```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

```
df=pd.read_csv("/content/insurance.csv")
```

```
df.head()
```

	age	sex	bmi	children	smoker	region	charges	insuranceclaim
0	19	0	27.900	0	1	3	16884.92400	1
1	18	1	33.770	1	0	2	1725.55230	1
2	28	1	33.000	3	0	2	4449.46200	0
3	33	1	22.705	0	0	1	21984.47061	0
4	32	1	28.880	0	0	1	3866.85520	1

```
#number of row ad column
df.shape
```

```
(1338, 8)
```

```
#getting some information about data
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 8 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   age             1338 non-null   int64  
 1   sex             1338 non-null   int64  
 2   bmi             1338 non-null   float64
 3   children        1338 non-null   int64  
 4   smoker          1338 non-null   int64  
 5   region          1338 non-null   int64  
 6   charges         1338 non-null   float64
 7   insuranceclaim  1338 non-null   int64  
dtypes: float64(2), int64(6)
memory usage: 83.8 KB
```

```
#as we can see that we dont have any null value in our data
```

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

```
0    1064
1     274
Name: smoker, dtype: int64
```

```
#how many female and male
df["sex"].value_counts()
```

```
1    676
0    662
Name: sex, dtype: int64
```

```
#lets check  stats score
df.describe()
```

	age	sex	bmi	children	smoker	region	charges	insuranceclaim
count	1338.000000	1338.000000	1338.000000	1338.000000	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	0.505232	30.663397	1.094918	0.204783	1.515695	13270.422265	0.585202
25%	27.000000	0.000000	26.296250	0.000000	0.000000	1.000000	4740.287150	0.000000

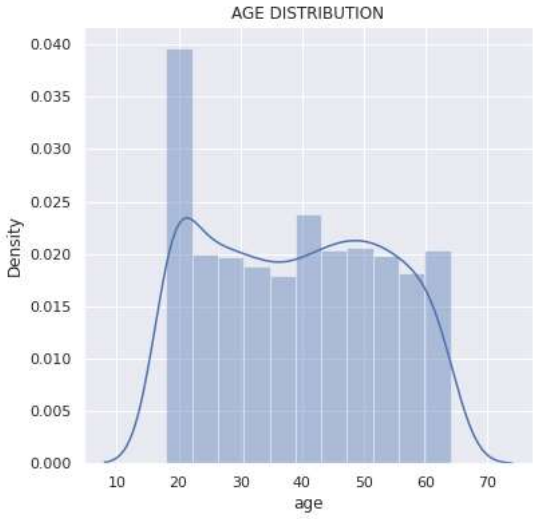
EDA

```
#checking numbers of unique rows i each features
df.nunique().sort_values()
```

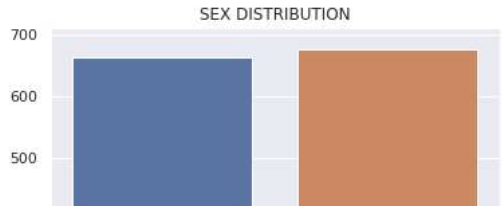
```
sex                 2
smoker              2
insuranceclaim      2
region              4
children            6
age                47
bmi               548
charges          1337
dtype: int64
```

```
#distiribution of age value
sns.set()
plt.figure(figsize=(6,6))
sns.distplot(df["age"])
plt.title("AGE DISTRIBUTION")
plt.show()
```

```
<ipython-input-11-2ff479f4b32d>:4: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["age"])
```




```
#visualise sex ratio

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



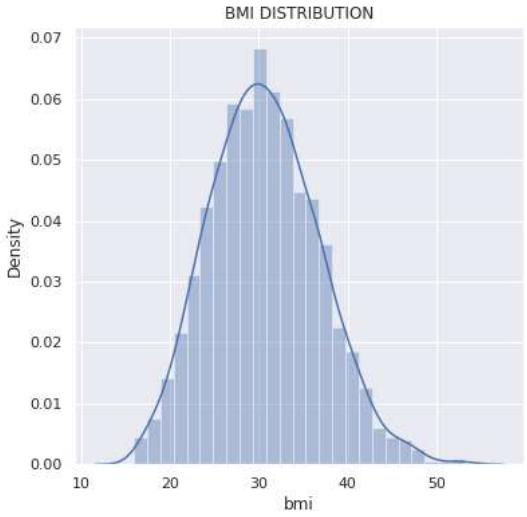

```
df["sex"].value_counts()
```

```
1    676
0    662
Name: sex, dtype: int64
```



