In [4]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

data=pd.read_csv("C:/Users/HP/Desktop/pywork/dataset/insurance.csv")

In [6]:

```
pwd
```

Out[6]:

```
'C:\\Users\\HP\\Desktop\\pywork\\dataset'
```

In [7]:

```
data.head(20)
```

Out[7]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520
5	31	female	25.740	0	no	southeast	3756.62160
6	46	female	33.440	1	no	southeast	8240.58960
7	37	female	27.740	3	no	northwest	7281.50560
8	37	male	29.830	2	no	northeast	6406.41070
9	60	female	25.840	0	no	northwest	28923.13692
10	25	male	26.220	0	no	northeast	2721.32080
11	62	female	26.290	0	yes	southeast	27808.72510
12	23	male	34.400	0	no	southwest	1826.84300
13	56	female	39.820	0	no	southeast	11090.71780
14	27	male	42.130	0	yes	southeast	39611.75770
15	19	male	24.600	1	no	southwest	1837.23700
16	52	female	30.780	1	no	northeast	10797.33620
17	23	male	23.845	0	no	northeast	2395.17155
18	56	male	40.300	0	no	southwest	10602.38500
19	30	male	35.300	0	yes	southwest	36837.46700

Data analyzing

In [8]:

```
data.isnull().sum()
```

Out[8]:

```
age         0
sex         0
bmi         0
children    0
smoker      0
```

```
charges     0
dtype: int64
```

In [9]:
```
data.shape
```

Out[9]:
```
(1338, 7)
```

In [10]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 7 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       1338 non-null   int64  
 1   sex       1338 non-null   object 
 2   bmi       1338 non-null   float64
 3   children  1338 non-null   int64  
 4   smoker    1338 non-null   object 
 5   region    1338 non-null   object 
 6   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
```

In [11]:
```
data.describe()
```

Out[11]:

	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000
75%	51.000000	34.693750	2.000000	16639.912515
max	64.000000	53.130000	5.000000	63770.428010

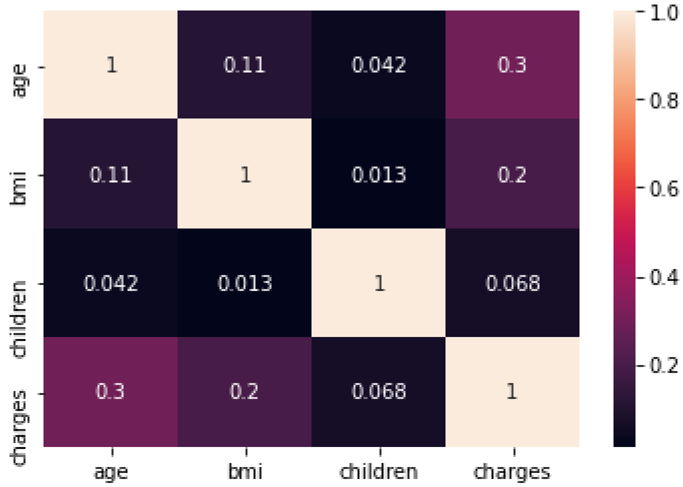
In [12]:
```
data.corr()
```

Out[12]:

	age	bmi	children	charges
age	1.000000	0.109272	0.042469	0.299008
bmi	0.109272	1.000000	0.012759	0.198341
children	0.042469	0.012759	1.000000	0.067998
charges	0.299008	0.198341	0.067998	1.000000

In [13]:
```
sns.heatmap(data.corr(),annot=True)
```

Out[13]:
```
<AxesSubplot:>
```

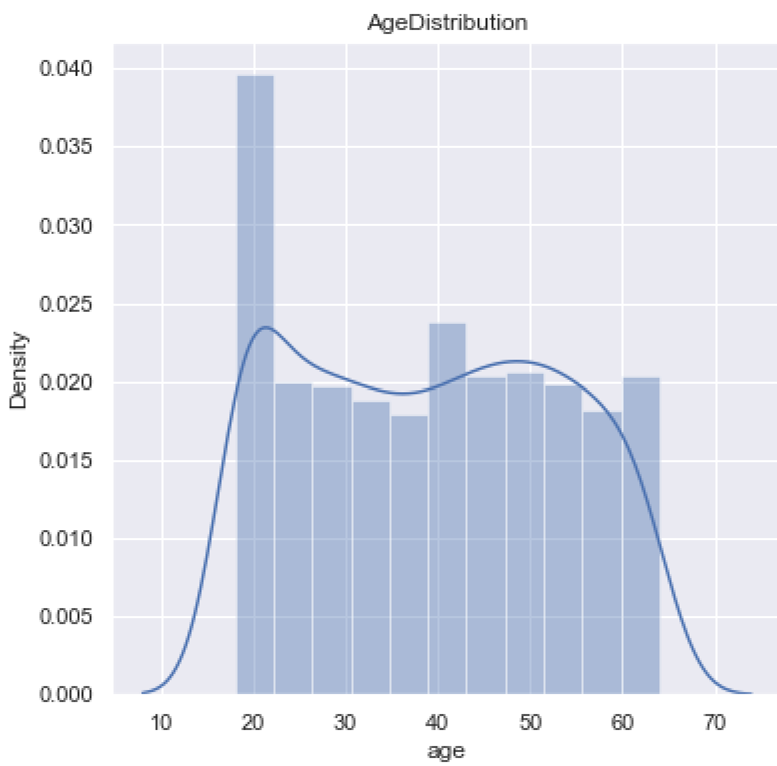


Disrribution of age Value

In [14]:

