithm="kd_tree")
        scores=cross_val_score(n,X_train,Y_train,cv=4,scoring="accuracy")
        cv_scores.append(scores.mean())
        best_k.append(k)
    accuracy=max(cv_scores)
    optimal_k=best_k[cv_scores.index(max(cv_scores))]
    plot=plt.plot(best_k,cv_scores)
    plt.show
    print("the k={} with max accuracy={} is ".format(optimal_k,accuracy))


    knn=KNeighborsClassifier(n_neighbors=optimal_k,algorithm="kd_tree")
    knn.fit(X_train,Y_train)
    y_pred=knn.predict(x_test)
    y_pred_proba=knn.predict_proba(x_test)
    #print("the accuracy of coorecy value is ",y_pred_proba)
    classification_reports=classification_report(y_test,y_pred)
    print("the classification reports:",classification_reports,sep='\n')
    confusion_mat=confusion_matrix(y_test,y_pred,labels=[0,1])
    print("the confusion matrix is : n",confusion_mat,sep='\n')
    sns.heatmap(confusion_mat,annot=True,fmt='g')
    plt.xlabel("y_test")
    plt.ylabel("y_pred")
    plt.title("the confusion matrix of kd_tree")
    plt.show()
```

In [64]:

```
avg_w2v=joblib.load("avg_w2v")
```

In [85]:

```
#avg_w2v it wil give an array of list
```

In [66]:

```
y_10000=joblib.load("y_amazon_10000")
```

In [67]:

```
y_10000
```

Out[67]:

```
1146    1
1145    1
7427    1
3481    1
6790    1
       ..
7451    0
8731    0
7620    1
7156    0
5259    1
Name: Score, Length: 9990, dtype: int64
```

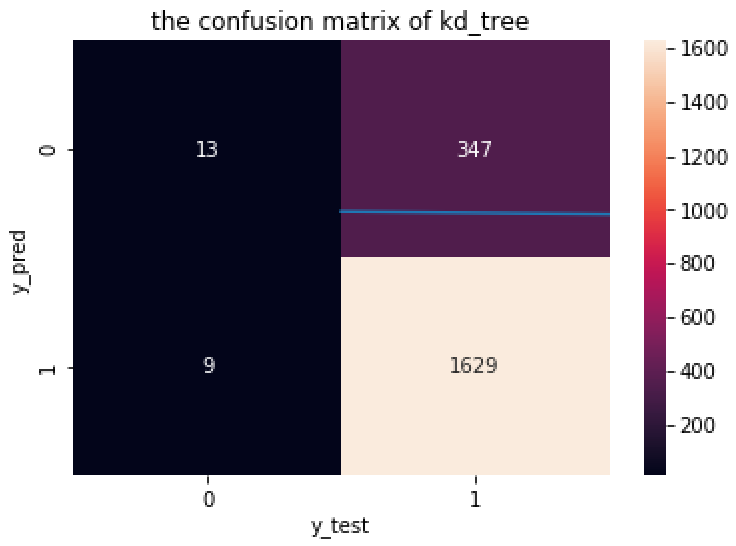
In [68]:

```
X_train,x_test,Y_train,y_test=train_test_split(avg_w2v,y_10000,test_size=0.20,shuff
```

In [69]:

```
%%time
kd_tree(80,X_train,Y_train,x_test,y_test)
```

```
the k=31 with max accuracy=0.8375880056217909 is
the classification reports:
              precision    recall  f1-score   support

           0       0.59      0.04      0.07       360
           1       0.82      0.99      0.90      1638

    accuracy                           0.82      1998
   macro avg       0.71      0.52      0.48      1998
weighted avg       0.78      0.82      0.75      1998

the confusion matrix is : n
[[  13  347]
 [   9 1629]]
```



```
CPU times: user 8min 33s, sys: 368 ms, total: 8min 33s
Wall time: 8min 33s
```

In [70]:

```
w2v=joblib.load("words_2_vec")
```

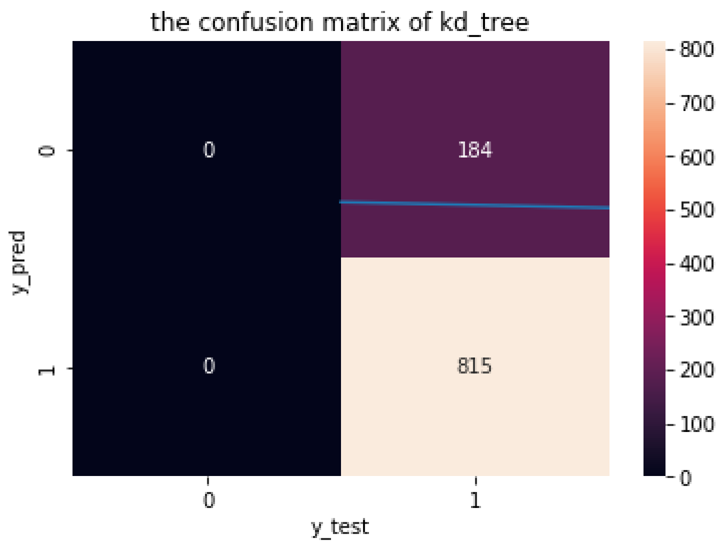
In [72]:

```
X_train,x_test,Y_train,y_test=train_test_split(w2v,y,test_size=0.20,shuffle=False)
```

In [74]:

```
%%time
kd_tree(51,X_train,Y_train,x_test,y_test)
```

```
the k=29 with max accuracy=0.8433043980854602 is

/home/sushil/anaconda3/lib/python3.7/site-packages/sklearn/metrics/cla
ssification.py:1437: UndefinedMetricWarning: Precision and F-score are
ill-defined and being set to 0.0 in labels with no predicted samples.
  'precision', 'predicted', average, warn_for)

the classification reports:
              precision    recall  f1-score   support

           0       0.00      0.00      0.00       184
           1       0.82      1.00      0.90       815

    accuracy                           0.82       999
   macro avg       0.41      0.50      0.45       999
weighted avg       0.67      0.82      0.73       999

the confusion matrix is : n
[[  0 184]
 [  0 815]]
```



```
CPU times: user 33.9 s, sys: 128 ms, total: 34.1 s
Wall time: 33.8 s
```

In [75]:

```
w_tf=joblib.load("tfidf_sent_vectors")
```

In [87]:

```
#w_tf
```

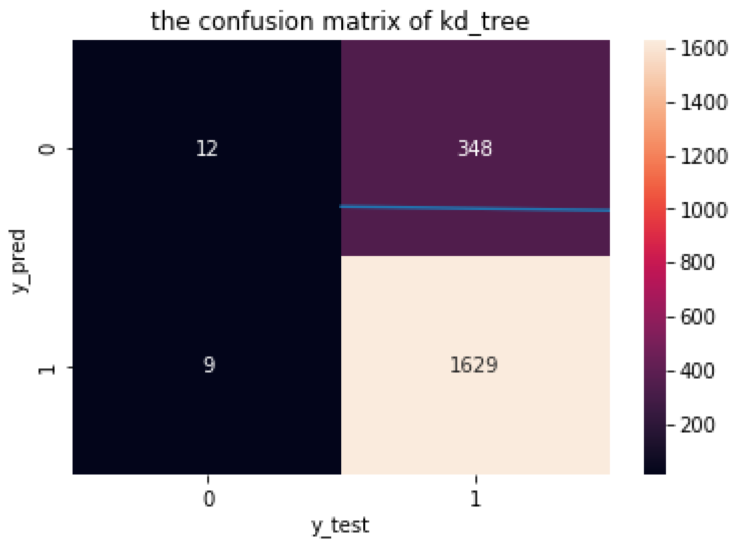
In [77]:

```
X_train,x_test,Y_train,y_test=train_test_split(w_tf,y_10000,test_size=0.20,shuffle=
```

In [78]:

```
%%time
kd_tree(51,X_train,Y_train,x_test,y_test)
```

```
the k=31 with max accuracy=0.8372121290567244 is
the classification reports:
              precision    recall  f1-score   support

           0       0.57      0.03      0.06       360
           1       0.82      0.99      0.90      1638

    accuracy                           0.82      1998
   macro avg       0.70      0.51      0.48      1998
weighted avg       0.78      0.82      0.75      1998

the confusion matrix is : n
[[  12  348]
 [   9 1629]]
```



```
CPU times: user 4min 10s, sys: 180 ms, total: 4min 10s
Wall time: 4min 10s
```

Conclusion:

```
(1) the accuracy of text processing on kd_tree and Brute force revolves arund
82%-84%
(2) We can improve our accuracy by balancing the data as our datasets isn't
balance by using over sampling or undersampling or by using smote
```

(3) IN kd_tree we found that it takes more time to train our model and less time to compute predict our model while in brute fore algorithm we observed that it take more time to predict model but it takes less time to train our model

In [ ]:

```
```