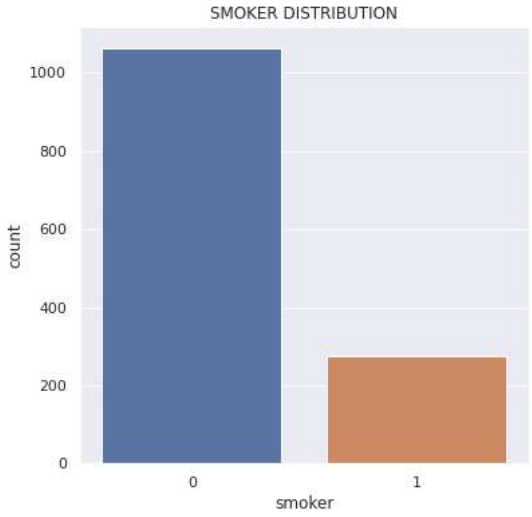
```
#bmi distribution
plt.figure(figsize=(6,6))
sns.distplot(df["bmi"])
plt.title("BMI DISTRIBUTION")
plt.show()
```

```
<ipython-input-14-d1d452f98eb9>:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["bmi"])
```

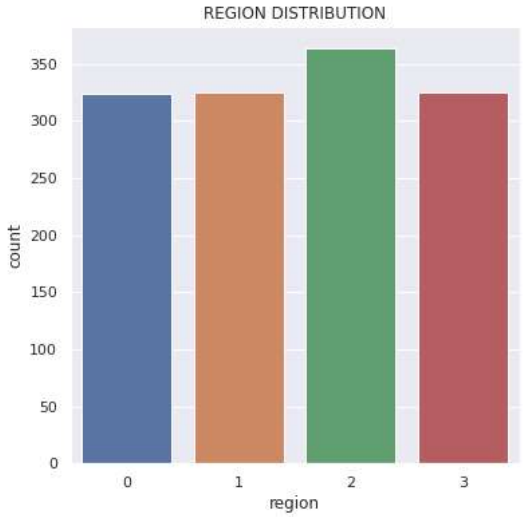



```
#normal bmi range--> 18.5 to 24.9


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

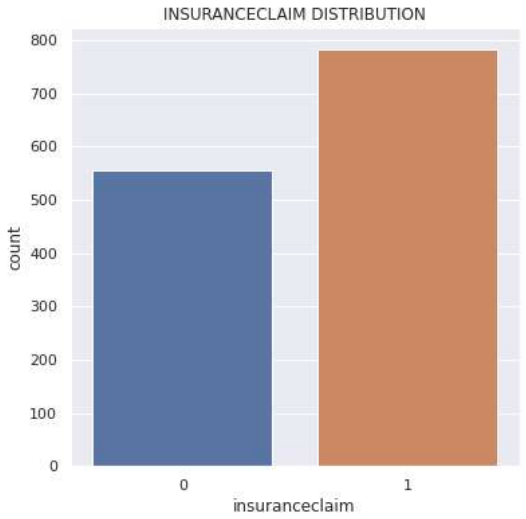
```
plt.figure(figsize=(6,6))
sns.countplot(x="smoker",data=df)
plt.title("SMOKER DISTRIBUTION")
plt.show()
```




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

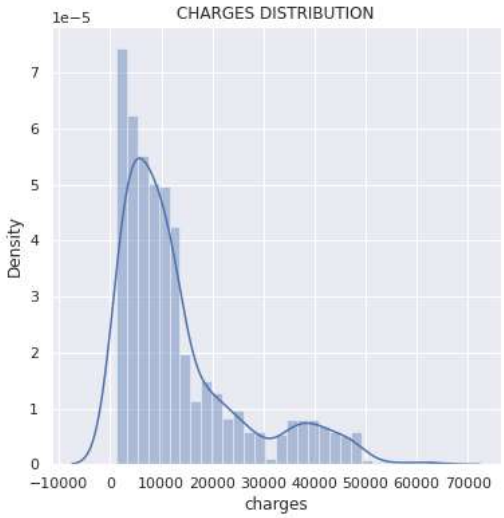