```
sns.set()
plt.figure(figsize=(6,6))
sns.distplot(data["age"])
plt.title("AgeDistribution")
plt.show()
```

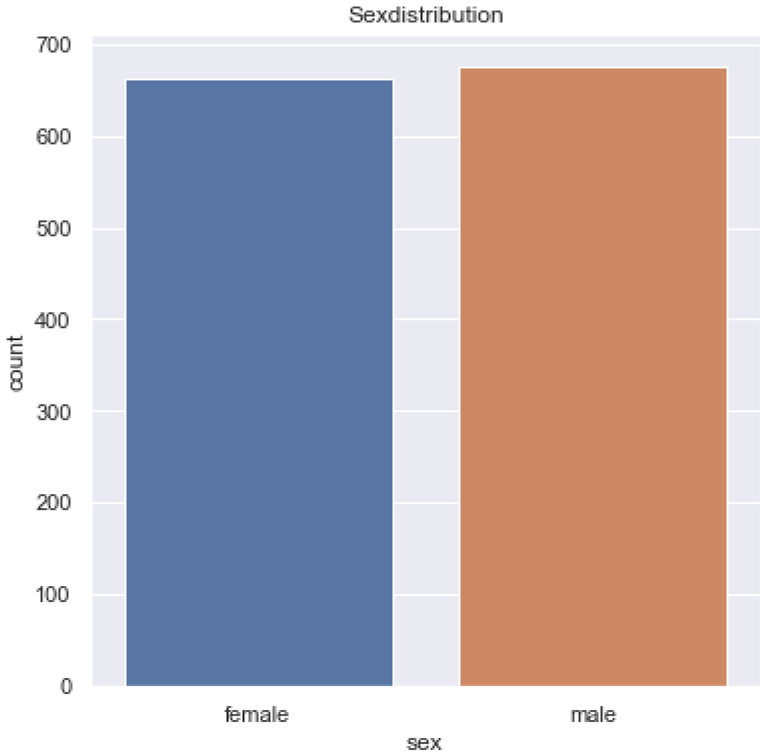
```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `dis
tplot` is a deprecated function and will be removed in a future version. Please adapt your
code to use either `displot` (a figure-level function with similar flexibility) or `histpl
ot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



Gender Columns distribution

In [15]:

```
plt.figure(figsize=(6,6))
sns.countplot(x="sex",data=data)
plt.title("Sexdistribution")
plt.show()
```



In [16]:

```
data["sex"].value_counts()
```

Out[16]:

```
male      676
female    662
Name: sex, dtype: int64
```

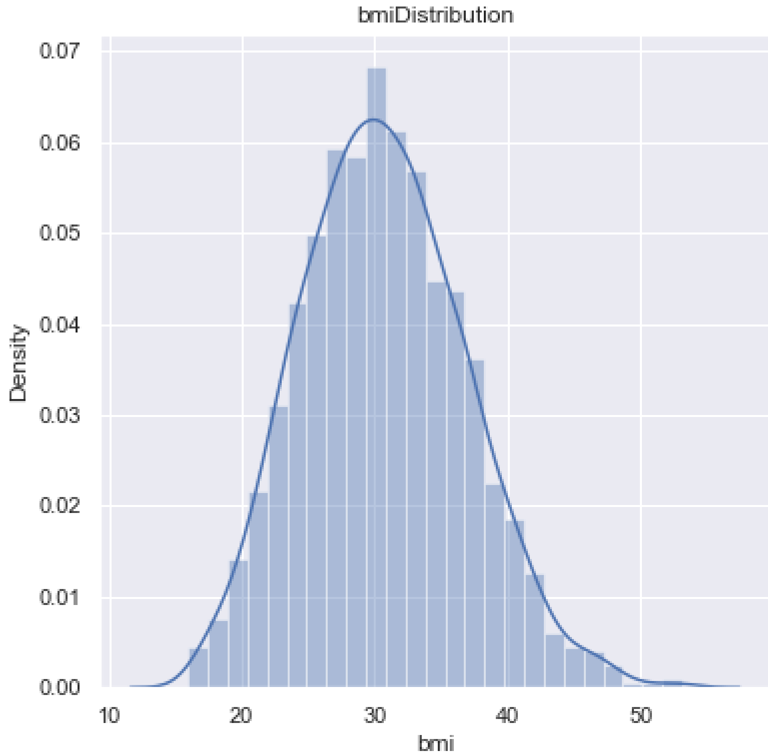
Bmi distribution

Normal Bmi Range 18.5 to 24.9

In [17]:

```
plt.figure(figsize=(6,6))
sns.distplot(data["bmi"])
plt.title("bmiDistribution")
plt.show()
```

