In [1]:
```
import pandas as pd
```

In [2]:
```
data=pd.read_csv("/home/placement/Desktop/usha g1/TelecomCustomerChurn.csv")
```

In [3]:
```
data.describe()
```

Out[3]:

	SeniorCitizen	tenure	MonthlyCharges
count	7043.000000	7043.000000	7043.000000
mean	0.162147	32.371149	64.761692
std	0.368612	24.559481	30.090047
min	0.000000	0.000000	18.250000
25%	0.000000	9.000000	35.500000
50%	0.000000	29.000000	70.350000
75%	0.000000	55.000000	89.850000
max	1.000000	72.000000	118.750000

In [4]:
```
data.head()
```

Out[4]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	...	DeviceProtec
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	No	...	
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Yes	...	
2	3668-QPYBK	Male	0	No	No	2	Yes	No	DSL	Yes	...	
3	7795-CFOCW	Male	0	No	No	45	No	No phone service	DSL	Yes	...	
4	9237-HQITU	Female	0	No	No	2	Yes	No	Fiber optic	No	...	

5 rows × 21 columns

In [5]:
```
data['TotalCharges'] = pd.to_numeric(data['TotalCharges'],errors='coerce')
```

In [6]:
```
data['TotalCharges']=data['TotalCharges'].fillna(data['TotalCharges'].median())
```

In [7]:
```
data.isna().sum()
```

Out[7]:
```
customerID          0
gender              0
SeniorCitizen       0
Partner             0
Dependents          0
tenure              0
PhoneService        0
MultipleLines       0
InternetService     0
OnlineSecurity      0
OnlineBackup        0
DeviceProtection    0
TechSupport         0
StreamingTV         0
StreamingMovies     0
Contract            0
PaperlessBilling    0
PaymentMethod       0
MonthlyCharges      0
TotalCharges        0
Churn               0
dtype: int64
```

In [8]:
```
data['SeniorCitizen']=data['SeniorCitizen'].map({0:'No',1:'Yes'})
data
```

Out[8]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	...	DevicePro
0	7590-VHVEG	Female	No	Yes	No	1	No	No phone service	DSL	No	...	
1	5575-GNVDE	Male	No	No	No	34	Yes	No	DSL	Yes	...	
2	3668-QPYBK	Male	No	No	No	2	Yes	No	DSL	Yes	...	
3	7795-CFOCW	Male	No	No	No	45	No	No phone service	DSL	Yes	...	
4	9237-HQITU	Female	No	No	No	2	Yes	No	Fiber optic	No	...	
...	...	...	...	...	...	...	...	...	...	...	...	
7038	6840-RESVB	Male	No	Yes	Yes	24	Yes	Yes	DSL	Yes	...	
7039	2234-XADUH	Female	No	Yes	Yes	72	Yes	Yes	Fiber optic	No	...	
7040	4801-JZAZL	Female	No	Yes	Yes	11	No	No phone service	DSL	Yes	...	
7041	8361-LTMKD	Male	Yes	Yes	No	4	Yes	Yes	Fiber optic	No	...	
7042	3186-AJIEK	Male	No	No	No	66	Yes	No	Fiber optic	Yes	...	

7043 rows × 21 columns

In [9]:
```
data.tail(20)
```

Out[9]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	...	DevicePro
7023	1035-IPQPU	Female	Yes	Yes	No	63	Yes	Yes	Fiber optic	No	...	
7024	7398-LXGYX	Male	No	Yes	No	44	Yes	Yes	Fiber optic	Yes	...	
7025	2823-LKABH	Female	No	No	No	18	Yes	Yes	Fiber optic	No	...	
7026	8775-CEBBJ	Female	No	No	No	9	Yes	No	DSL	No	...	
7027	0550-DCXLH	Male	No	No	No	13	Yes	No	DSL	No	...	
7028	9281-CEDRU	Female	No	Yes	No	68	Yes	No	DSL	No	...	
7029	2235-DWLJU	Female	Yes	No	No	6	No	No phone service	DSL	No	...	
7030	0871-OPBXW	Female	No	No	No	2	Yes	No	No	No internet service	...	No
7031	3605-JISKB	Male	Yes	Yes	No	55	Yes	Yes	DSL	Yes	...	
7032	6894-LFHLY	Male	Yes	No	No	1	Yes	Yes	Fiber optic	No	...	
7033	9767-FFLEM	Male	No	No	No	38	Yes	No	Fiber optic	No	...	
7034	0639-TSIQW	Female	No	No	No	67	Yes	Yes	Fiber optic	Yes	...	
7035	8456-QDAVC	Male	No	No	No	19	Yes	No	Fiber optic	No	...	
7036	7750-EYXWZ	Female	No	No	No	12	No	No phone service	DSL	No	...	
7037	2569-WGERO	Female	No	No	No	72	Yes	No	No	No internet service	...	No

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	...	DevicePro
7038	6840-RESVB	Male	No	Yes	Yes	24	Yes	Yes	DSL	Yes	...	
7039	2234-XADUH	Female	No	Yes	Yes	72	Yes	Yes	Fiber optic	No	...	
7040	4801-JZAZL	Female	No	Yes	Yes	11	No	No phone service	DSL	Yes	...	
7041	8361-LTMKD	Male	Yes	Yes	No	4	Yes	Yes	Fiber optic	No	...	
7042	3186-AJIEK	Male	No	No	No	66	Yes	No	Fiber optic	Yes	...	