```
plt.figure(figsize=(6,6))
sns.countplot(x="insuranceclaim",data=df)
plt.title("INSURANCECLAIM DISTRIBUTION")
plt.show()
```

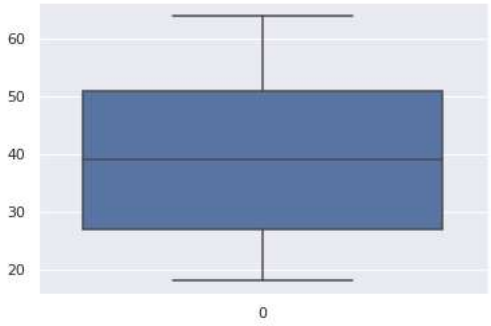


```
plt.figure(figsize=(6,6))
sns.distplot(df["charges"])
plt.title("CHARGES DISTRIBUTION")
plt.show()
```

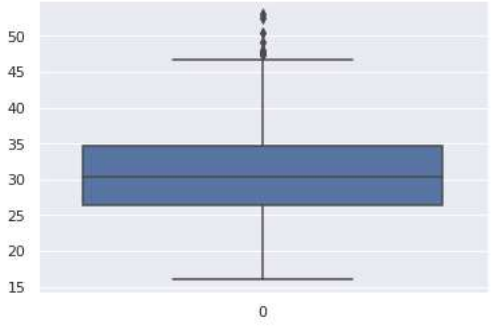
```
<ipython-input-20-2e2e0d09d3c5>:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df["charges"])
```




```
#check outlier in age
sns.boxplot(df["age"])
plt.show()
```



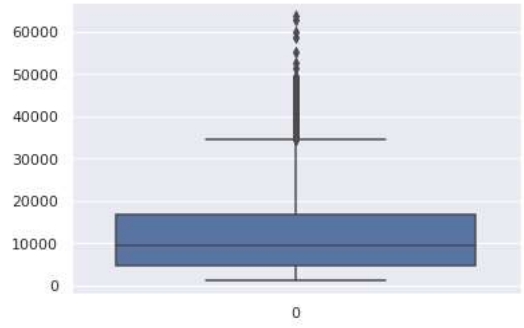
```
#check outlier in bmi
sns.boxplot(df["bmi"])
plt.show()
```



```
#position of outlier
print(np.where(df["bmi"]>46.5))
```

```
(array([ 116,  286,  401,  438,  454,  543,  547,  660,  847,  860,  930,
       1047, 1088, 1317]),)
```

```
#check outlier in charges
sns.boxplot(df["charges"])
plt.show()
```




```
#position of outlier
outlier=(np.where(df["charges"]>35000))


#Removal of outlier:

df1 = df.copy()

for i in [i for i in df1.columns]:
    if df1[i].nunique()>=12:
        Q1 = df1[i].quantile(0.25)
        Q3 = df1[i].quantile(0.75)
        IQR = Q3 - Q1
        df1 = df1[df1[i] <= (Q3+(1.5*IQR))]
        df1 = df1[df1[i] >= (Q1-(1.5*IQR))]
df1 = df1.reset_index(drop=True)
display(df1.head())
print('\n\033[1mInference:\033[0m Before removal of outliers, The dataset had {} samples.'.format(df.shape[0]))
print('\033[1mInference:\033[0m After removal of outliers, The dataset now has {} samples.'.format(df1.shape[0]))
```

	age	sex	bmi	children	smoker	region	charges	insuranceclaim
0	19	0	27.900	0	1	3	16884.92400	1
1	18	1	33.770	1	0	2	1725.55230	1
2	28	1	33.000	3	0	2	4449.46200	0
3	33	1	22.705	0	0	1	21984.47061	0
4	32	1	28.880	0	0	1	3866.85520	1

```
Inference: Before removal of outliers, The dataset had 1338 samples.
Inference: After removal of outliers, The dataset now has 1191 samples.
```

```
#remove duplicte row (if any)
r,c=df1.shape
df2=df1.copy()
df2.drop_duplicates(inplace=True)
df2.reset_index(drop=True,inplace=True)

if df2.shape==(r,c):
  print("dataset doesnot have any duplicate value")
else:
  print("numbers of duplicate drop---",{r-df2.shape[0]})
```