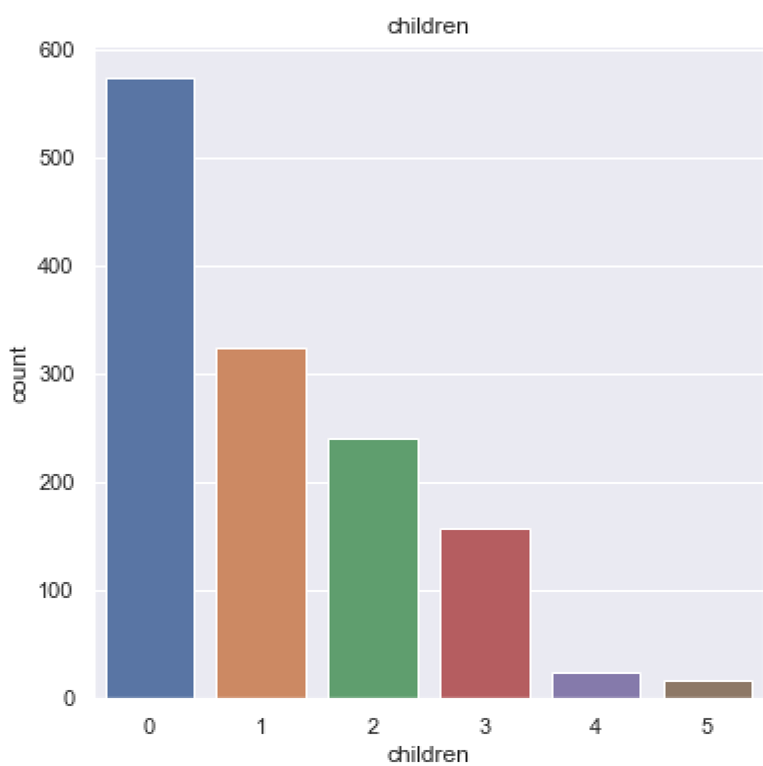
```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



Children Columns

In [18]:

```
plt.figure(figsize=(6,6))
sns.countplot(x="children",data=data)
plt.title("children")
plt.show()
```



In [19]:

```
data["children"].value_counts()
```

Out[19]:

```
0    574
1    324
```

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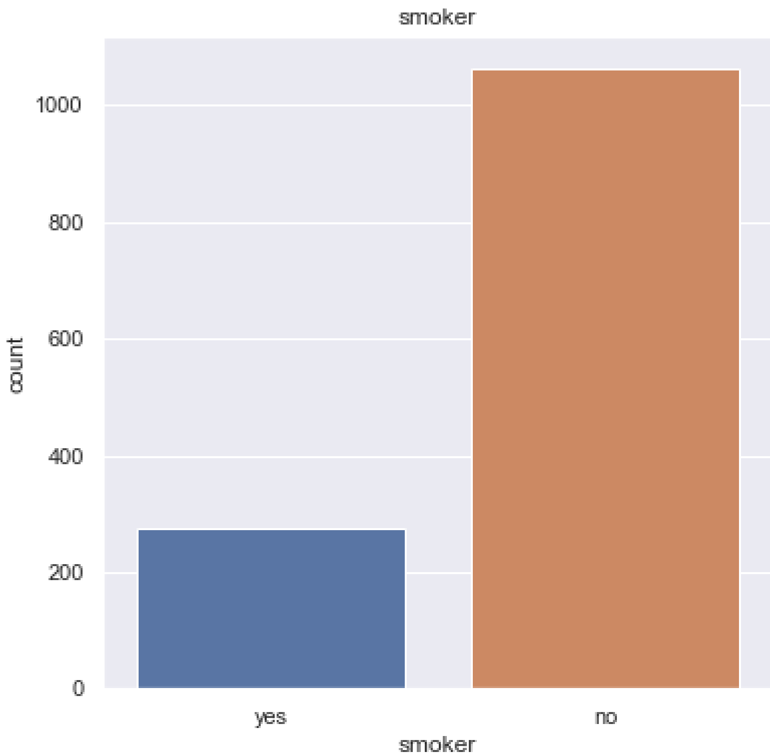
```
3    157
4     25
5     18
Name: children, dtype: int64
```

In [20]:

```
## Smoker Columns
plt.figure(figsize=(6,6))
sns.countplot(x="smoker",data=data)
plt.title("smoker")
plt.show()
```



In [21]:

```
data["smoker"].value_counts()
```

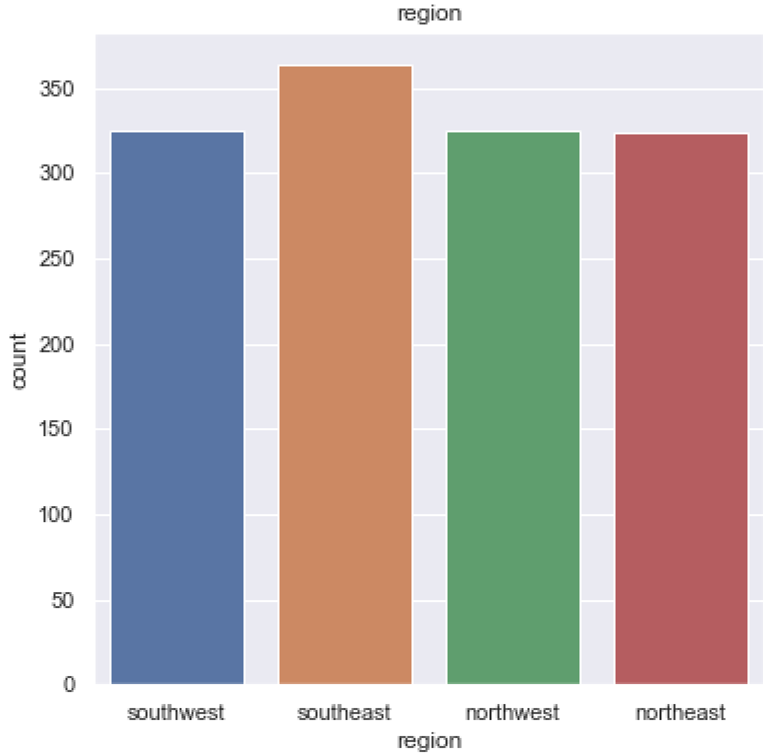
Out[21]:

```
no     1064
yes     274
Name: smoker, dtype: int64
```

Region Column

In [22]:

```
plt.figure(figsize=(6,6))
sns.countplot(x="region",data=data)
plt.title("region")
plt.show()
```



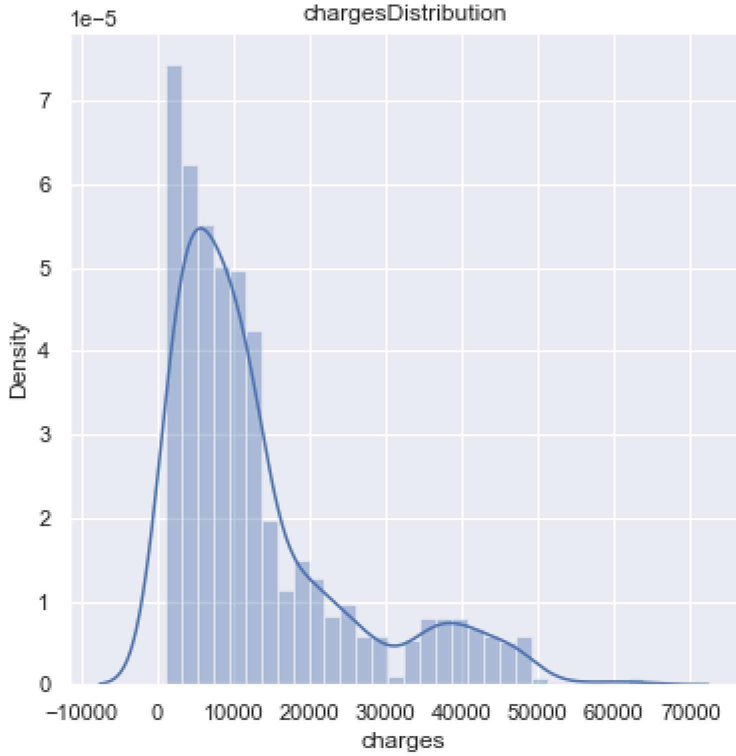
In [23]:
```
data["region"].value_counts()
```

Out[23]:
```
southeast    364
northwest    325
southwest    325
northeast    324
Name: region, dtype: int64
```

Distribution of Charges Values

In [24]:
```
plt.figure(figsize=(6,6))
sns.distplot(data["charges"])
plt.title("chargesDistribution")
plt.show()
```

```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `dis
tplot` is a deprecated function and will be removed in a future version. Please adapt your
code to use either `displot` (a figure-level function with similar flexibility) or `histpl
ot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