20 rows × 21 columns

In [ ]:

In [10]:
```
x=data.drop(['customerID','Churn'],axis=1)
y=data['Churn']
```

In [11]:
```
x=pd.get_dummies(x)
```

In [12]:
```
x.head()
```

Out[12]:

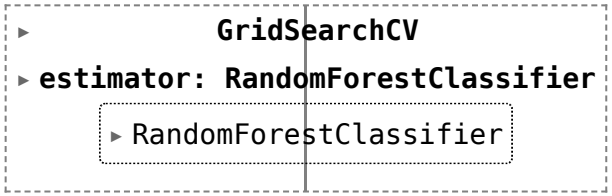
	tenure	MonthlyCharges	TotalCharges	gender_Female	gender_Male	SeniorCitizen_No	SeniorCitizen_Yes	Partner_No	Partner_Yes	Dependents
0	1	29.85	29.85	1	0	1	0	0	1	
1	34	56.95	1889.50	0	1	1	0	1	0	
2	2	53.85	108.15	0	1	1	0	1	0	
3	45	42.30	1840.75	0	1	1	0	1	0	
4	2	70.70	151.65	1	0	1	0	1	0	

5 rows × 46 columns

In [13]:
```
from sklearn.model_selection import train_test_split
x_train, x_test,y_train, y_test = train_test_split(x, y, test_size=0.33,random_state=42)
```

In [14]:
```
from sklearn.model_selection import GridSearchCV #GridSearchCV is for parameter tuning
from sklearn.ensemble import RandomForestClassifier
cls=RandomForestClassifier()
n_estimators=[25,50,75,100,125,150,175,200] #number of decision trees in the forest, default = 100
criterion=['gini','entropy'] #criteria for choosing nodes default = 'gini'
max_depth=[3,5,10] #maximum number of nodes in a tree default = None (it will go till all possible nodes)
parameters={'n_estimators': n_estimators,'criterion':criterion,'max_depth':max_depth} #this will undergo 8*2
RFC_cls = GridSearchCV(cls, parameters)
RFC_cls.fit(x_train,y_train)
```

Out[14]:



In [15]:
```
x_train.isna().sum()
```

Out[15]:
```
tenure                                     0
MonthlyCharges                             0
TotalCharges                               0
gender_Female                              0
gender_Male                                0
SeniorCitizen_No                           0
SeniorCitizen_Yes                          0
Partner_No                                 0
Partner_Yes                                0
Dependents_No                              0
Dependents_Yes                             0
PhoneService_No                            0
PhoneService_Yes                           0
MultipleLines_No                           0
MultipleLines_No phone service             0
MultipleLines_Yes                          0
InternetService_DSL                        0
InternetService_Fiber optic                0
InternetService_No                         0
OnlineSecurity_No                          0
OnlineSecurity_No internet service         0
OnlineSecurity_Yes                         0
OnlineBackup_No                            0
OnlineBackup_No internet service           0
OnlineBackup_Yes                           0
DeviceProtection_No                        0
DeviceProtection_No internet service       0
DeviceProtection_Yes                       0
TechSupport_No                             0
TechSupport_No internet service            0
TechSupport_Yes                            0
StreamingTV_No                             0
StreamingTV_No internet service            0
StreamingTV_Yes                            0
StreamingMovies_No                         0
StreamingMovies_No internet service        0
StreamingMovies_Yes                        0
Contract_Month-to-month                    0
Contract_One year                          0
```

```
Contract_Two year                          0
PaperlessBilling_No                        0
PaperlessBilling_Yes                       0
PaymentMethod_Bank transfer (automatic)    0
PaymentMethod_Credit card (automatic)      0
PaymentMethod_Electronic check             0
PaymentMethod_Mailed check                 0
dtype: int64
```

In [16]:
```
RFC_cls.best_params_
```

Out[16]:
```
{'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 125}
```

In [17]:
```
cls=RandomForestClassifier(n_estimators=175,criterion='entropy',max_depth=10)
```

In [18]:
```
cls.fit(x_train,y_train)
```

Out[18]:
```
RandomForestClassifier
RandomForestClassifier(criterion='entropy', max_depth=10, n_estimators=175)
```

In [19]:
```
rfy_pred=cls.predict(x_test)
```

In [20]:
```
rfy_pred
```

Out[20]:
```
array(['Yes', 'No', 'No', ..., 'Yes', 'No', 'No'], dtype=object)
```

In [21]:
```
from sklearn.metrics import confusion_matrix
confusion_matrix(y_test,rfy_pred)
```

Out[21]:
```
array([[1543,  154],
       [ 307,  321]])
```

In [22]:
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test,rfy_pred)
```

Out[22]:
```
0.8017204301075269
```

In [23]:
```
import warnings
warnings.filterwarnings("ignore")
from sklearn.linear_model import LogisticRegression
classifier= LogisticRegression()
classifier.fit(x_train,y_train)
```

Out[23]:
```
▾ LogisticRegression

LogisticRegression()
```

In [ ]:
```

```