```
    numbers of duplicate drop--- {1}
```

```
df2.shape
```

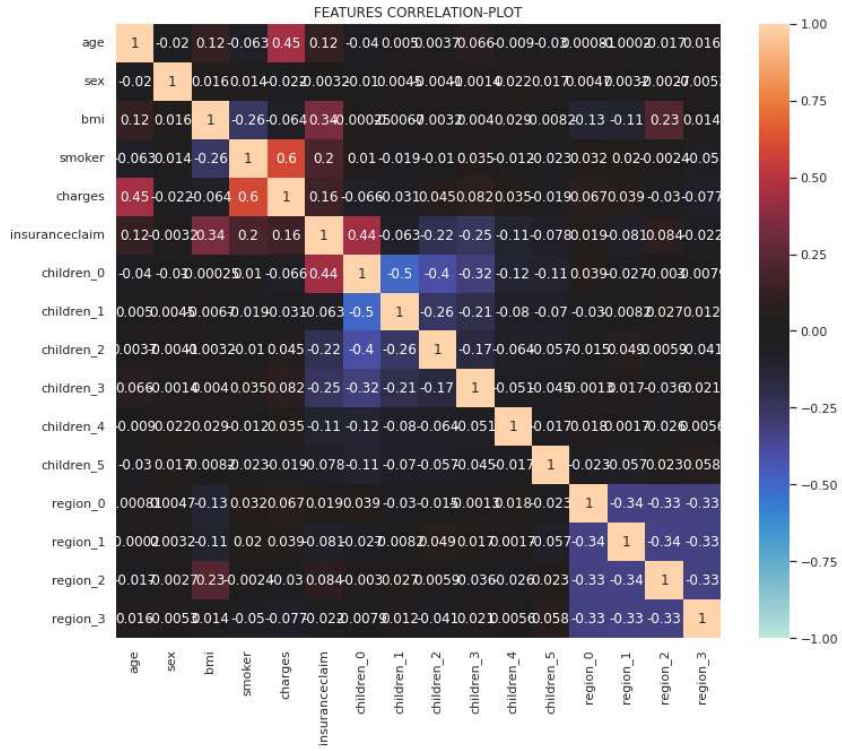
```
    (1190, 8)
```

```
df3=pd.get_dummies(df2,columns=["children","region"])


df=df3
df.shape
```

```
    (1190, 16)
```

Feature selection

```
#checking the correlation
features=df.columns
plt.figure(figsize=[12,10])
plt.title("FEATURES CORRELATION-PLOT")
sns.heatmap(df[features].corr(),vmin=-1,vmax=1,center=0,annot=True)
plt.show()
```




```
df.drop(["children_0","region_0"],axis=1,inplace=True)
```

```
X_train,X_test,y_train,y_test=train_test_split(df.drop("insuranceclaim",axis=1),df["insuranceclaim"],test_size=0.2,random_state=12)
```

```
print("X_train : ",X_train.shape)
print("X_test : ",X_test.shape)
print("y_train : ",y_train.shape)
print("y_test : ",y_test.shape)
```

```
X_train :  (952, 13)
X_test :  (238, 13)
y_train :  (952,)
y_test :  (238,)
```

```
from sklearn.preprocessing import StandardScaler
# initialize scaler
normalizer = StandardScaler()
#fit on data
normalizer.fit(X_train)
#transform
X_train_scaled = normalizer.transform(X_train)
X_test_scaled = normalizer.transform(X_test)
# save into diff data
X_train_scaled= pd.DataFrame(X_train_scaled,columns=X_train.columns)
X_test_scaled= pd.DataFrame(X_test_scaled,columns=X_test.columns)
```

```
#after scaling
print("X_train : ",X_train_scaled.shape)
```

```
print("X_test : ",X_test_scaled.shape)
print("y_train : ",y_train.shape)
print("y_test : ",y_test.shape)
```

```
X_train :  (952, 13)
X_test :  (238, 13)
y_train :  (952,)
y_test :  (238,)
```

```
from sklearn.svm import SVC
from sklearn.metrics import confusion_matrix,accuracy_score


# model

clf = SVC(kernel = 'rbf',random_state = 0)
clf.fit(X_train_scaled,y_train)
```

```
SVC
SVC(random_state=0)
```

```
# prediction

y_pred = clf.predict(X_test_scaled)
y_pred
```

```
array([1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0,
       1, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0,
       0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1,
       1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1,
       0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0,
       1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1,
       0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1,
       1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0,
       1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0,
       1, 0, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0,
       0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0])
```

```
# accuracy

accuracy = accuracy_score(y_test,y_pred)
print(accuracy)
```

```
0.865546218487395
```

✓ 0s completed at 19:30