Data Preprocessing

In [25]:
```
data=pd.get_dummies(data)
```

In [26]:
```
data.head(10)
```

Out[26]:

	age	bmi	children	charges	sex_female	sex_male	smoker_no	smoker_yes	region_northeast	region_r
0	19	27.900	0	16884.92400	1	0	0	1	0	
1	18	33.770	1	1725.55230	0	1	1	0	0	
2	28	33.000	3	4449.46200	0	1	1	0	0	
3	33	22.705	0	21984.47061	0	1	1	0	0	
4	32	28.880	0	3866.85520	0	1	1	0	0	
5	31	25.740	0	3756.62160	1	0	1	0	0	
6	46	33.440	1	8240.58960	1	0	1	0	0	
7	37	27.740	3	7281.50560	1	0	1	0	0	
8	37	29.830	2	6406.41070	0	1	1	0	1	
9	60	25.840	0	28923.13692	1	0	1	0	0	

In [27]:
```
x=data.drop(columns=["charges"])
y=data["charges"]
```

Test Train Split dataset

In [28]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test= train_test_split(x,y,train_size=0.8,random_state=1)
```

In [29]:
```
print(x_train.shape,x_test.shape,y_train.shape,y_test.shape)
```

```
(1070, 11) (268, 11) (1070,) (268,)
```

Linear Regresssion Model

In [30]:
```
from sklearn.linear_model import LinearRegression

model = LinearRegression()
```

In [31]:
```
model.fit(x_train,y_train)
```

Out[31]:
```
LinearRegression()
```

In [32]:
```
print(model.coef_)
print(model.intercept_)
```

```
[   257.49024669    321.62189278    408.06102001    121.0765328
   -121.0765328  -11893.24302268  11893.24302268    584.37636275
    188.27979919   -453.99951691   -318.65664503]
-109.81988139964778
```

In [33]:
```
y_pred = model.predict(x_test)
```

In [34]:
```
pd.DataFrame({'Actual':y_test,'Predicted':y_pred}).head(20)
```

Out[34]:

	Actual	Predicted
559	1646.42970	4383.680900
1087	11353.22760	12885.038922
1020	8798.59300	12589.216532
460	10381.47870	13286.229192
802	2103.08000	544.728328
298	38746.35510	32117.584008
481	9304.70190	12919.042372
616	11658.11505	12318.621830
763	3070.80870	3784.291456
750	19539.24300	29468.457254
48	12629.89670	11002.813943
547	11538.42100	17539.694738
1143	6338.07560	8681.354720
767	7050.64200	8349.043255
194	1137.46970	3130.127255
424	8968.33000	10445.838961
3	21984.47061	3863.743579
785	6414.17800	6944.625108
443	28287.89766	15009.631211

	Actual	Predicted
921	13462.52000	14441.599119

Validation

In [35]:
```
from sklearn.metrics import r2_score,mean_squared_error, mean_absolute_percentage_error
```

In [36]:
```
model.score(x_test,y_test)  # It gives the r square value only
```

Out[36]:
```
0.7623311844057112
```

In [37]:
```
print('R2 value', r2_score(y_test,y_pred))
print('MSE',mean_squared_error(y_test,y_pred))
rmse = mean_squared_error(y_test,y_pred)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred))
```

```
R2 value 0.7623311844057112
MSE 35479352.80730363
RMSE 5956.454717976427
MAPE 0.40580730868622433
```

Check overfitting

In [38]:
```
y_pred_train=model.predict(x_train)
```

In [39]:
```
print('R2 value', r2_score(y_train,y_pred_train))
print('MSE',mean_squared_error(y_train,y_pred_train))
rmse = mean_squared_error(y_train,y_pred_train)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_train,y_pred_train))
```

```
R2 value 0.7477680686451552
MSE 36787756.370462015
RMSE 6065.291120009164
MAPE 0.4123642394704418
```

KNN MOdel

In [40]:
```
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import GridSearchCV
Scaler= StandardScaler()
```

In [41]:
```
x_train_s=Scaler.fit_transform(x_train)
x_test_s=Scaler.fit_transform(x_test)
```

In [42]:
```
from sklearn.neighbors import KNeighborsRegressor
knn=KNeighborsRegressor()

params={"n_neighbors":[2,3,4,5,6,7]}
gscv=GridSearchCV(estimator=knn,param_grid=params,scoring="r2",verbose=1,cv=2 )
```

In [43]:

```
gscv.fit(x_train_s,y_train)
```

```
Fitting 2 folds for each of 6 candidates, totalling 12 fits
```

Out[43]:

```
GridSearchCV(cv=2, estimator=KNeighborsRegressor(),
             param_grid={'n_neighbors': [2, 3, 4, 5, 6, 7]}, scoring='r2',
             verbose=1)
```

In [44]:

```
gscv.best_params_
```

Out[44]:

```
{'n_neighbors': 3}
```

In [45]:

```
knn_n=KNeighborsRegressor(**gscv.best_params_)
knn_n.fit(x_train_s,y_train)
y_pred_knn=knn_n.predict(x_test_s)
```

In [46]:

```
pd.DataFrame({'Actual':y_test,'Predicted':y_pred_knn}).head(20)
```

Out[46]:

	Actual	Predicted
559	1646.42970	2169.012350
1087	11353.22760	15103.203553
1020	8798.59300	12744.222170
460	10381.47870	13543.822853
802	2103.08000	1681.611000
298	38746.35510	32977.294633
481	9304.70190	8162.453867
616	11658.11505	16324.224437
763	3070.80870	2406.560467
750	19539.24300	19721.722800
48	12629.89670	21154.955780
547	11538.42100	11842.275000
1143	6338.07560	6825.354367
767	7050.64200	7153.875667
194	1137.46970	1221.493467
424	8968.33000	8366.622000
3	21984.47061	3734.380550
785	6414.17800	5570.556667
443	28287.89766	11643.997900
921	13462.52000	12789.095000

Validation

In [47]:

```
print('R2 value', r2_score(y_test,y_pred_knn))
print('MSE',mean_squared_error(y_test,y_pred_knn))
rmse = mean_squared_error(y_test,y_pred_knn)**0.5
```

```python
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_knn))
```

```
R2 value 0.8077693784591055
MSE 28696310.136282556
RMSE 5356.893702163835
MAPE 0.3246738216602979
```

Decision Tree

In [48]:

```python
from sklearn.tree import DecisionTreeRegressor
from sklearn.model_selection import GridSearchCV
model_dt=DecisionTreeRegressor()
model_params = {'max_depth':[3,4,5]}
```

In [49]:

```python
gscv=GridSearchCV(model_dt,param_grid=model_params,verbose=1,cv=2,scoring="r2")
```

In [50]:

```python
gscv.fit(x_train,y_train)
```

```
Fitting 2 folds for each of 3 candidates, totalling 6 fits
```

Out[50]:

```
GridSearchCV(cv=2, estimator=DecisionTreeRegressor(),
             param_grid={'max_depth': [3, 4, 5]}, scoring='r2', verbose=1)
```

In [51]:

```python
gscv.best_params_
```

Out[51]:

```
{'max_depth': 3}
```

In [52]:

```python
dt_n=DecisionTreeRegressor(**gscv.best_params_)
dt_n.fit(x_train,y_train)
y_pred_dt=dt_n.predict(x_test)
```

In [53]:

```python
pd.DataFrame({'Actual':y_test,'Predicted':y_pred_dt}).head(20)
```

Out[53]:

	Actual	Predicted
559	1646.42970	4042.610827
1087	11353.22760	13872.597617
1020	8798.59300	10427.817324
460	10381.47870	10427.817324
802	2103.08000	4042.610827
298	38746.35510	38230.012778
481	9304.70190	10427.817324
616	11658.11505	13872.597617
763	3070.80870	6599.945247
750	19539.24300	18540.379523
48	12629.89670	13872.597617
547	11538.42100	13872.597617
1143	6338.07560	6599.945247
[illegible]	[illegible]	6599.945247

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	Actual	Predicted
194	1137.46970	4042.610827
424	8968.33000	10427.817324
3	21984.47061	6599.945247
785	6414.17800	6599.945247
443	28287.89766	13872.597617
921	13462.52000	13872.597617

In [54]:

```
print('R2 value', r2_score(y_test,y_pred_dt))
print('MSE',mean_squared_error(y_test,y_pred_dt))
rmse = mean_squared_error(y_test,y_pred_dt)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_dt))
```

```
R2 value 0.8607824832143326
MSE 20782479.95070205
RMSE 4558.7805332898015
MAPE 0.3714211571925749
```

Random Forest

In [55]:

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import GridSearchCV
model_ran = RandomForestRegressor()
model_params = {'n_estimators':[80,100,120],
               'max_depth':[3,4,5]}
```

In [56]:

```
gscv = GridSearchCV(estimator=model_ran, param_grid=model_params,scoring="r2",verbose=1 )
```

In [57]:

```
gscv.fit(x_train,y_train)
```

```
Fitting 5 folds for each of 9 candidates, totalling 45 fits
```

Out[57]:

```
GridSearchCV(estimator=RandomForestRegressor(),
             param_grid={'max_depth': [3, 4, 5],
                         'n_estimators': [80, 100, 120]},
             scoring='r2', verbose=1)
```

In [58]:

```
gscv.best_params_
```

Out[58]:

```
{'max_depth': 4, 'n_estimators': 80}
```

In [59]:

```
ran_n=RandomForestRegressor(**gscv.best_params_)
ran_n.fit(x_train,y_train)
y_pred_ran=dt_n.predict(x_test)
```

In [60]:

```
pd.DataFrame({'Actual':y_test,'Predicted':y_pred_ran}).head(20)
```

Out[60]:

	Actual	Predicted
559	1646.42970	4042.610827
[illegible]	[illegible])	13872.597617

	Actual	Predicted
1020	8798.59300	10427.817324
460	10381.47870	10427.817324
802	2103.08000	4042.610827
298	38746.35510	38230.012778
481	9304.70190	10427.817324
616	11658.11505	13872.597617
763	3070.80870	6599.945247
750	19539.24300	18540.379523
48	12629.89670	13872.597617
547	11538.42100	13872.597617
1143	6338.07560	6599.945247
767	7050.64200	6599.945247
194	1137.46970	4042.610827
424	8968.33000	10427.817324
3	21984.47061	6599.945247
785	6414.17800	6599.945247
443	28287.89766	13872.597617
921	13462.52000	13872.597617

In [61]:

```
print('R2 value', r2_score(y_test,y_pred_ran))
print('MSE',mean_squared_error(y_test,y_pred_ran))
rmse = mean_squared_error(y_test,y_pred_ran)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_ran))
```

```
R2 value 0.8607824832143326
MSE 20782479.95070205
RMSE 4558.7805332898015
MAPE 0.3714211571925749
```

SVM model

In [62]:

```
from sklearn.svm import SVR
from sklearn.model_selection import GridSearchCV
model_svr=SVR()
model_params =  {'C': [0.1, 1, 10, 100, 1000],
              'gamma': [1, 0.1, 0.01, 0.001, 0.0001],
              'kernel': ['rbf','polynomial']}
```

In [63]:

```
gscv=GridSearchCV(estimator=model_svr,param_grid=model_params,scoring="r2",verbose=1,cv=2
```

In [64]:

```
gscv.fit(x_train_s,y_train)
```

```
Fitting 2 folds for each of 50 candidates, totalling 100 fits
C:\Users\HP\anaconda3\lib\site-packages\sklearn\model_selection\_validation.py:610: FitFai
ledWarning: Estimator fit failed. The score on this train-test partition for these paramet
```

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```
t to nan. Details:
```

```
Traceback (most recent call last):
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\model_selection\_validation.py", l
ine 593, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
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rs\HP\anaconda3\lib\site-packages\sklearn\model_selection\_validation.py", l
```

```
ine 593, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\svm\_base.py", line 226, in fit
    fit(X, y, sample_weight, solver_type, kernel, random_seed=seed)
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\svm\_base.py", line 277, in _dense
_fit
    self._probB, self.fit_status_ = libsvm.fit(
  File "sklearn\svm\_libsvm.pyx", line 176, in sklearn.svm._libsvm.fit
ValueError: 'polynomial' is not in list

  warnings.warn("Estimator fit failed. The score on this train-test"
C:\Users\HP\anaconda3\lib\site-packages\sklearn\model_selection\_validation.py:610: FitFai
ledWarning: Estimator fit failed. The score on this train-test partition for these paramet
ers will be set to nan. Details:
Traceback (most recent call last):
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\model_selection\_validation.py", l
ine 593, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\svm\_base.py", line 226, in fit
    fit(X, y, sample_weight, solver_type, kernel, random_seed=seed)
  File "C:\Users\HP\anaconda3\lib\site-packages\sklearn\svm\_base.py", line 277, in _dense
_fit
    self._probB, self.fit_status_ = libsvm.fit(
  File "sklearn\svm\_libsvm.pyx", line 176, in sklearn.svm._libsvm.fit
ValueError: 'polynomial' is not in list

  warnings.warn("Estimator fit failed. The score on this train-test"
C:\Users\HP\anaconda3\lib\site-packages\sklearn\model_selection\_search.py:918: UserWarnin
g: One or more of the test scores are non-finite: [-0.11504047         nan -0.11480249
nan -0.11492358         nan
 -0.11505291         nan -0.11506907         nan -0.11476662         nan
 -0.1123891          nan -0.11359824         nan -0.1148909          nan
 -0.11505254         nan -0.11260431         nan -0.0917633          nan
 -0.10088801         nan -0.11327172         nan -0.1148872          nan
 -0.09455512         nan  0.10708769         nan  0.02298174         nan
 -0.09772029         nan -0.11323476         nan  0.05129786         nan
  0.61222169         nan  0.54323829         nan  0.05227982         nan
 -0.09736076         nan]
  warnings.warn(
```

Out[64]:

```
GridSearchCV(cv=2, estimator=SVR(),
             param_grid={'C': [0.1, 1, 10, 100, 1000],
                         'gamma': [1, 0.1, 0.01, 0.001, 0.0001],
                         'kernel': ['rbf', 'polynomial']},
             scoring='r2', verbose=1)
```

In [65]:

```
gscv.best_params_
```

Out[65]:

```
{'C': 1000, 'gamma': 0.1, 'kernel': 'rbf'}
```

In [66]:

```
svr_r=SVR(**gscv.best_params_)
svr_r.fit(x_train_s,y_train)
y_pred_svr=svr_r.predict(x_test_s)
```

In [67]:

```
pd.DataFrame({'Actual':y_test,'Predicted':y_pred_svr}).head(20)
```

Out[67]:

	Actual	Predicted
559	1646.42970	2699.281564
1087	11353.22760	10941.165286
1020	8798.59300	8964.272411
460	10381.47870	9995.957053

	Actual	Predicted
802	2103.08000	2698.223685
298	38746.35510	25893.212287
481	9304.70190	8902.406874
616	11658.11505	11460.999208
763	3070.80870	3150.477450
750	19539.24300	24128.188824
48	12629.89670	11935.999663
547	11538.42100	11224.075853
1143	6338.07560	5820.841384
767	7050.64200	6903.173519
194	1137.46970	1156.231263
424	8968.33000	9040.251799
3	21984.47061	3959.957165
785	6414.17800	6442.136472
443	28287.89766	12292.362502
921	13462.52000	12733.599144

In [68]:

```
print('R2 value', r2_score(y_test,y_pred_svr))
print('MSE',mean_squared_error(y_test,y_pred_svr))
rmse = mean_squared_error(y_test,y_pred_svr)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_svr))
```

```
R2 value 0.7491155393646178
MSE 37452192.75189884
RMSE 6119.819666615907
MAPE 0.16446544676677868
```

Comparison of all the model

In [69]:

```
pd.DataFrame({'Actual':y_test,'Liner_reg__model_Predicted':y_pred,'Knn_model_Predicted':y_
```

Out[69]:

	Actual	Liner_reg__model_Predicted	Knn_model_Predicted	DecisionTree_model_Predicted	RandomFore
559	1646.42970	4383.680900	2169.012350	4042.610827	
1087	11353.22760	12885.038922	15103.203553	13872.597617	
1020	8798.59300	12589.216532	12744.222170	10427.817324	
460	10381.47870	13286.229192	13543.822853	10427.817324	
802	2103.08000	544.728328	1681.611000	4042.610827	
298	38746.35510	32117.584008	32977.294633	38230.012778	
481	9304.70190	12919.042372	8162.453867	10427.817324	
616	11658.11505	12318.621830	16324.224437	13872.597617	
763	3070.80870	3784.291456	2406.560467	6599.945247	
750	19539.24300	29468.457254	19721.722800	18540.379523	

Loading [MathJax]/extensions/Safe.js

	Actual	Liner_reg__model_Predicted	Knn_model_Predicted	DecisionTree_model_Predicted	RandomFore
48	12629.89670	11002.813943	21154.955780	13872.597617	
547	11538.42100	17539.694738	11842.275000	13872.597617	
1143	6338.07560	8681.354720	6825.354367	6599.945247	
767	7050.64200	8349.043255	7153.875667	6599.945247	
194	1137.46970	3130.127255	1221.493467	4042.610827	
424	8968.33000	10445.838961	8366.622000	10427.817324	
3	21984.47061	3863.743579	3734.380550	6599.945247	
785	6414.17800	6944.625108	5570.556667	6599.945247	
443	28287.89766	15009.631211	11643.997900	13872.597617	
921	13462.52000	14441.599119	12789.095000	13872.597617	

In [70]:

```
print('Linear Regression Model')
print('R2 value', r2_score(y_test,y_pred))
print('MSE',mean_squared_error(y_test,y_pred))
rmse = mean_squared_error(y_test,y_pred)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred))



print('Knn Model')



print('R2 value', r2_score(y_test,y_pred_knn))
print('MSE',mean_squared_error(y_test,y_pred_knn))
rmse = mean_squared_error(y_test,y_pred_knn)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_knn))




print('Decison Tree Model')




print('R2 value', r2_score(y_test,y_pred_dt))
print('MSE',mean_squared_error(y_test,y_pred_dt))
rmse = mean_squared_error(y_test,y_pred_dt)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_dt))


print('Random Forest Model')



print('R2 value', r2_score(y_test,y_pred_ran))
print('MSE',mean_squared_error(y_test,y_pred_ran))
rmse = mean_squared_error(y_test,y_pred_ran)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_ran))

t Vector Machine regressor')
```

```python
print('R2 value', r2_score(y_test,y_pred_svr))
print('MSE',mean_squared_error(y_test,y_pred_svr))
rmse = mean_squared_error(y_test,y_pred_svr)**0.5
print('RMSE',rmse)
print('MAPE',mean_absolute_percentage_error(y_test,y_pred_svr))
```

```
Linear Regression Model
R2 value 0.7623311844057112
MSE 35479352.80730363
RMSE 5956.454717976427
MAPE 0.40580730868622433
Knn Model
R2 value 0.8077693784591055
MSE 28696310.136282556
RMSE 5356.893702163835
MAPE 0.3246738216602979
Decison Tree Model
R2 value 0.8607824832143326
MSE 20782479.95070205
RMSE 4558.7805332898015
MAPE 0.3714211571925749
Random Forest Model
R2 value 0.8607824832143326
MSE 20782479.95070205
RMSE 4558.7805332898015
MAPE 0.3714211571925749
Support Vector Machine regressor
R2 value 0.7491155393646178
MSE 37452192.75189884
RMSE 6119.819666615907
MAPE 0.16446544676677868
```

In [ ]: